Clutha
District Council

ENGINEERING CODE OF PRACTICE

Document Acceptance

	Name	Date
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Approved By:		

Revision History

Revision No:	Review Comments	Prepared By:	Date
Original Issues	Review base documents and refine as for CDC	Bevan Mullions Niko Trbuhovic	2024 -2025
Version 3	Develop and review document for final draft	Niko Trbuhovic	01/09/2025
Version 4	Draft for industry feedback	Niko Trbuhovic	05/03/2026

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Foreword

The purpose of this Code of Practice (CoP) is to establish guidelines for managing and regulating subdivision, land use, and development within the Clutha District. This CoP aims to ensure that these activities are conducted in an environmentally, socially, and culturally sustainable manner, while maintaining the necessary technical robustness.

This robustness is essential to guarantee that new developments are durable, future-focused, and do not impose undue environmental or financial burdens on future generations. Additionally, it seeks to prevent unnecessary future liabilities and costs for both Clutha District Council (CDC) and its communities.

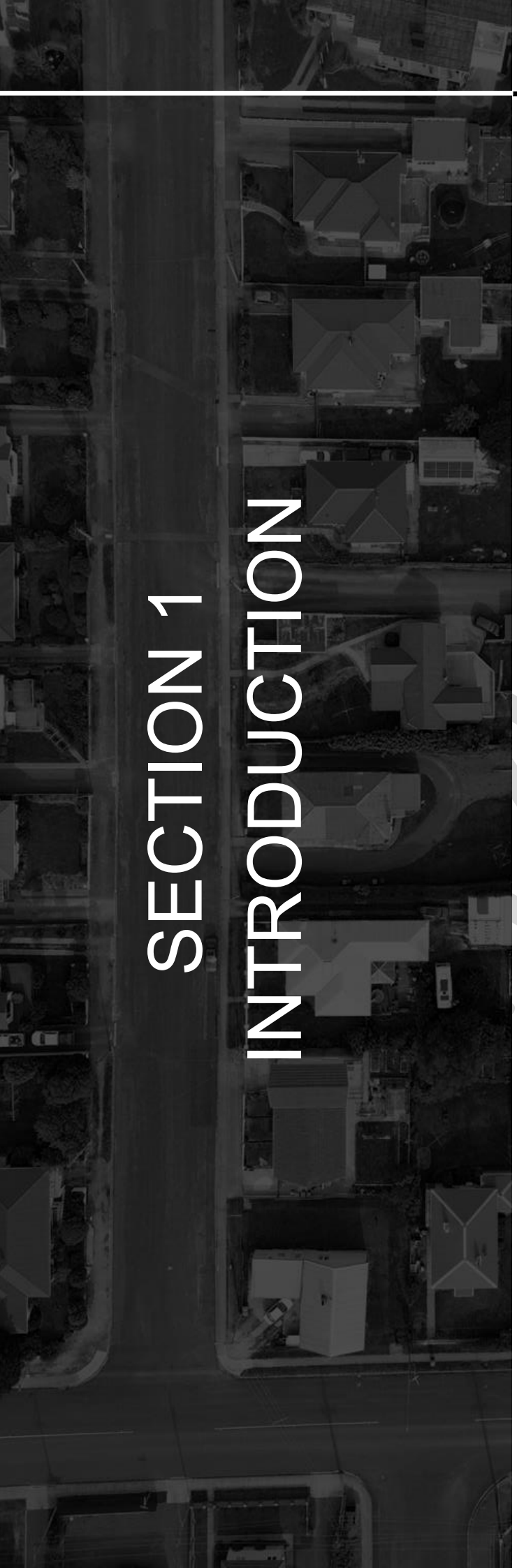
This CoP supersedes all previous regulations or bylaws related to subdivision and land development within the Clutha District.

"Clutha District Council acknowledges and respects Te Rūnanga o Ngāi Tahu as Rangatira over the South Otago region, with rights and responsibilities to protect the environment. He kaitiaki te tangata, he heramana te whenua. Tō tātou whenua, tō tātou wai, hei painga mō ngā whakatipuranga."

Clutha District Council extends its gratitude to Dunedin City Council, Invercargill City Council, and Southland District Council for their contributions. Their documents served as a foundational reference in the development of this engineering code. We acknowledge their valuable input and support in shaping our standards.

Acknowledgements

Clutha District Council extends its gratitude to Invercargill City Council and Southland District Council for their contributions in development of this document. Their documents served as a foundational reference in the development of this engineering code. We acknowledge their valuable input and support in shaping our standards.



SECTION 1
INTRODUCTION

Section 1 Table of Contents

This document sets out the minimum engineering and performance standards for subdivision and land development within the Clutha District.

It defines the technical requirements that Clutha District Council (Council) expects developers and their agents to meet when designing and delivering:

- Infrastructure intended to vest in Council; and
- Infrastructure that will remain in private ownership but connects to, or impacts on, Council's networks.

This document provides consistent minimum standards and guidance for assets that Council will accept as part of its network, including requirements necessary to support safe, durable and efficient long-term operations and maintenance.

This Code operates alongside the District Plan and relevant national legislation, including the Resource Management Act 1991. It does not replace or override statutory requirements. Where any inconsistency arises between this Code, the District Plan, or prevailing legislation, statutory requirements shall take precedence.

Council acknowledges that the resource management system is subject to ongoing reform. This Code will be interpreted and applied in a manner consistent with any future replacement legislation. Notification of change will be published on Clutha District Councils website.

1.1 Relationship to NZ Standards

This document adopts **NZS 4404:2010 Land Development and Subdivision Infrastructure** as the base standard for meeting minimum engineering requirements.

Specific variations, amendments and additional requirements applicable within the Clutha District are set out in this Code. Where a conflict exists between NZS 4404:2010 and this document, this Code shall prevail.

1.2 Objective of Document

The objective of this document is to;

- Assist developers to determine the engineering design standards and performance targets that must be achieved in order to meet the conditions set by the Council for the development in the Clutha District.
- Assist developers to assess their obligations, responsibilities and liabilities on engineering issues before embarking on a subdivision or land development project, or a building project within the Clutha District.
- Help Council to maintain a consistent and fair approach to the appraisal of developments while allowing for some degree of flexibility on solutions.
- Provide consistent minimum standards and guidance for assets that council will accept as part of its network.

1.3 Alternative Means of Compliance

Alternative solutions are not discouraged. However, any proposed alternative must:

- Demonstrate that it meets or exceeds the performance intent of this Code;
- Be supported by appropriate design documentation and risk assessment; and
- Be certified by suitably qualified and experienced professionals.
- Council approval must be obtained prior to implementation of any alternative solution.

This is an end-product-based document. Developers are required to document each phase of the development process and provide certification confirming that works have been designed and constructed in accordance with this Code or an approved alternative.

1.4 Objective of this Document

The objectives of this document are to:

- Assist developers to determine the engineering design standards and performance targets that may be required to satisfy Council conditions for subdivision, land use, or building consents within the Clutha District.
- Clarify obligations, responsibilities and liabilities relating to engineering matters prior to undertaking subdivision, land development or building projects.
- Enable Council to maintain a consistent and fair approach to the technical appraisal of development proposals, while allowing flexibility for alternative solutions where appropriate.

- Protect the integrity, capacity and long-term performance of Council's infrastructure networks.

1.5 Intention of Document

This document is intended to apply to land and infrastructure development within the District, including:

Subdivision Consents
Providing engineering standards to support compliance with subdivision requirements and to identify infrastructure standards that may form part of consent conditions.

Land Use Consents
Providing engineering standards to support compliance with land use requirements and to identify infrastructure standards that may form part of consent conditions.

Building Consents
Providing technical requirements for the provision and connection of services in accordance with the requirements of the Building Act.

1.6 Relationship Between This Code and The Local Planning Legislation

The District Plan assists Council in fulfilling its statutory functions under the current Resource Management Act (1991) by regulating the effects of subdivision and land development on the environment.

The District Plan establishes rules and performance standards for subdivision and land development activities. Where consent is required, conditions may include infrastructure requirements that reference this Code. In some circumstances, permitted activities may also be required to comply with specified infrastructure standards.

This Code provides the detailed engineering standards that support the implementation of those requirements.

1.7 Relationship with Ngāi Tahu and Local Rūnanga

Clutha District Council, together with the Queenstown Lakes District Council, Otago Regional Council, jointly with the four Southland councils continue to fund and support Te Ao Mārama Inc, the agency approved by Te Runanga o Ngāi Tahu to act on iwi liaison matters and supporting papatipu rūnanga in Murihiku/ Southland under the Resource Management Act 1991 and the Local Government Act 2002.

Work has begun to strengthen the relationship with Aukaha of Otago, the agency supporting papatipu rūnanga of Otago, with a view to contributing to funding and support. The papatipu rūnanga and the participant councils continue to meet quarterly at the Te Roopū Taiao hui, and on regular occasions papatipu rūnanga across Otago and Southland meet with Otago and Southland Councils. This provides for excellent partnership and exchange of information.

Council acknowledges the unique relationship it has with Ngai Tahu. The area that the Clutha District Council covers crosses over the boundaries of two major Ngai Tahu Takiwa (area's). They are The Rūnanga o Ōtakou and Ngai Tahu ki Murihiku.

Te Runanga o Otakou has mana whenua over the Otakou area and extends from Heyward Point to the Clutha River then inland, with a shared interest in the lakes and mountains to the west of the Otakou Coast. Ngai Tahu ki Murihiku are represented by two Papatipu Runanga Hokonui Runanga and Te Ao Marama Inc. who have mana whenua over from the Clutha River south to Mataura and down to the Councils boundary with the Southland District.

The Papatipu Runganga who have mana whenua over these areas are represented by the following bodies when it comes to operating in the Resource Management space:

Te Runanga Otakou is represented by Aukaha

Website: https://aukaha.co.nz/
Address: Level 2, 266 Hanover Street, Dunedin Central, New Zealand 9016
Postal Address: PO Box 446, Dunedin 9054, New Zealand Phone 03 477 0071
Phone: +64 03 477 0071

Ngai Tahu ki Murihiku is represented by Hokonui Runanga and Te Ao Marama, their contact details are:

Hokonui Runanga

Website:	https://ngaitahu.iwi.nz/ngai-tahu/papatipu runanga/hokonui/
Email:	hokonui.office@ngaitahu.iwi.nz
Address:	6 McKinnon Road, McNabb, Gore 9775
Postal Address	PO Box 114, Gore 9740
Phone:	+64 03 208 7954

Te Ao Marama Inc.

Website:	https://www.tami.co.nz
Email:	office@tami.maori.nz
Address:	98 Yarrow Street, Invercargill 9810
Phone:	+64 03 931 1242

Iwi bring to the Subdivision, Land Use and Development space a depth of cultural knowledge, experience and values to enrich the development practices of infrastructure providers and add further dimension to the Code of Practice.

The Code of Practice is a living document intended to evolve over time, and its relationship with the values and aspirations of Ngāi Tahu whānui will similarly evolve.

1.8 Relationship with the Building Act 2004 (or its subsequent amendments)

The Building Act is the national framework for building control to ensure that buildings are safe and sanitary and have suitable means of escape in an emergency such as fire.

The Building Regulations made under the Building Act provide the mandatory requirements for building control in the form of the New Zealand Building Code.

The Building Code contains the functional and physical requirements and performance criteria that building works should achieve.

Where the development of land and subdivision infrastructure involves the creation of structures (includes drainage) with associated site works, including specific aspects of stormwater management and the interaction of buildings, fences, retaining walls, and stormwater flows, the requirements of the Building Act shall be observed. **Nothing in this Code of Practice shall detract from the requirements of the Building Act or the Building Code.**

In some instances, and with the prior agreement of Council, certain works may be approved under the engineering approval process outlined in Section 3 in place of requiring a building consent.

1.9 Document Structure

The Code of Practice document is divided into 7 Parts that have the following Sections contained in them:

Part 1:

a) Introduction
b) References and Abbreviations
c) General Requirements and Procedures
d) Earthworks and Geotechnical Requirements

Part 2:

a) Roads

Part 3:

a) Stormwater

Part 4:

a) Wastewater

Part 5:

a) Water Supply

Part 6:

a) Network Utility Services
b) Landscape
c) Community Facilities

Part 7:

a) Appendix A
b) Appendix B

The Sections in this Code of Practice are grouped into the following areas:

- **Section 1** - Outlines matters of general application and general requirements to be observed.
- **Section 2** - Lists the referenced documents and abbreviations used in this Code of Practice.
- **Section 3 to 11** - Provides specific provisions on particular types of infrastructure to be provided.
- **Appendices**

The Code of Practice provides best practice land development and subdivision infrastructure techniques in Low Impact Design, Climate Change, and Urban Design.

The provisions of this Code of Practice **does not reduce** the responsibility of professionals to exercise their judgement and devise appropriate engineering solutions for the particular circumstances of each development, having full regard to Council's expected asset life.

The Council standards as set out in this document are intended to reflect the minimum standard required by the Council. They should not be seen as a replacement for professional engineering design.

SECTION 2
REFERENCES & ABBREVIATIONS

Section 2 Table of Contents

2.1 Referenced Documents

Reference is made in this CoP to documents section 2 – 2.4. Where an Act or Standards document is referenced, this must be the current version including any associated amendments or applicable successor.

2.1.1 Local Planning Documents

- Clutha District Council Water Services Bylaw 2019
- Infrastructure Strategy 2024/2034
- Clutha District Council Long Term Plan 2024/2034
- Otago Regional Council - Regional Plans
- Clutha District Plan
- Milton 2060 Flood Risk Management Strategy for Milton and the Tokomairiro Plain July 2012
- Clutha District Council Roading Bylaw 2018
- Clutha 10-year Long Term Plan: 2018 – 2028

2.1.2 Statutory Requirements

The provisions of this CoP shall be read subject to the provisions of regional and District Plans and to any applicable statutes, regulations, bylaws, and any subsequent amendments, including (but not limited to):

- Requirements of the District Plan
- Resource Management Act 1991
- Local Government Act 2002
- Building Act 2004
- Land Transfer Act 1952
- Unit Titles Act 2010
- Property Law Act 2007
- Local Government Official Information and Meetings Act (LGOIMA) 1987
- Health and Safety at Work (General Risk & Workplace Management) Regulations 2016
- Health Act 1956
- Health (Drinking Water) Amendment Act 2007
- Water Services Act 2021
- Resource Management (National Environmental Standard for Sources of Human Drinking Water) Regulations 2007
- Reserves Act 1977
- Civil Defence Emergency Management Act 2002
- Civil Defence Emergency Management Amendment Act 2016
- Conservation Act 1987
- Electricity Act 1992
- Electrical Safety Regulations 2009
- Heritage New Zealand Pouhere Taonga Act 2014
- Infrastructure (Amendments Relating to Utilities Access) Act 2010
- Land Transport Rule (Traffic Control Devices) 2004
- Local Government Act 1974
- Utilities Access Act 2010
- Public Works Act 1981
- New Zealand urban design protocol. Ministry for the Environment 2005.
- Ministry for the Environment - New Zealand Urban Design Protocol. Reference: ME 579 colour.pdf
- Ministry for the Environment - National Environmental Standards for Telecommunications
- Ministry for the Environment - National Environmental Standards for Electricity Transmission Activities
- Ministry for the Environment - National Environment Standard for Assessing and Managing Contaminants in Soil to Protect Human Health
- Ministry for the Environment - National Environmental Standards for Storing Tyres Outdoors 2021
- Ministry for the Environment - National Environmental Standards for Commercial Forestry 2017

2.1.3 New Zealand Standards

NZS 1170	Structural design action
NZS 1170	Structural design actions
NZS 3104	Specifications for concrete production
NZS 3109	Concrete construction
NZS 3114:	Specification for concrete surface finishes
NZS 3116	Concrete segmental and flagstone paving
NZS 3121	Water and aggregate for concrete
NZS 3501	Specification for copper tubes for water, gas and sanitation
NZS 3604	Timber-framed buildings
NZS 4058	Specification for pre-cast concrete drainage and pressure and non-pressure pipes
NZS4121	Design for access and mobility: Buildings and associated facilities
NZS 4241	Public toilet
NZS 4402	Methods of testing soils for civil engineering purposes
NZS 4404	Land development and subdivision infrastructure
NZS 4431	Code of practice for earth fill for residential development
NZS 4442	Welded steel pipes and fittings for water, sewage and medium pressure gas
NZS 4501	Code of practice for the location and marking of fire hydrants
NZS 4522	Underground fire hydrants and surface box frames and fittings
NZS 5828	Playground equipment and surfacing
NZS 6803	Acoustics – Construction Noise
NZS 7643	Code of Practice for the installation of un-plasticised PVC pipe systems
NZS 8409	New Zealand standard for the management of agrichemicals
NZS 8630	New Zealand handbook – tracks and outdoor visitor structures
NZS/AS 1657	Fixed platforms, walkways, stairways and ladders. Design, construction and installation
NZS/BS 21	Pipe threads for tubes and fittings
NZS/BS 5163	Specification for predominantly key operated cast iron gate valves for water works purposes
SA/SNZ TS 1158.6	Lighting for roads and public spaces – Part 6 Luminaires – Performance
NZS 5828	Playground equipment and surfacing
SNZ PAS 4509	New Zealand Fire Service firefighting water supplies code of practice

2.1.4 Joint Australian/New Zealand Standards

AS/NZS 1100	Technical drawing: structural engineering drawing
AS/NZS 1158	Lighting for roads and public spaces
AS/NZS 1254	PVC-U pipes and fittings for stormwater and surface water applications
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/NZS 1546	On-site domestic wastewater treatment units
AS/NZS 1547	On-site domestic wastewater management
AS/NZS 2032	Installation of PVC pipe systems
AS/NZS 2033	Installation of polyethylene pipe systems
AS/NZS 2041.4	Buried Corrugated Metal Structures - Helically formed sinusoidal pipes
AS/NZS 2280	Ductile iron pipes and fittings
AS/NZS 2544	Grey iron pressure fittings
AS/NZS 2566	Buried flexible pipelines
AS/NZS 2638	Gate valves for water works purpose – resilient-seated
AS/NZS 2890	Parking facilities
AS/NZS 3000	Electrical installations (Australian/New Zealand wiring rules)
AS/NZS 3500	Plumbing and drainage
AS/NZS 3518	Acrylonitrile butadiene styrene (ABS) compounds, pipes and fittings for pressure applicati
AS/NZS 3690	Installation of ABS pipe systems
AS/NZS 3725	Design for installation of buried concrete pipes
AS/NZS 4793	Mechanical tapping bands for waterworks purposes
AS/NZS 3845	Road safety barrier systems
AS/NZS 3879	Solvent cements and priming fluids or PVC (PVC-U and mPVC-M) and ABS pipes and fittin
AS/NZS 4020	Testing of products for use in contact with drinking water
AS/NZS 4058	Precast concrete pipes (pressure and non-pressure)
AS/NZS 4065	Concrete utility services poles
AS/NZS 4087	Metallic flanges for water works purposes
AS/NZS 4129	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	Metallic flanges – Part 2: Cast iron flanges
AS/NZS 4441	Oriented PVC (PVC-O) pipes for pressure applications
AS/NZS 4676	Structural design requirements for utility services poles
AS/NZS 4677	Steel utility services poles
AS/NZS 4680	Hot-dip galvanized (zinc) coatings on fabricated ferrous articles
AS/NZS 4765	Modified PVC (PVC-M) pipes for pressure applications
AS/NZS 4793	Mechanical tapping bands for waterworks purposes
AS/NZS 4819	Rural and Urban Addressing
AS/NZS 4998	Bolted unrestrained mechanical couplings for waterworks purposes
AS/NZS 5065	Polyethylene and polypropylene pipes and fittings for drainage and sewerage applications

2.1.5 Australian Standards

AS 1579	Arc-welded steel pipes and fittings for water and wastewater
AS 1646	Elastomeric seals for water works purposes
AS 1741	Vitrified clay pipes and fittings with flexible joints - Sewer quality
AS 1906	Retroreflective materials and devices for road traffic control purposes
AS 2129	Flanges for pipes
AS 2200	Design charts for water supply and sewerage
AS 2638	Gate valves for waterworks purposes – Resilient seated
AS 2700	Colour Standards for general purposes
AS 2870	Residential slabs and footings - Construction
AS 3571	Plastics piping systems - Glass-reinforced thermoplastics (GRP) systems based on unsaturated polyester (UP) resin
AS 3572	Glass filament reinforced plastics
AS 3681	Application of polyethylene sleeving for ductile iron piping
AS 3996	Access covers and grates
AS 4181	Stainless steel clamps for water purposes
AS 4702	Polymeric cable protection covers

2.1.6 British Standards

BS EN 295:	Vitrified clay pipes and fittings and pipe joints for drains and sewers
Part 1	Requirements

Part 2	Quality control and sampling
Part 3	Test methods
Part 4	Requirements for special fittings, adaptors and compatible accessories
Part 6	Requirements for vitrified clay manholes
Part 7	Requirements for vitrified clay pipes and joints for pipe jacking
Part 10	Performance requirements
BS EN 805	Water supply - Requirements for systems and components outside buildings
BS 3412	PE materials for moulding and extrusion

2.2 Other Publications

2.2.1 General

- Ministry of Justice National Guidelines for Crime Prevention through:
  - Environmental Design in New Zealand Part 1
  - Environmental Design in New Zealand Part 2
- Erosion and Sediment Control Guide for Land Disturbing Activities in the Auckland Region
- Auckland Council.Stormwater Management Devices in the Auckland Region – Guidance Document
- National guideline for crime prevention through environmental design in New Zealand. Wellington: Ministry of Justice
  - Part 1 Seven Qualities of Safer Places National Guidelines for Crime Prevention
  - Part 2 Implementation Guide

2.2.2 Earthworks and Geotechnical Requirements

- BRANZ Study Report 004, Assessment of slope stability at building sites. BRANZ and Worley Consultants Ltd, 1987.
- Cook, D, Pickens, G A, and MacDonald, G. 'The role of peer review', Report by Crawford S A. NZ Geomechanics News (Dec 1995).
- The design of permanent slopes for residential building development', EQC Research Project 95/183
- New Zealand Geotechnical Society Inc. Field description of soil and rock, 2005.
- New Zealand Geotechnical Society Inc. 'Geotechnical issues in land development Proceedings of New Zealand Geotechnical Society Symposium, Hamilton, 1996
- NZGS/MBIE Geotechnical Earthquake Engineering Guidance, Modules 1-6 (2016-17)
- GNS Science/Te Pū Ao Landslide Planning Guide, Reducing Landslide Risk through Land-Use Planning
- Methodology for Determining Minimum Floor Levels 2011

2.2.3 Roading

Austroads

- Austroads codes and guides, 2009. (Subject to the relevant New Zealand supplement).
- Austroads. Guide to road design – Part 1-8: Austroads.
- Austroads. Guide to Pavement Technology Part 2: Pavement Structural Design, Austroads, 2019
- Austroads. Guide to traffic management - Part 8: Local area traffic management. Austroads, 2008.
- Austroads. Guide to Road Safety Part 6 Road Safety Audit, Austroads, 2019
- Austroads guide to bridge Technology Part 8: Hydraulic design of Waterway Structures, June 2019,
- Bus stop infrastructure design guidelines. Auckland: ARTA, 2009

Cement Concrete & Aggregates Australia

- Cement and Concrete Association of Australia. Guide to residential streets and paths.

Waka Kotahi New Zealand Transport Agency

Waka Kotahi New Zealand Transport Agency. – it is noted that many of Waka Kotahi guidelines and reference manuals are now online documents - https://www.nzta.govt.nz/

- Chipsealing in New Zealand
- Cycle network and route planning guide
- Cycling network guidance
- Pedestrian planning and design guide
- Manual of Traffic Signs and Markings (MOTSAM) Part I – Traffic Signs & Part II – Markings
- Road safety audit procedures for projects (Manual number TFM9)
- RTS 11: Urban roadside barriers and alternative treatments
- RTS 14 'Guidelines for facilities for blind and vision-impaired pedestrians
- RTS 18: New Zealand on-road tracking curves for heavy vehicles
- Stormwater treatment standard for State Highway Infrastructure
- Waka Kotahi NZTA Bridge manual (SP/M/022)
- Economic Evaluation Manual 2013
- Pedestrian planning and design guide 2009
- Manual of Traffic Signs and Markings (MOTSAM) Part I – Traffic Signs & Part II – Markings 2010
- Traffic control devices manual (TCD manual)
- Safe System audit guidelines for transport projects (supersedes Road safety audit procedures for projects Manual number TFM9).
- Waka Kotahi (NZTA) specifications Resources:
    - B/2 Construction of Unbound Granular Pavement Layers
    - F/1 Earthw orks Construction
    - F/2 Pipe Subsoil Drain Construction
    - F/3 Pipe Culvert Construction
    - M/1 Bitumen for Pavements
    - M/1-A Asphalt Binders
    - M/4 Crushed Basecourse Aggregate
    - M/6 Sealing Chip
    - M/10 Dense Graded Asphaltic Concrete
    - M/13 Adhesion Agents
    - M/27 Stone Mastic Asphalt
    - P/3 First Coat Sealing
    - P/4 Resealing
    - P/17 Bituminous Reseals
    - P/33 Coloured Surfacing
    - T/10 Skid Resistance Deficiency Investigation and Treatment Selection

United Kingdom Department for Transport

- United Kingdom Department for Transport. Manual for streets
- United Kingdom Transport Research Laboratory. TRL661 - The manual for streets: evidence and research

2.2.4 Stormwater, Wastewater and Water Supply

- **Auckland Regional Council**
    - Technical Publication No. 124 (TP124) Low impact design manual for the Auckland region, 2000.
    - Technical Report 2008-20 Application of low impact design to brownfield sites.
    - Technical Report 2009-83 Integration of low impact design, urban design and urban form principles
    - Australasian Society for Trenchless Technology (ASTT Guidelines for horizontal directional drilling, pipe bursting, micro tunnelling and pipe jacking
    - Stormwater Treatment Devices: Design Guideline Manual (TP10),
    - Erosion and sediment control: Guidelines for land disturbing activities in the Auckland Region (TP90)

- **Clutha District Council**
  - Clutha District Council Watermain PE Pipelines Specifications
  - Clutha District Council Gravity Sewer Lateral Connection Guidelines
  - Clutha District Council Pressure Sewer Requirements
  - Clutha District Council Rule G11: Hygiene Code Of Practice
  - TO BE COMPLETED

- **Ministry for the Environment**
  - Coastal hazards and climate change - Guidance for local government.
  - Preparing for climate change - A guide for local government in New Zealand.
  - Preparing for coastal change - A summary of coastal hazards and climate change guidance for local government.
  - Preparing for future flooding - A guide for local government in New Zealand.
  - Tools for estimating the effects of climate change on flood flow - A guidance manual for local

- **Ministry of Business, Innovation & Employment. NZ Building Code:**
  - E1
  - B2
  - G13
  - G14
  - and associated acceptable solutions and verification methods.

- **Water New Zealand**
  - Underground Utilities – Seismic Assessment and Design Guidelines and associated Technical Note 15 – Manhole Flotation
  - NZ Infiltration and Inflow Control Manual . 2rd Edition, 2015.
  - New Zealand Gravity Pipe Inspection Manual 4rd edition. 2020

- **Water Services Association of Australia (WSAA)**
  - WSA 02-2014 Gravity Sewerage Code of Australia
  - WSA 03-2011 Water Supply Code of Australia
  - WSA 04-2005 Sewage Pumping Station Code of Australia
  - WSA 06-2008 Vacuum Sewerage Code of Australia
  - WSA 07-2007 Pressure Sewerage Code of Australia

- **Various**
  - Najafi, M.Trenchless technology - Pipeline and utility design, construction, and renewal.
  - Stein, D. Trenchless technology for installation of cables and pipelines. Germany: Stein & Partner, 2005.
  - Uni-Bell. Handbook of PVC pipe. 4th ed
  - Taumata Arowai Ngā ture me ngā paerewa hou, Standards, Rules, and Aesthetic Values
  - Water Services (Drinking Water Standards for New Zealand) Regulations 2022

2.2.5 Network Utility Services

- Guide for safety with underground services
- NZ Electrical codes of practice.
- National code of practice for utilities' access to the transport corridors
- Utilities Access Act 2010

Note: The NZUAG code of practice is an interim measure until a national code of practice is approved under the Utilities Access Act 2010.

2.3 Related Documents

When interpreting this EngCoP it may be helpful to refer to other documents, including but not limited to:

2.3.1 General

- Ministry for the Environment. Climate change effects and impacts assessment - A guidance manual for local government. 2nd ed. Wellington: Ministry for the Environment, 2008.
- Climate Change Projections for New Zealand: Atmospheric projections based on simulations undertaken for the IPCC 5th Assessment 2nd edition, MfE, 2018
- National Climate Risk Assessment for New Zealand, 2020
- National Adaptation Plan, Ministry for the Environment, 2022
- Interim guidance on the use of new sea-level rise projections, Ministry for the Environment, 2022
- Te hau mārohi ki anamata Towards a productive, sustainable and inclusive economy AOTEAROA NEW ZEALAND'S FIRST EMISSIONS REDUCTION PLAN, Ministry for the Environment, 2022
- A guide to local climate change risk assessments - 2021

2.3.2 Earthworks and Geotechnical Requirements

- Erosion and sediment control: guidelines for land disturbing activities in the Auckland Region - 1999.
- Planning for development of land on or close to active faults - A guideline to assist resource management planners in New Zealand - 2004.
- Guidelines for assessing planning policy and consent requirements for landslide prone land - 2007

2.3.3 Roading

- Jones, P, Boujenko, N, and Marshall, S. Link and place - A guide to street planning and design. London: Landor Books, 2007.
- Ministry of Justice National guidelines for crime prevention through environmental design in New Zealand
    - Part 1: Seven qualities of safer places
    - Part 2: Implementation guide
- Ministry of Transport Government policy statement on land transport funding 2012/12 - 2021/22
- Ministry of Transport. Safer journeys - New Zealand's road safety strategy 2010 - 2020
- National Code of Practice for Utilities, Access to the Transport Corridors.
- Waka Kotahi New Zealand Transport Agency
    - Traffic note 48 - Light vehicle sizes and dimensions: Street survey results and parking space requirements
    - Manual of traffic signs and markings (MOTSAM) Parts 1 - 4
    - Waka Kotahi (NZTA) Code of practice for temporary traffic management (CoPTTM: Part 8 of the Traffic Control Devices manual (TCD Manual).
    - Waka Kotahi (NZTA) register of network standards and guidelines
- SNZ HB 44:2001 Subdivision for people and the environment
- Concrete Masonry Association of Australia. Concrete segmental pavements - Design guide for residential accessways and roads

2.3.4 Stormwater, Wastewater and Water Supply

- Auckland Council. On-site stormwater management manual. Auckland: Auckland City Council, 2002.
- Auckland Council. Soakage design manual. Auckland: Auckland City Council, 2003.
- Auckland Council. Stormwater management devices in the Auckland region. Auckland Council guideline document, GD2017 /001 (GD01)
- Auckland Council. Technical Publication No. 10 (TP10) Design guideline manual stormwater treatment devices, 2003.
- Auckland Council. Technical Publication No. 108 (TP108) Guidelines for stormwater runoff modelling in the Auckland region, 1999.

- Auckland Council. Technical Report TR2013/018: Hydraulic Energy Management - inlet and outlet design for treatment devices, 2013
- Auckland Council. Water Sensitive Design for Stormwater. March 2015 Guideline Document 2015/004
- Auckland Council. Technical Report TR2013/040: Stormwater Disposal via Soakage, 2013
- Christchurch City Council. Waterways, wetlands and drainage guide - Part A: Visions and Part B: Design. 2003.
- Environment Protection Authority (EPA) Victoria. Maintaining water sensitive urban design elements. Melbourne: EPA Victoria, 2008.
- Greater Wellington Regional Council. Fish friendly culverts. June 2003. Available at: http://www.gw.govt.nz/assets/council-publications/fishfriendlyculv.pdf
- New Zealand Water Environment Research Foundation (NZWERF) On-site stormwater management guideline. Wellington: NZWERF, 2004.
- New Zealand Society of Large Dams (NZSOLD). Dam safety Guidelines. 2015
- National Institute of Water and Atmospheric Research (NIWA). New Zealand Fish Passage Guidelines, for structures up to 4 metres. 2018
- North Shore City Council. Bioretention guidelines. Takapuna: North Shore City Council, 2008.
- Puddephatt, J, and Heslop, V. Guidance on an integrated process - Designing, operating and maintaining low impact urban design and development devices. Landcare Research, July 2008.
- Sustainable urban drainage systems (SUDS) design manuals for countries in the United Kingdom
- Water sensitive urban design (WSUD) manuals from various Australian states and cities

2.3.5 Websites

- Auckland Council https://www.aucklandcouncil.govt.nz
- Austroads http://www.austroads.com.au
- Ministry for the Environment http://www.mfe.govt.nz
- National Pest Plant Accord http://www.biosecurity.govt.nz/nppa
- Heritage New Zealand http://www.heritage.org.nz
- New Zealand Legislation http://www.legislation.govt.nz
- New Zealand Waka Kotahi Transport Agency http://www.nzta.govt.nz/
- Plastics Industry Pipe Association of Australia: http://www.pipa.com.au
- Trips Database Bureau https://www.transportationgroup.nz/trips-database-%20%20bureau/
- Water Services Association of Australia http://www.wsaa.asn.au/
- Earth Sciences New Zealand https://www.gns.cri.nz/
- Three Waters Legislation https://www.taumataarowai.govt.nz/about-us/legislation

2.4 Abbreviations

A list of abbreviations used throughout these specifications is as follows:

ABBREVIATION	DEFINITION
ARI	Average Recurrence Interval, sometimes known as 'return period'. It is the average number of years that it is predicted will pass before an event of a given magnitude occurs. For example, a 50 year ARI event would on average happen every 50 years
The Council	Clutha District Council
CPTED	Crime Prevention Through Environmental Design – a crime prevention philosophy based on the premise that 'proper design and effective use of the physical environment can produce behavioural effects that will reduce the incidence and fear of crime, thereby improving the quality of life.' (Crowe, 1991, Crime Prevention Through Environmental Design: Applications of Architectural Design and Space Management Concepts).
CBR	The load-bearing strength of subgrade is measured by California Bearing Ratio (CBR) test.
CMP	Catchment Management Plan – a plan that considers the full hydrological catchment or sub-catchment and is specific to stormwater.
DN	Nominal internal diameter under the pipe manufacturing standard.
GRP	Glass Reinforced Plastic
EPO	Environmental Protection Overlay
HAIL	Hazardous Activities and Industries List
EngCoP	Engineering Code of Practice
ICMP	Integrated Catchment Management Plan – a plan that considers the effects of the full hydrological catchment for stormwater and plans for water, wastewater and stormwater.
LASS	Local Authority Shared Services
MDPE	Medium Density Polyethylene
NZTA	New Zealand Transportation Agency responsible for the management and operations of the State Highway network and allocation of central government roading funds.
PE	Polyethylene
PVC	Polyvinyl Chloride
RAMM ThinkProject	Road Assessment and Maintenance Management and is a computer-based maintenance system that helps to manage the maintenance and renewal of all transportation assets.
RCC	Road Corridor Co-ordinator
RPZ	Reduced Pressure Zone Device or Backflow Prevention Device
SW	Stormwater
TA	Territorial Authority
TMP	Traffic Management Plan
TTM	Temporary Traffic Management
WIA	Water Impact Assessment
PIC	Potential Impact Assessment
CDC	Clutha District Council
ORC	Otago Regional Council
DCC	Dunedin City Council
WW	Waste Water

Table 1: Abbreviations

2.5 Definitions

In this Technical Specification, unless inconsistent with the context, the following shall apply.

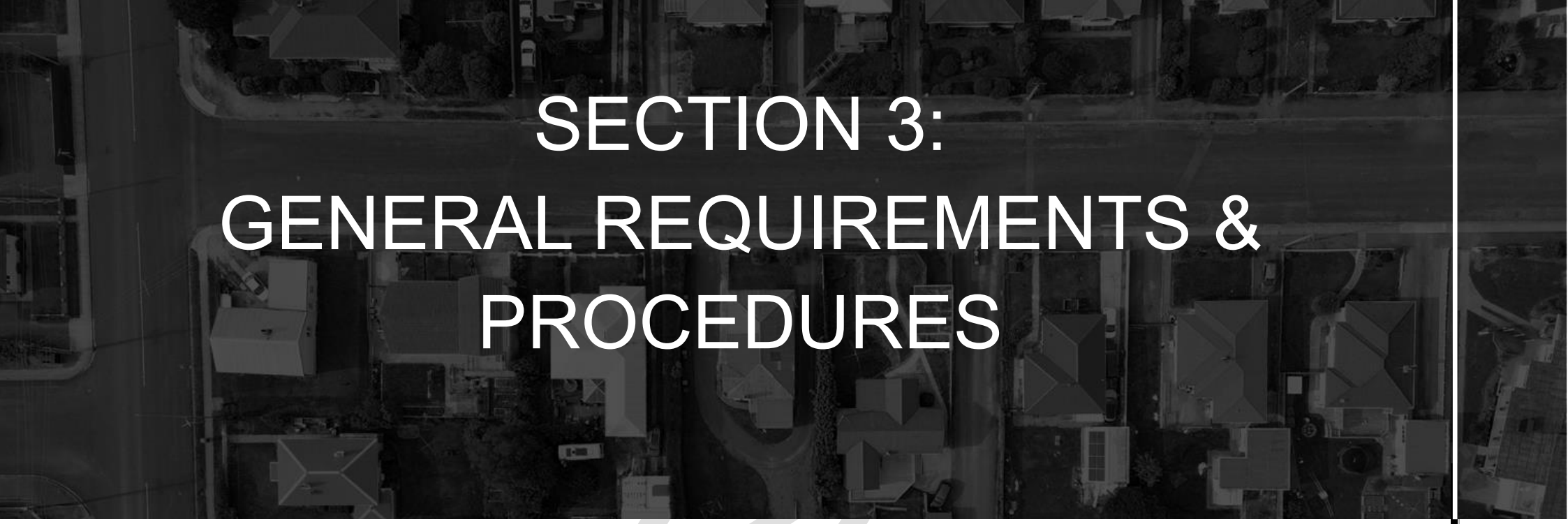
TERM	DEFINITION
Access/Inspection Point	A place where access may be made to a connection for inspection, cleaning or maintenance as defined in the NZ Building Code.
Access Way (or Accessway)	As defined in s315(1) of the Local Government Act 1974.
Annual Exceedance Probability (AEP)	The probability of exceedance of a given occurrence, generally a storm, in a period of one year (1% AEP is equivalent to a 1 in 100-year storm).
Applicant	The person or company that submits the fully completed application to Council for the purposes of receiving Council's consent to subdivide land.
As-built Plan	A plan that depicts the final installed configuration and highlights any departures from the approved design.
Backflow	The unplanned reversal flow of water, or mixtures of water and contaminants into the water supply system.
Berm	A piece of land between the trafficable road surface and the road legal boundary. These areas may be grassed and contain a footpath, signs, streetlights, drainage, bunds or other street furniture.
BPO	Best Practicable Option: in relation to a discharge of a contaminant means the best method for preventing or minimising the adverse effects on the environment.
Carriageway	An area of road reserve provided for the movement of vehicles and cycles or parking of vehicles.
Cement Lining	An internal lining of a pipe, often sacrificial, to extend the life of the pipe from corrosive environments. Typically used to line the inside of steel pipes to protect from corrosion.
CLM	Contaminant Load Model to determine contaminant concentrations predicted for the existing and proposed land-use scenarios.
Code of Practice for Temporary Traffic Management (COPTTM)	Part 8 of the Traffic Control Devices Manual (TCD Manual) which sets out the requirements for all temporary traffic management on State Highways and local roads. It includes the various levels of temporary traffic management, signs and forms used, and examples of traffic management plans.
Collector/Arterial Roads	Roads carrying greater than 1000 vehicles per day (vpd) but note that this is the HCC definition.
Connection	Wastewater and Stormwater Connection – also known as a lateral. A pipeline branch which has no terminal manhole structure which terminates in a private area for the purpose of connecting a premise. Water Connection – also known as service pipe. The section of water pipe between a water main and the point of supply.
Contractor	The company engaged to undertake the physical works on behalf of the council only, it does not relate to an applicant's/developer's contractor. The Contractor's responsibility shall be as defined by the General Conditions of Contract for the works.
Corridor Access Request (CAR)	The process by which utility organisations gain approval to work within the transportation corridor through an application under the National Code of Practice for Utilities' Access to the Transport Corridors.
Corridor Manager	a. In relation to a road (as defined in section 315(1) of the Local Government Act 1974, and which includes State Highways and Government roads), the local authority or other person that has jurisdiction over the road. b. In relation to a motorway (as defined in Section 2(1) of the Government Roading Powers Act 1989), the New Zealand Transport Agency. c. In relation to railway land, the licensed access provider who controls access to the land.
Council representative Council officer	A person appointed by the Council to approve the Engineering work.
Crime Prevention through Environmental Design (CPTED)	Has a set of four principles: surveillance, access management, territorial reinforcement, and quality environments of the built environment. These CPTED principles lead to a reduction in the incidence and fear of crime as well as an improvement in the quality of life.
CSDC	Comprehensive Stormwater Discharge Consent defining stormwater consent conditions.

TERM	DEFINITION
Cycle Lane	A longitudinal strip within a roadway reserved by a marking or sign for the use of cycles.
Cycle Path	A part of the road that is physically separated from the roadway that is intended for the use of cyclists, but which may be used also by pedestrians. This includes a cycle track formed under section 332 of the Local Government Act 1974.
Developer	The company or person who has been granted or holds planning consent for the land being subdivided or is responsible for the consent application. The Developer shall ensure that only suitably qualified and experienced professionals are appointed to undertake the design and supervision of the development works.
Developer's Professional Advisor	The person, appointed by the developer, who shall be responsible for: a. The investigation, design and obtaining of approvals for construction. b. Contract administration and supervision of construction. c. Certification upon completion of Construction.
Developer's Representative	A suitably qualified professional appointed by the Developer to represent them, including registered Engineer and geo-professional (see definition below).
Disconnection	The physical cutting and sealing of any customer connections at the point of discharge or supply.
District	The relevant participating district council.
Drain (Private Drain)	Refers to the private wastewater or stormwater systems that connect the premise at the point of discharge. This section of drain is owned and maintained by the customer or group of customers.
Drinking Water	As defined in the Health (Drinking Water) Amendment Act.
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.
Earthworks	Any alteration to the contours, including the excavation and backfilling or re-compaction of existing natural ground and the stripping of vegetation and topsoil.
Footpath	A portion of any road, pedestrian accessway or public reserve that is laid out or constructed by authority of the Council primarily for pedestrians; and may include the edging, kerbing and channelling thereof.
Freeboard	A provision for flood level design estimate imprecision, construction tolerances, and natural phenomena (such as waves, debris, aggradations, channel transition, and bend effects) not explicitly included in the calculations.
Geo-professional	A suitably qualified and experienced Geotechnical Engineer, Engineering Geologist or Hydrogeologist holding membership with the Institution of Professional Engineers New Zealand (IPENZ) or equivalent professional body, including a current Professional Indemnity Insurance Policy acceptable to the Council
Ground	Describes the material in the vicinity of the surface of the earth whether soil or rock.
Groundwater Drainage	Subsoil drainage system to manage the water content within soils.
Gully Trap	Fitting designed to prevent foul air escaping from the drainage system and used to receive the discharge from private internal waste pipes.
Household 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.
Independent Qualified Person	A specialist approved by Council and having the appropriate skills and qualification to carry out specific procedures.
Infill Development	Redevelopment of urban land through either subdivision or Building Consent.
Infiltration	Groundwater entering a public sewer or private drain through defects such as poor joints and cracks in pipes or manholes. It does not include inflow.
Inflow	Water discharged into private drains from non-complying connections or other drain laying faults. It includes stormwater entering through illegal downpipe connections or from low gully traps.
Interceptor	Strategic gravity wastewater pipe with an external diameter of 525 mm or greater diameter.
Land Drainage System	The flow of stormwater and groundwater focussing on the control of peak surface water runoff, sediments and water quality for such discharges and their reticulation under urban conditions.
Level of Service	The expected performance level of infrastructure.
Local Authority	A regional council or territorial authority as defined in the Local Government Act 2002.
Local Roads	Roads carrying up to 1000 vehicles per day (VPD), note that this is the HCC definition

TERM	DEFINITION
Low Impact Design	An approach to land development and stormwater management that recognises the value of natural systems in order to mitigate environmental impacts and enhance local amenity and ecological values.
Manhole	Service opening which allows access for inspection, cleaning or maintenance of a public wastewater or stormwater system.
Means of Compliance	The method by which the requirements of the relevant District Plan may be complied with. It implies that there may be other methods which may meet the requirement, but which may be subject to specific consideration or approval.
Movement Lane	That part of the formed and sealed road used by vehicular traffic that serves the link function in a road. It may have a shared use for other activities such as walking, cycling, parking and play.
Natural Hazard	Any atmospheric or earth or water related occurrence (including earthquake, tsunami, erosion, volcanic and geothermal activity, landslip, subsidence, sedimentation, wind, drought, fire or flooding) the action of which adversely affects or may adversely affect human life, property, or other aspects of the environment.
Network Utility Operator	Has the same meaning given to it by Section 166 of the Resource Management Act.
Owner	The owner of the land being subdivided (may or may not be the Developer).
Parking Bays	The parking spaces and associated manoeuvring areas of a road or proposed road (as defined by the kerb) which are accessed directly from the road
Pedestrian Access Ways	A path between two roads primarily for the use by pedestrians, these do not include paths on reserves.
Pedestrian Mall	A specified road or part of road that Council has declared a pedestrian mall as set out in Part 336 of the Local Government Act 1974 thereby prohibiting or restrict the driving, riding, or parking of any vehicle, or the riding of any animal, on all or any portion of the pedestrian mall either generally or during particular hours.
PE or Epoxy Lining	Trenchless underground relining and rehabilitation of existing pipes.
Point of Discharge	The boundary between the public sewer and private drain normally at the boundary of the property. Where a public sewer or stormwater system passes through private property the connection point shall be the upstream end of the pipe fitting which forms the junction with the public sewer or stormwater pipe.
Point of Supply	The point on the water pipe leading from the water main to the premises, which marks the boundary of responsibility between the customer and the Council, irrespective of property boundaries.
Potable water	In relation to drinking water, means water that does not contain or exhibit any determinants to any extent that exceeds the maximum acceptable values (other than aesthetic guideline values) specified in the drinking-water standards applicable at the time.
Primary Design Flow	The estimated runoff selected to provide a reasonable degree of protection to the surrounding land.
Primary System (Stormwater)	The primary stormwater system is to accommodate a specified design rainfall event appropriate for the zone as defined in Section 4: Stormwater, Clause 4.2.3. It may include (but not limited to) wetlands, ponds, lakes, rain gardens, swales and filters, pipelines, inlet/outlet structures and soakage areas.
Principal Main	A water main of a minimum of 100mm internal diameter (DN 100) fitted with fire hydrants.
Private Road	Any roadway, place, or arcade laid out or formed within a district on private land, whether before or after the commencement of Part 315 of the Local Government Act 1974, by the owner thereof, but intended for the use of the public generally.
Private Treatment Device	Stormwater treatment device located on private land and maintained by the private owner.
Private Way	Has the meaning ascribed to it in Section 315 of the Local Government Act 1974. A private way is designed to provide vehicular and/or pedestrian access to a public street, and may comprise separately owned entrance strips subject to rights-of-way or a separate lot (access lot) which is jointly owned and used by adjacent lots. It includes any common area defined for the purposes of providing the vehicular access for cross-lease or unit title subdivision.
Professionals	Suitably qualified and experienced persons capable of undertaking the various activities associated with the planning and design phases of the project.

TERM	DEFINITION
Prohibited Characteristics	Trade waste discharged containing the physical and chemical characteristics which the Council has determined must not be discharged into the public sewer system.
Public Treatment Device	Stormwater treatment device vested to and maintained by the Council. Usually providing treatment for large catchments
Receiving Water	The water body that receives the discharge from the stormwater conveyance system and is usually a watercourse, stream, river, pond, lake, or the sea.
Resource Consent	An authorisation given to certain activities or uses of natural and physical resources required under the Resource Management Act (the RMA) by the Council and/or Regional Council.
Restricted flow supply	A type of water supply connection where a small flow is supplied through a flow control device, and storage is provided by the customer to cater for demand fluctuations.
Restrictor	A flow control device fitted to the service pipe to limit the flow rate of water to a customer's premises.
Rider Main	A water main of a minimum of 50 mm internal diameter (DN 50) up to DN 100.
Right of Way (ROW)	A piece of land for vehicular access and with rights as defined in the Property Law Act 2007.
Rising Main (RM)	A pressure main through which wastewater is pumped.
Road	Means all land comprising formed and unformed roads as defined in section 315(1) of the Local Government Act 1974.
Road Controlling Authority	The party that controls the road and is responsible for its operation and maintenance. This is typically the NZ Transport Agency for State Highways and the Territorial Authority for other public roads. Means the territorial local authority, agency or approved organisation in control of roads in accordance with section 317 Control of Roads of the Local Government Act 1974. Approved organisation is defined in the Land Transport Management Act 2003.
Road Culvert	A structure that allows water to flow from one side of the road to the other but does not connect to the council stormwater system. Typically embedded so as to be surrounded by soil, a culvert may be made from a pipe, reinforced concrete or other material.
Road Opening Notice	See Corridor Access Request.
Road Reserve	The land vested for use as road, whether formed or not.
Root protection zone	Means the minimum area required to ensure a tree's health and stability is safeguarded.
Rural Water Supply Area Rural Water Scheme	An area formally identified by the Council as an area serviced by a reticulated water supply system that is intended to supply water for specified purposes via restricted flow supplies and/or on demand supplies but not necessarily with a fire fighting capability. (Refer to the Council's Water Supply Bylaw or GIS).
Secondary Flow	Path The path taken by stormwater runoff in excess of the primary design flow. Capable of providing protection to the surrounding buildings for a once in 100 years return period rain event for commercial, industrial, and habitable residential floor levels.
Service Lane	Any lane laid out or constructed either by the authority of the Council or the Minister of Works and Development or, on or after 1 April 1988, the Minister of Lands for the purpose of providing the public with a side or rear access for vehicular traffic to any land. Means land dedicated as service lane which is used from time to time for the vehicular servicing of adjacent properties.
Service Pipe	See 'Connection'
Service Vehicles	Vehicles that are used to service the needs of the residences, and undertake operation and maintenance activities on the infrastructure within the road corridor such as; rubbish trucks, road sweepers, recycling trucks, line marking trucks, resealing trucks.
Sewer / public sewer	See 'Wastewater System'
Shared Zone	A length of road that is intended to be used by both pedestrians and vehicles, where pedestrians have the right of way over vehicles, as set out in the Land Transport (Road User) Rule 2004 clause 10.2
Shoulder	The portion of the side of the road that is not normally trafficked and resides between the solid white edge line and the edge of seal.
Special Vehicle Lane	A lane defined by signs or markings and restricted to a specified class or classes of vehicle; and includes a bus lane, a transit lane, a cycle lane, multiple occupancy lanes and a light-rail vehicle lane.

TERM	DEFINITION
Stormwater	Rainwater that does not naturally percolate into the ground or evaporate, but flows via overland flow, interflow, channels, or pipes into a defined surface water channel, open watercourse, or a constructed infiltration facility.
Street	Has the same meaning as 'road' as defined by Section 315 of the Local Government Act 1974.
Subdivision	As described in section 218 of the Resource Management Act 1991. Has the same meaning as contained within section 218 of the Resource Management Act 1991 which means: a) The division of an allotment: i. By an application to a District Land Registrar for the issue of a separate certificate of title for any part of the allotment. ii. the disposition by way of sale or offer for sale of the fee simple to part of the allotment. iii. By a lease of part of the allotment which, including renewals, is or could be for a term of more than 35 years. iv. By the grant of a company lease or cross-lease in respect of any part of the allotment v. By the deposit of a unit plan, or an application to a District Land Registrar for the issue of a separate certificate of title for any part of a unit on a unit plan. b) An application to a District Land Registrar for the issue of a separate certificate of title in circumstances where the issue of that certificate of title is prohibited by section 226. The term subdivide land has a corresponding meaning.
Supply Pipe	The section of pipe between the point of supply and the customer's premises through which water is conveyed to the premises. This pipe is owned and maintained by the customer.
Survey plan	As described in Section 2 of the Resource Management Act 1991
Surface water run-off	All naturally occurring water, other than subsurface water, which results from rainfall on the site or water flowing onto the site, including that flowing from a drain, stream, or river.
Survey Plan	A survey plan under Section 2 of the Resource Management Act.
Swale	A constructed watercourse shaped or graded in earth materials and stabilized with site-suitable vegetation or rocks, for the safe conveyance and water-quality improvement of stormwater run-off.
Target Operating Speed	The desired maximum speed for motor vehicles identified by the designer to suit the land use context and road classification. This speed can be managed by physical and psychological devices such as narrowed movement lanes, reduced forward visibility, parking, slow points, build outs, leg lengths, chicanes, planting, landscaping, street furniture, and art works.
Territorial Authority (TA)	A city council or a district council named in Part 2 of Schedule 2 of the Local Government Act 2002
The Works	The works shall generally be defined as the works for which this specification is being used and shall have the definition of 'Contract Works' as defined in NZS 3910:2013.
Trade Waste	Is any liquid, with or without matter in suspension or solution, that is or may be discharged from a trade premises to the Council's wastewater system in the course of any trade or industrial process or operation, or in the course of any activity or operation of a like nature; and may include condensing or cooling water or stormwater which cannot be practically separated.
Vehicular Crossing	Means the part of a vehicle access that starts where a driveway leaves the legal boundary of a property and continues until it meets the road carriageway.
Wahi tapu	Means a place sacred to Māori in the traditional, spiritual, religious, ritual, or mythological sense.
Wastewater	Water that has been used and contains unwanted dissolved or suspended substances from communities, including homes, businesses, and industries.



SECTION 3:
GENERAL REQUIREMENTS & PROCEDURES

Section 3 Table of Contents

3.1 Scope

Section 3 of this Code of Practice outlines matters of general application and general requirements to be observed.

Schedules containing information to be provided in Certificates or As-Builts Plans are included in this section.

3.2 Infrastructure Development Process

3.2.1 General

The responsibility for the site-specific design rests on the Designer of the works. Suitable investigations depending on the nature of the works, the site conditions and circumstances shall be advised by the Designer.

The Designer will need to consider all risks to lifeline systems (Infrastructure) in the event of a natural disaster, including the potential effects of climate change.

3.2.2 Resource Consent

To apply for a resource consent for subdivision or development of land, or as otherwise considered necessary by Council when considering applications to construct infrastructure, Council will require documents to be submitted as indicated in accordance with this Code of Practice.

3.2.2.1 Landowners Written Consent

Where construction is required on another property, consent in writing from the affected landowner(s) must be provided and any Plans and Designs that show they are giving informed consent must be signed by the landowner(s) too. (proof of ownership shall be included within the documentation provided).

The Council will need to understand any proposed easement details at the design approval stage, during construction and the as built acceptance process.

3.2.3 Preliminary Discussion

The Council encourages Designers and/or the Developers Advisor to meet with Council and other possible stakeholders, in the early stages of the design development to discuss any proposed works. The aim of these early discussions is to confirm how the development will meet the Council's standards and integrate with existing networks and infrastructure. These meetings being of a technical nature need suitably qualified and experienced designers to attend to guide their clients on the way forward.

As part of the preliminary discussions the developer shall start consultation with Council on matters such as:

- Vesting of Land
- Creation of Easements
- Landscape design and construction at an early stage of the design development.

Stormwater systems including secondary flow paths shall be considered when landscape designs are determined, to avoid conflict with these systems.

3.2.4 Design

3.2.4.1 Standard Design Basis

Proposals submitted on a standard design basis shall conform to this Code of Practice.

3.2.4.2 Investigation

All investigation, calculations, design, supervision, and certification of the infrastructure outlined in this Code of Practice shall be carried out by or under the control of persons who:

- Are experienced in the respective fields.
- Hold appropriate membership in the respective professional bodies or are recognised by the Council as having proven experience.
- Have appropriate professional indemnity insurance and public liability insurance.

3.2.4.3 Otago Regional Council Requirements

The requirements of relevant plans from Otago Regional Council shall be met. Requirements will generally be limited to effects of stormwater on the natural environment. Otago Regional Councils Regional Water Plan also apply.

Where required site-specific discharge permits and water permits shall be obtained. Advice should be sought from Otago Regional Council at the earliest stage of planning.

Discharge and temporary water permits required during construction shall be applied for by the developer and exercised in the name of the developer.

3.2.4.4 Catchment Management Planning

Stormwater management planning should be carried out on a sub-catchment or catchment-wide basis. Where the proposed development is in an area covered by an Otago Reginal Council Water Plan or Water and Land Plan, designers will be required to comply with the design philosophy in the plan.

If there is no catchment management plan for the area of the proposed development, the stormwater planning requirements should be discussed with Otago Regional Council at an early stage.

The implications of future development on adjoining land should be on the basis of replicating the pre- development hydrological regime whereby the maximum rate of discharge and peak flood levels post- development are no greater than pre-development.

3.2.4.5 Water Quality

Stormwater treatment devices will be required to avoid adverse water quality effects on receiving waters. The type of potential contaminants shall be identified and then treatment devices designed to address the particular issues. The need for treatment devices shall be considered for every discharge even when it is not a direct discharge to a receiving water, for instance where the discharge is to an existing network. In this instance specific approval from Council will be required.

3.2.4.6 Connection to the Public System

Where the connection of individual lots and developments (including lateral pipelines) are to the public system they shall meet the requirements in guidelines and be approved by the Council.

All services within the boundaries of the road reserve shall be maintained by Council or other utility company once formally taken over by that organisation.

Unless specifically arranged otherwise and protected by an easement, services through privately owned allotments shall be the responsibility of the landowner. Refer to the Water Services Bylaw 2018 for details.

3.2.4.7 Roading Design

Development design shall ensure connectivity to properties and roads that have been developed, or that have the potential to be developed in the future.

Unless otherwise approved by the Council through a resource consent decision, all new allotments shall have physical connections to power and telecommunication utilities.

3.2.4.8 Documents to be Submitted for Design Approval

Prior to, or as a condition of, granting a resource consent for subdivision or development of land, or as otherwise required by a District or Regional Plan, when considering applications to construct infrastructure, Council may require documents to be submitted including where appropriate the following:

Design and construction documentation including drawings, specifications, and calculations for the following:

- Earthworks and geotechnical requirements;
- Roading and site access including a design and access statement and a road safety audit. The Access Statement shall cover the relevant aspects listed in the Code of Practice.

Road Safety Audit - Proposals that provide for new roads to vest in the Council shall be subject to the Waka Kotahi NZ Transport Agency Road safety audit procedures for projects unless the Council decides that audits are not required at any or all of the stages.

Safety audits shall cover all road users, including the needs of pedestrians, cyclists, and disabled/elderly users. Where appropriate, the requirements of these groups may demand specific audit procedures.

3.2.4.8.1 Documents to be Submitted for Design Approval

The approval process for land development and subdivision design and construction and documents and supporting information on stormwater drainage infrastructure to be provided at each stage of the process shall be in accordance with Section 1 of this Code of Practice and to be approved by the Council. Specific information to be provided on any concept plans or scheme plans for development or subdivision incorporating stormwater infrastructure shall include details such as proposed capacities, storage, overland flow paths, structural details and the like.

Resource Consents from the Regional Council to discharge, divert, or dam water may also be required. In these circumstances it is good practice:

- To consult with the Council prior to consent application.
- To lodge applications with the Council at the same time so that land use and water-related resource consents can, if required, be dealt with beforehand or at a joint hearing under Sect ion 102 of the RMA.

3.2.4.8.2 Wastewater

Wastewater infrastructure proposed in the subdivision requires approval from the Clutha District Council. This will include a submission on an analysis of the downstream network including pumping stations,

wastewater treatment plant and Regional Council discharge conditions and discharge limits. Applications for design approval shall include the information outlined in Section 4 and Section 9 of this Code of Practice.

If the scope of the development is sufficiently large to include its own pumping station, then reference should be made to WSA 04.

- Structure Plan - Council may provide a structure plan setting out certain information to be used in design, such as flows, sizing, upstream controls, recommended pipe layout, or particular requirements of Council. Where a structure plan is not provided, the designer shall determine this information by investigation using this Code of Practice and normal engineering principles.
- Future Development – Where further development in the catchment upstream of the one under consideration, is provided for in the district or regional plan, Council may require wastewater infrastructure to be constructed to serve any planned upstream development at the development under consideration upstream boundary. All infrastructure proposed to service future development will require the approval of Council.
- Pumping Stations - Pump stations to service new subdivision areas will be permitted only where there is prior agreement with Council on need, catchment area and positioning. Pump stations shall meet the performance standards detailed in this Code of Practice and any referenced documents.

3.2.4.8.3 Potable Water Supply

Water supply infrastructure requires approval from the Council. Design drawings compatible with Council's requirements and the design parameters included in this Code of Practice shall be provided to Council for approval.

The designer is responsible for all aspects of the water system design, excepting those aspects nominated and provided to the designer by Council. If the scope of the development is large and includes its own water source, treatment or reservoirs, reference shall be made to WSA 03.

Detailed plans and design calculations shall be submitted to Council. In addition the requirements outlined in this Code of Practice shall be met.

- Structure Plan - Council may provide a structure plan setting out certain information to be used in the design, such as flows, sizing, upstream controls, recommended pipe layout, or other particular requirements of the Council. Where a structure plan is not provided, the designer shall determine this information by investigation

using the Code of Practice and engineering principles and shall obtain approval for these parameters with Council prior to the design.

- Future Development - Where further subdivision, adjacent to the one under consideration, is provided for in District or Regional plans, Council may require water supply infrastructure to be sized and or installed to cater for such future development.

3.2.4.8.4 Network Utility Services

Refer to the relevant provider. Location of utility services within the road reserve shall be discussed with Council prior to design.

3.2.4.8.5 Landscape and Reserves

All proposed planting to be located within the publicly vested areas shall be agreed with Council prior to installation. Suitability and long- term maintenance implications are to be assessed and agreed.

3.2.4.8.6 Community Facilities

The provision of community facilities such as public toilets and sports grounds shall be discussed with

Council who shall lead the public discussion with the community.

3.2.4.8.7 Geotechnical Engineering Report for section 106 Assessment of the Resource Management Act 1991

A geotechnical engineers-professional's report on the suitability of the land for subdivision or development. The Geo-professional is to be as defined in the Definitions section of this Code of Practice.

3.2.4.8.8 Other Reports

Other Reports as considered necessary by the Clutha District Council will be supplied to provide further evidence that the proposed infrastructure can achieve the requirements of this Code of Practice.

3.2.4.8.9 Safety in Design Register

A "Safety in Design" register that records design decisions made through the planning and design process to mitigate health and safety risks during the investigation, design, construction, operation and maintenance, and demolition of the infrastructure. A "Safety in Design" analysis will be required for overland flow paths and stormwater control devices..

3.2.4.8.10 Scheule 2A Design Certificate

A design certificate in the form of the certificate in Schedule 2A.

3.2.4.9 Approval of Design

When it is satisfied that the design meets the requirements of this Code of Practice, or in the case of an alternative design, that the design satisfies the requirements, Council shall notify the developers representative that the design has been approved and endorse the plans, specifications, and other documents accordingly.

When discovered during construction, design approval may need to be varied to complete infrastructure to comply with this Code of Practice and ensure that asset management principles can be achieved. This includes achieving asset lives for road pavements of 25 years and stormwater and wastewater infrastructure of 100 years.

For the purpose of this approval Council may require the owner to make amendments to any plans, specifications, and other documentation and to submit further or other reports. In considering project design and giving its approval, Council shall act without undue delay.

3.2.4.10 Alternative Design Basis

Proposals submitted on an alternative design basis may differ from this Code of Practice and shall apply specifically to a particular proposal. Council approval of an alternative design does not confer approval in general by the Council to any design criteria, construction technique or material forming part of the alternative design.

An explanation of the design basis or construction method is to be submitted, for approval in principle. It will be considered on its merits and may be approved provided that the design results in infrastructural development equivalent or superior in performance to that complying with this Code of Practice.

Alternative designs need to provide flexibility to meet the circumstances and requirements peculiar to the site, or as a means of encouraging innovative design, or to meet the principle of life-cycle costing..

3.2.4.11 Life-Cycle Costing

Life-cycle costing may be used to consider options in a proposal or a proposal as a whole. In undertaking a life-cycle costing, consideration shall be given to the initial costs borne by the developer and the maintenance and replacement costs borne by the future owners or Council. A reasonable balance shall be maintained between these short-term and long-term costs.

3.2.5 Datum and Co-ordinate Systems

All reduced level information shall be in metres in terms of the Council datum and shall be referred to a permanent benchmark identified on the plans. The Council vertical and horizontal datum is defined using:

- New Zealand Vertical Datum 2016 (NZVD2016).
- Horizontal coordinates in New Zealand Transverse Mercator 2000 (NZTM 2000) projection.

3.2.6 Design Drawings

3.2.6.1 General

Design drawings shall be prepared in accordance with Council's latest published practices/requirements. Except where otherwise notified, the requirements are as set out in this Code of Practice.

All drawings shall be provided in the forms required by Council. Hand drawn plans or Hand drawn mark ups will not be accepted except for the smallest of projects.

Drawings should not contain any linked, embedded objects or external referencing.

Drawings shall be to adequate detail to clearly illustrate the proposals and enable assessment of compliance with this Code of Practice and enable accurate construction.

3.2.6.2 Composition of Design Drawings

Design drawings generally include the following:

- A locality plan giving the overall layout and location.
- Detailed plans, longitudinal sections, cross sections, and diagrams of the proposed developments.
- Separate drawing sets for the various networks being constructed, e.g., – for roading, for car parks, for potable water, for stormwater and for wastewater.
- Special details where the standard drawings are not sufficient.
- A north point and level datum, the scale or scales used, the date of preparation and the date of any amendments, the designer's name and contact details, and a unique contract and drawing number or identifier.

3.2.6.3 Scale for Design Drawings

The scale for plans is generally 1:500 but other accepted scales may be used to suit the level of detail on the plans. Special details shall be to scales appropriate for clarity.

3.2.6.4 Content of Design Drawings

The following information when relevant shall be shown on the design drawings:

- The extent of the construction showing existing and proposed roads, and the relationship with adjacent construction, services, or property.
- Significant existing vegetation to be removed and any special or protected trees, areas of heritage significance, and existing water bodies that may be affected by the construction
- The extent of earthworks, including earthworks on proposed reserves, existing and proposed contours, areas of cut and fill, batter slopes, subsoil drainage, and sediment control measures both temporary and permanent.
- The design of proposed roads (and their connections with existing roads), including longitudinal and cross section plans, horizontal and vertical geometry and levels, typical cross sections, details of proposed pavement surface, kerbing, swales, berms, footpaths, cycle paths, tree planting, road marking and signals, and all other proposed road furniture.

- The horizontal and vertical location and alignment, lengths, sizes, materials, minimum cover, position relative to other services of all proposed water, wastewater, and stormwater systems and service connections, valves, hydrants, manholes, bends, tees, meters and backflow devices, and services that may be reconnected or plugged, and any proposed overland stormwater flow path.
- Details and location of mechanically restrained portions of pipelines, pipeline bridges, pumping stations, reservoirs, intake and outlet structures and the location of surface obstructions, hazards, or other features that may be affected by the construction.
- For water mains, the nominal static pressure head at the point of connection and at the lowest point; design pressure and maximum design pressure.
- Details and location of existing and proposed telecommunications, electricity and gas supply, and street lighting layout, including proposed underground and above ground junction boxes, transformers and similar equipment. This information is typically provided by the service authorities once other design drawings are finalized and approved
- Details of proposed landscaping of roads and allotments, and details of proposed reserve development including earthworks, hydrological features, walkways and accessways, landscaping features, landscaping structures, tree planting, revegetation, hard and soft surface treatment, park and road furniture, and playground equipment.
- The location of any natural waterways or wetlands upstream and downstream and within the site or in close proximity to a boundary. The location in plan and level of the water's edge and shoulder of the banks shall be indicated
- Typical pre-existing and post development cross sections through any natural waterways or wetlands
- The proposed proximity of buildings to the water's edge or the shoulder of the banks, or both.
- Clear identification of the extent of any river, stream, or coastal floodplains on, or in close proximity to the site and overland flow paths within the site
- Confirm the level datum is as defined within this document.

Applications for design approval shall include the information outlined in Section 3.2.4.8 of this Code of Practice. In addition the following information shall be provided:

- A plan showing the proposed location of existing and proposed stormwater infrastructure and flow paths.
- Detailed long sections showing the levels and grades of proposed stormwater infrastructure in terms of the Council datum.
- Details and calculations prepared which demonstrate that agreed levels of service will be maintained. All applications to develop within a flood plain shall be supported by detailed calculations and plans to determine the floodplain boundaries and building floor levels to meet the freeboard requirements in Section 6.3.6.1.
- Details and calculations prepared which clearly indicate any impact on adjacent area or catchment that the proposed infrastructure may have.
- Operations and maintenance guidelines for any water quantity and or quality control structures shall be submitted to Council for design approval along with other documents. The guidelines should describe the design objectives of the structure, describe all major features, explain operations such as recommended means of sediment removal and disposal, identify key design criteria, and identify on-going management and maintenance requirements such as plant establishment, vegetation control, and nuisance control.

3.2.7 Low Impact Design

Low Impact Design can be used to augment traditional methods such as detention ponds to reduce stormwater flows from new developments back to Greenfields flow characteristics and is both a design approach and a range of structural techniques that can be applied to urban development and stormwater management. As a design approach, Low Impact Design provides an opportunity to identify and recognize natural features and integrate these into the design of development layouts in order to minimise environmental impacts or enhance natural features. The integration of natural processes in the design stage of a development can result in more attractive, multifunctional landscapes with greater social, environmental, cultural, and transport outcomes.

Low impact design solutions that use natural processes and add value to urban environments are the preferred approach.

3.2.8 Climate Change

Climate change is likely to increase the magnitude and frequency of some hazards, therefore it is important to incorporate risk management in the design of infrastructure supporting new developments to maintain the same level of service throughout the design lifetime. The design of infrastructure for land development and subdivision needs to provide for the impact of sea level rise and the increased frequency of extreme weather events especially storm water impacts. To this end requirements for stormwater design set out in Section 6 include requirements for climate change and define the storm events to be designed to for primary and secondary drainage systems. Secure location over the lifespan rather than constructing protection is required for assets.

Requirements for climate change with respect to sea level rise are specifically detailed in Section 6.3.6.2.

3.2.9 Urban Design Protocol

The New Zealand urban design protocol seeks to ensure that the design of buildings, places, spaces, and networks that make up our towns and cities, work for all of us, both now and in the future. Council is a signatory to the New Zealand Urban Design Protocol. The New Zealand urban design protocol identifies seven essential design qualities for good urban design:

- **Context:** seeing that buildings, places, and spaces are part of the whole town or city.
- **Character:** reflecting and enhancing the distinctive character, heritage, and identity of our urban environment.
- **Choice**: ensuring diversity and choice for people.
- **Connections:** enhancing how different networks link together for people.
- **Creativity:** encouraging innovative and imaginative solutions.
- **Custodianship:** ensuring design is environmentally sustainable, safe, and healthy.
- **Collaboration:** communicating and sharing knowledge across sectors, professions, and with communities.

The New Zealand urban design protocol has been the primary influence on the urban layouts that are encouraged in this Code of Practice.

3.2.10 Construction Phases

3.2.10.1 Pre-Construction

Construction shall not commence on site unless and until:

- Resource consents have been issued, except when no such consents are required.
- Council have approved any other consents and the drawings, specifications, and calculations for the specific infrastructure that is required in accordance with Section 3 of this Code of Practice.
- A pre-construction site meeting with Council representatives, the Developers representative, the Contractor(s) has been held. At this meeting the following shall be displayed
    - CAR and TMP approved documents
    - Health and Safety plan
    - Approved engineering plans

Any necessary permits and consents required by law.

3.2.10.2 Notification of Construction Programs

The developer shall notify Council, in writing, of the names and addresses of contractors to whom it is proposed to award the contracts, and the nature of the construction in each case.

Unless Council requires otherwise, the developer shall notify Council in writing when the following phases of construction are reached and such other phases as the Council may determine to enable inspection to be carried out:

1. Commencement of construction.
2. Completion of temporary works including erosion and sedimentation control devices.
3. Prior to concrete pour construction.
4. Prepared earthworks and subsoil drainage prior to filling.
5. Completed earthworks and prepared subgrade.
6. Water, wastewater, and stormwater reticulation prior to backfilling.

7. Water and wastewater reticulation during pressure testing.
8. Finished basecourse before the commencement of road sealing.
9. Disinfection of water mains.

At least 48 hours' notice shall be given by the developer. Further construction phases shall not proceed until inspection has been made.

3.2.10.3 Construction

All construction carried out in any development shall be carried out by persons who:

- Have the appropriate experience and qualifications in the relevant areas.
- Have the appropriate equipment.
- Have the appropriate public liability insurance.
- Meet the requirements of the Health and Safety in Employment Act.

3.2.10.4 Earthworks Construction

Earthworks shall be carried out to the standards detailed in the Code of Practice.

The construction control testing shall be carried out by a testing laboratory or competent person under the control of a suitably qualified person or, where required by Council, a geo-professional, and to the recognized testing standards as deemed appropriate. The testing laboratory shall have recognized registration or quality assurance qualifications.

3.2.10.5 Stormwater Construction

The construction of pipelines shall be carried out in accordance with the requirements of AS/NZS 2032 (PVC), AS/NZS 2033 (PE), AS/NZS 2566 Parts 1 and 2 (all buried flexible pipelines), or AS/NZS 3725 (concrete pipes).

For Urban developments on site disposal of stormwater may be permitted only where:

- No piped system is immediately available or will not be available within 10 years of the subdivision application.
- No piped system is available immediately adjacent or within a reasonable distance of the site.
- Where ground conditions are suitable, and it is appropriate to encourage low impact design for the management of stormwater.

Otherwise, a 100mm lateral connection for each new urban lot to the public stormwater reticulation is required.

For clarification of what constitutes a "reasonable distance" refer to Section 9.8 of this Code of Practice. Areas where construction has taken place shall be reinstated to the condition required by Council.

3.2.10.6 Wastewater Construction

The construction of pipelines shall be carried out in accordance with the requirements of AS/NZS 2032 (PVC), AS/NZS 2033 (PE), AS/NZS 2566 Part 1 and 2 (all buried flexible pipelines), AS/NZS 3725 (concrete pipes), or AS 1741 or BS EN 295 (VC).

Areas where construction has taken place shall be reinstated to a condition as required by Council. For Urban developments on site disposal of wastewater is not permitted unless:

- No piped system is immediately available or will not be available within 10 years of the subdivision application.
- No piped system is available immediately adjacent or within a reasonable distance of the site.
- Where ground conditions are suitable, and it is appropriate to encourage low impact design for the management of stormwater.
- Otherwise, a 100mm lateral connection for each new urban lot to the public wastewater reticulation is required.

For clarification of what constitutes a "reasonable distance" refer to Section 9.8 of this Code of Practice.

3.2.10.7 Water Supply Construction

Excavation of existing carriageways shall conform to Council's Road opening procedures in accordance with an authorized CAR. Excavation in existing carriageways shall be carried out in a safe manner with the minimum disruption to traffic and pedestrians and in full compliance with MOTSAM.

3.2.10.8 Road Construction

Pavement construction shall comply with the requirements of Council and as a minimum to the Waka Kotahi NZ Transport Agency standards set out in this Code of Practice.

3.2.11 Documentation held on Site

A full set of up to date approved drawings shall be maintained on site at all times. These drawings shall be made available to Council staff during site inspections.

3.2.12 Variations to the Approved Design

Should the approved design need amending in any way that impacts upon the principles of the approved design, the developer shall resubmit the revised design for approval and obtain that approval prior to construction.

3.2.13 Inspections and Hold Points

Throughout this Code of Practice there are a number of construction points which require notification to Council in advance so that the works can be inspected. The developer shall treat these as hold points and shall not progress until such time that Council confirms acceptance or approval to proceed. To avoid delays to the developer's construction program this requirement highlights the need to provide adequate notice (5 days preferable, 2 days absolute minimum).

3.2.14 Supervision of Construction

The level of supervision undertaken in connection with any construction shall be agreed between Council and the developer, or, if appointed, the developer's professional advisor or the IQP as the case may be, and shall be appropriate to the circumstances considering the size and importance of the project, the complexity of the construction, and the experience and demonstrated skill in quality management of the person undertaking the construction.

Council will require completion certification for construction and supervision to be submitted to it on completion. The certificates shall be in the form given in Schedules 2B and 2C in the Code of Practice. Such certification will be required from the contractors undertaking the construction, the developer or the developer's professional advisor (if appointed).

3.2.15 Connecting to existing services

Connection of wastewater and stormwater to existing systems will normally be carried out by the appropriate network utility operator at the cost of the developer, except that at the discretion of Council, connections may be made by the owner, or contractor employed by the owner, if appropriately qualified and under the network utility operator's supervision.

Water connections and cut ins to any live network will only be carried out by Councils contracted network operator. No other person(s) may connect into council's water reticulation network.

The developer shall give the network utility operator a **minimum** of five working days' notice of intention to connect to existing services. Where required, new services shall be tested by the installer and approved by the network utility operator, prior to connection.

3.2.16 Inspection and Acceptance

Council may, at its discretion, also require a pipeline test to be carried out. Such testing shall be carried out as specified in Section 8.7.

3.2.17 Maintenance

The developer shall maintain the infrastructure until it is formally taken over by Council or to a date specified in a bond or consent condition for completion of uncompleted infrastructure. The developer shall not be responsible for damage caused by other activities (outside the developer's control) such as building construction by others or for fair wear and tear or vandalism caused by public use of the roads that have been taken over by Council or network authority. The developer shall be responsible for the first mud tank or catchpit desludging after chip sealing and not before vesting of roads.

3.2.18 Testing

Any infrastructure required to be tested and witnessed by Council/the utility operator shall be pre-tested and proved satisfactory by the developer before testing by the network utility operator is requested. Evidence of a "Pass" must be provided.

3.2.19 Reinstatement

Areas where construction has taken place shall be reinstated to the condition specified in the CAR, and shall be no less a standard than the original construction pre-works.

3.2.20 Asset Handover Process

3.2.20.1 Completion Documentation

On completion of all subdivision, land use and development infrastructure, as built data and information is required for submission to Council. The developer shall provide Council with the following:

- The geotechnical reports and as-built plans required by Section 4.4 of this Code of Practice.
- As-built plans of all infrastructure showing the information set out in Schedule 2D. As-built plans will be required in an electronic format (as laid out in this document) for urban subdivisions and developments that incorporate assets to vest shall be supplied in hard copy. The electronic data is to use the New Zealand Transverse Mercator (NZTM) co-ordinate system or the current standard co-ordinate system recognised by the governing body (LINZ).
- If electronic data does not meet Council's format requirements or is deemed to be of inadequate quality, Council will return to the developer for error correction.
- Evidence that all testing required by this Code of Practice has been carried out and that the test results comply with the requirements of this Code of Practice.
- Evidence that reticulation and plant to be taken over by network utility operators have been installed to their standards and will be taken over, operated and maintained by the network utility operator concerned.
- Design certificate as per Schedule 3A
- An updated Safety in Design register. This should be an updated form prepared at the completion of design to indicate what risks have been closed out during the construction phase.
- Completion certificates as per Schedules 3B and 3C.
- Certification by a suitably qualified person where they have recommended a specific design and construction has been undertaken in accordance with that recommendation. The certification shall state that the suitably qualified person supervised the construction, and it has been completed in accordance with the recommended design principles.
- Other documentation required by Council including, but not limited to, operation and maintenance manuals, and warranties for new facilities involving electrical or mechanical plant, and asset valuations for all infrastructures to be taken over by Council.

More specific requirements on roads, Three Waters, and community resources are listed in the following sections.

3.2.20.2 Roads

Roading specific tests are required for assets to be vested on the completion of the subdivision development or infrastructure build. The testing results are to be submitted to Council as part of the roading asset handover process. The list of required tests is presented in Table 2. For assets that are not to be vested, developers shall provide a declaration to state that all Code of Practice standards have been met.

Council will be adopting the updated national RAMM database guideline as a minimum requirement plus any other Council specific requirements.

Table 2: Test Requirements for Roads – Design Stage

Design Stage			
Material Type	**Testing Required**	**Test Method**	**Testing Frequency**
Design and Site Investigation Stage	Subgrade CBR/Test Pits provided for any investigations undertaken to inform the Design	To comply with	As required for Design Purposes
Roading Plans	Long section and Cross Sections, etc		

Laboratory Tests			
Material Type	**Testing Required**	**Test Method**	**Testing Frequency**
Source properties (all granular materials, including sealing chip)	Weathering, Crushing	NZS 4407	1 test / source no more than 48 months old
Sub-base and Basecourse	Maximum Dry Density (NZ Vibrating compaction)	NZS 4402	1 test/source for each granular layer at minimum frequency of one test per 5,000m^2 of material laid
Sub-base	• Particle Size Distribution, Sand Equivalent, • Log-Log graph, • The slope (n), • Coefficient of Uniformity (Cu) and Curvature (Cc)	NZS 4407	• Lots <2,000m^3, 2 samples • Lots >2,000m^3,2 samples • Plus 1 sample for each additional 1,000m^3
Basecourse	• Particle Size Distribution, % crushed faces • Sand Equivalent, • Log-Log graph, • The slope (n), • Coefficient of Uniformity (Cu) and Curvature (Cc)	NZS 4407	• Lots <1,000m^3 2 samples Lots, • >1,000m^3 2 samples, • Plus 1 sample for each additional 500m^3

Field Tests			
Material Type	**Testing Required**	**Test Method**	**Testing Frequency**
Sub-base	Field Dry Density – Nuclear Density Meter	NZS 4407 TNZ B/02	1 set of tests/1,000m^2 of surface area 0.5m lifts in culvert trenches
Construction Tolerances	Tolerances/Stringing	TNZ B/02	Every 20m

Field Tests			
Material Type	**Testing Required**	**Test Method**	**Testing Frequency**
Concrete Kerb and Channel and Footpaths	• Slump and strength	-	-
Basecourse	• Field Dry Density – Nuclear Density Meter, (including field and oven water contents)	NZS 4407 TNZ B/02	• 1 set of tests/1,000m^2 of surface area
Basecourse	• Benkelman Beam	See Clause 5.4.9	• Wheel path in both lanes at maximum interval of 10m
Surfacing	• Spray sheets / Mix design	TNZ P/3 TNZ M/10 NZTA Z8:2020	• NZTA Z8:2020 Minimum Standard for Inspection, • Sampling and Testing
Underground Services	• Description, As-builts, and Photographic Evidence	-	-
Street Lighting	• All relevant information	-	-
Site Visits Checklists	• ITP	-	-

3.2.20.3 Three Waters

The As-Built handover documents for Three waters infrastructure will include drawings, excel sheets and reports – refer to Clutha District Councils **As-Built Specification for Water Services**.

These need to be based on site survey, georeferenced CAD or Shape files with coordinates and descriptions. Table 3 lists an example of the minimum requirements for Three waters as-built asset information.

The details of all pipes should include:

- Material and type, manufacturer
- Length
- Structural details (i.e. pressure class, stiffness rating & load rating)
- Diameter
- Off-set, segment and overall length dimensions should all correctly add up and agree once drawn into GIS.
- Meter number and Lot reference

Table 3: Generic Requirements of As-Built Asset Information for Three Waters Assets

As-Built Asset Information for Three Waters Assets
Microsoft Excel Spreadsheet
• Coordinate system (NZTM 2000)
• Asset Type for each record

As-Built Asset Information for Three Waters Assets
• XYZ/Northing Easting and Height coordinates
AutoCAD Files
• Coordinate system (NZTM 2000)
• Well labelled objects
• Historic/abandoned pipes
• Legend with a breakdown of layers (e.g., 'Water_lateral', 'Water_Main', 'Water_Toby')
• Existing infrastructure and type of work (e.g., dug up, abandoned, replaced)
• New infrastructure clear and readable
• Parcels or reference for adding to Council system
As-Built Report
• Coordinate system (NZTM 2000)
• Asset Type for each record
• XYZ/Northing Easting and Height coordinates
Microsoft Excel Spreadsheet
• What/who this project/work was for and who the owners of the various assets that have been created are
• Existing infrastructure and type of work (e.g., dug up, abandoned, replaced)

3.2.20.4 Community Resources

Community resources includes community facilities, open space, water facilities, community services, and heritage and culture. Table 4 presents the requirements of asset handover for the community resource activities.

Table 4: Requirements of Asset Handover for Community Resources Activities

Sub-Activity	Land Use and Services	Requirements of Asset Handover
Community facilities	Community Centre and Halls Offices and Libraries Public Toilets Dump Stations Amenity Building	Treat as a building asset, for which the as-built information below should be collected: 1. As-Built Design Drawings 2. Vendor Supply Information (shop Drawings and Technical Dataset) 3. Operation and Maintenance Information Survey information of the Locations of Key Assets
Open Space	Reserve Community Park	Asset handover submission need to specify based on the nature of the facilities: paths/tracks, seats, signage, bridges, board walk, fences, drinking fountains. For which the as-built information below should be collected: 1. As-built design drawings

Sub-Activity	Land Use and Services	Requirements of Asset Handover
		2. Vendor supply information (shop drawings and technical dataset) 3. Operation and maintenance information 4. Survey information of the locations of key assets
	Nature Park	
	Sports field	Asset handover submission need to specify based on the nature of the facilities: paths/tracks, seats, signage, bridges, board walk, fences, drinking fountains, artificial surface, training nets, clubrooms. For which the as-built information below should be collected: 1. As-built design drawings 2. Vendor supply information (shop drawings and technical dataset) 3. Operation and maintenance information 4. Survey information of the locations of key assets
	Streetscaping	Asset handover submission need to specify based on the nature of the facilities: paths/tracks, seats, signage, bridges, board walk, fences, drinking fountains. For which the as-built information below should be collected: 1. As-built design drawings 2. Vendor supply information (shop drawings and technical dataset) 3. Operation and maintenance information 4. Survey information of the locations of key assets
	Linear Park	
	Playground	Asset handover submission need to specify based on the nature of the facilities: play equipment, soft fill, wooden edging, seats, shade, drinking fountains, paths, signage. For which the as-built information below should be collected: 1. As-built design drawings 2. Vendor supply information (shop drawings and technical dataset) 3. Operation and maintenance information 4. Survey information of the locations of key assets
	Golf Course	
Community services	Cemeteries	Asset handover submission need to specify based on the nature of the facilities: cemetery beams (Concrete strips), sheds, memorial walls, seats and shelters. For which the as-built information below should be collected: 1. As-built design drawings 2. Vendor supply information (shop drawings and technical dataset) 3. Operation and maintenance information 4. Survey information of the locations of key assets
	Community housing units	
Water Facilities	Wharf/jetty	Treat as a building asset, for which the as-built information below should be collected: 1. As-built design drawings 2. Vendor supply information (shop drawings and technical dataset) 3. Operation and maintenance information 4. Survey information of the locations of key 5. assets
	Boat ramp	
	Navigation aid	
	Swimming pontoon	
	Retaining walls	
	Viewing platform	

3.2.20.5 Approval of Uncompleted Work

Where in the opinion of Council it is assessed as reasonable, and unlikely to materially affect the safe operation of public assets and expectations and interests of the public and directly affected private parties, the Council may approve the deferral of completion of an element of a consented and approved work, subject to satisfactory bonds being arranged.

3.2.20.6 Bonds and Charges for Uncompleted Works

Bonds to cover uncompleted works, especially where a subdivision or development has been substantially completed, are recognized as an acceptable procedure and should be permitted at the discretion of Council. Acceptance of a bond for uncompleted works shall not be unreasonably withheld.

Bonds shall be secured by an appropriate guarantee or shall be in cash and lodged with Council. Where necessary bonds shall be executed and registered.

The amount of the bond shall be the estimated value of the uncompleted work plus legal and quality assurance costs and inspection costs plus 50% to cover additional costs estimated to be incurred by Council in the event of default. Works with a value less than $5,000.00 will not be bonded.

3.2.20.7 Reserves and Land Protection Covenants

Layout plans and location of reserves and land protection covenants shall be discussed with Council prior to the lodgement of finalized plans. Development plans for all future reserves shall be submitted with application for engineering approval, and no work is to be carried out on site before Council approval is issued.

All reserve development shall be completed in accordance with the plans approved by the Council. Development may include earthworks, drainage, overland flow paths, planting, paths, structures (such as seating, tables, litter bins, fencing, barriers, signs, and play equipment) and facilities (such as toilets, changing sheds and footpath lighting) as specified by the Council.

3.2.20.8 Certification

The developer shall keep records of all testing and commissioning to be provided to Council as part of asset handover process.

3.2.20.9 As Built Drawings

3.2.20.9.1 General

Full as-built documentation is to be submitted for all infrastructure to be vested in Council and all private infrastructure that is located within public land.

All as-built information will be issued in the approved format and of a quality acceptable to Council prior to the issue of Section 224(c). If electronic data does not meet Council's format requirements or is deemed to be of inadequate quality, Council reserves the right return to the developer for error correction. Further processing may be delayed until an as-built set has been approved.

The as-built documentation shall consist of:

- One set of paper prints showing the plan location of all new infrastructure features and utilities and any that have been either removed or retired as a result of the project.
- For all except very limited developments involving only one or two pipes, a digital copy of the plan information.
- A digital table of asset information such as pipe type, pipe diameter, pipe lengths, position co - ordinates, levels, depths, water meter numbers etc.

All as-built plans are to be prepared under the supervision and certified as to accuracy by a suitably qualified person using a Schedule 3D, As-Built Plans certificate.

For Three Waters Infrastructure – refer to the **Clutha District Councils Three Waters Asbuilt Specification for Water Services.**

The documents are to be prepared in a format suitable for downloading into Council's GIS. Detailed requirements for each of these are set out below

3.2.20.9.2 Plan Coverage

Plans shall show:

- Accurate property boundary positions.
- The datums for levels and for coordinate positions.
- Local benchmarks for level and position, if applicable.
- All roading features (kerb and channel, footpaths).
- Street lighting and transformers.
- All wastewater, stormwater and water supply surface boxes and features.
- All pipelines with gravity and rising mains identified.
- Pipelines and other assets removed from the site.
- Superseded or disconnected pipelines still remaining at the site.
- Any asbestos material items left buried.
- The location of all cable to be taken over by Council.
- The location of any non-council utility services sited by agreement on Council reserves.
- Areas of filling showing the extent of and depth of fill (appropriate grid or fill contours).
- Correct road names as approved by Council.
- All alterations from the original design shall be shown on the plan with reference m a de in
- accompanying correspondence to the Engineer's approval for the alterations.

3.2.20.9.3 Plan Prints

Hard copy plans shall be supplied if requested by Council. They shall be prepared in accordance with accepted good engineering design practice and be easy to follow and clear to read. Drawings shall comply with AS/NZS 1100.

3.2.20.9.4 Digital Plans

Digital plans are to be prepared in a format such as DXF, DWG or Shapefile that can be imported into Council's GIS. Council's preference is for plan to be provided in Shapefile format. Surveyors and draughtsmen are advised to contact the Council office to check particular requirements. A digital (PDF version of the drawings shall also be provided.

For **Three Waters Infrastructure –** refer to the **Clutha District Council As-Built Specification for Water Services**.

Plans are to be prepared in accordance with the following conventions:

- The coordinate system shall match that used by the Council GIS (see Section 3.5 for requirements).
- Each utility asset type is to be placed on a specific separate layer.
- The layer is to be given a meaningful name (such as sewer mains or streetlights) with this name being consistently used for all plans.
- Only information relevant to the layer is to be placed on that layer.
- Each pipe is to be represented by a single line representing the pipe centreline.
- Each pipe shall run continuously between manholes and be broken at manholes.
- Water mains with bends are to be drawn as one continuous line.
- Pipes are not to be broken at service lines, sump leads or laterals junctions.
- Line work is to be accurately snapped to point features and to be accurately joined at junctions and bends.
- Point assets on water mains, such as valves, hydrants, tees are to be snapped on to the main, not breaking it.
- Manholes are to be located by the point at the centre of the manhole lid. Other surface features such as sumps, valves and hydrants are to be represented by the point at their centre.
- Gravity flow stormwater and sewer pipes are to be numbered in the direction of flow.
- Pressure networks are to be generally numbered in the direction of falling pressure.
- Each point feature and each line end on the plan is to be uniquely numbered with position and descriptive details relevant to each point being attached in a table, as set out in the next section.

3.2.20.9.5 Digital Tables

The following tables of information are to be supplied in digital format:

For all facilities:

- Feature number.

- Feature type.
- X, Y, Z co-ordinates.
- Additional information as below.

For underground facilities:

- Depths to manhole inverts and to pipe inverts entering manholes through drop connections.
- Depths of lateral service pipes at property terminations.
- Position of lateral connections relative to property side boundaries.
- Descriptive information. Descriptive information shall include such aspects as material type, pipe class, pipe diameter, manhole diameter, hydrant manufacturer relevant to the type of asset being described and sufficient to fully specify what has been installed.

Note: for Three Waters Assets, refer to Clutha District Councils Asbuilt Specification for Water Services

3.2.20.9.6 For street-lighting:

- Descriptive information about poles such as make, model, material, height.
- Information on the mounting arm or bracket and final mounting height.
- Information on the luminare such as make, model type – Clutha District Council has luminaires standard available

3.2.20.9.7 Conventions to be followed in populating the tables with information are:

- The feature number may be any unique whole number allocated by the licensed cadastral surveyor, but the numbers used are to be sequential.
- The feature type is to be the commonly used name such as sump, valve, and manhole with the naming being consistent over the project.
- Co-ordinate positions shall be accurate to within +/-100 mm.
- Levels shall be accurate to within +/-20 mm and expressed in terms of mean sea level.
- The local origin of levels shall be recorded.
- Pipe lengths are to be in metres.
- Levels are to be in metres.
- Diameters and other descriptive dimensions are to be in millimetres.

Note: for Three Waters Assets, refer to Clutha District Councils Asbuilt Specification for Water Services

All text in tables is to be in UPPER CASE lettering. As-built information for individual connections to Council infrastructure will be in a format as agreed with Council engineering staff.

3.2.20.10 As-Built Drawings and Documentation for Earthworks and Subsoil Drains

Where earthworks have occurred, an as-built plan shall be prepared showing finished contours. The plans shall also show original contours where earthworks have occurred to illustrate the extent and depth of cuts and fills. Alternative methods of representing earthwork depths may be acceptable including plans showing lines joining all points of equal depth of cut and fill at appropriate vertical intervals. Regardless of the method used, cross sections shall be provided showing original and finished levels together with any Geotech features such as subsoil drains and reinforcement.

The as-built plans shall also record the position, type, and size of all subsoil drains and their outlets, and show any areas of fill or natural ground which the geo-professional considers do not comply with this Standard or areas where the standards have been varied from the original construction specification.

These plans shall be made available to Council and the developer in conjunction with the geotechnical completion report.

For all developments where a geo-professional is engaged the geo-professional shall submit a geotechnical completion report to the developer and Council accompanied by a statement of professional opinion as set out in Schedule 0 2A in the Code of Practice. The geotechnical report shall identify any specific design requirements which would necessitate the building design deviating from NZS 3604.

3.2.20.11 Roading

On completion of construction, information and documents as required by Council shall be provided by the developer's professional advisor. (See Schedule 3D for further information.) The information provided shall provide sufficient detail to

enable Council to complete the road assessment and maintenance management, Think Project (previously RAMM) database input.

3.2.20.12 CCTV Inspections

The developer shall supply to Council, prior to acceptance of the subdivision closed circuit television (CCTV) inspection records electronically for all newly constructed foul sewer and stormwater mains. A pan and tilt camera shall be used and lateral connections shall be inspected from inside the main. Inspection data shall be provided digitally in a format for capture into Council's Information Management System (e.g., Flexidata or similar).

When any defect is identified in the CCTV survey, remedial work shall be carried out to the satisfaction of the Engineer and a further CCTV inspection carried out to confirm correction of the defect.

CCTV inspections and deliverables shall be in accordance with New Zealand Gravity Pipe Inspection Manual 4th Edition (or its subsequent amendments) and the requirements of Council.

3.3 Completion Documentation

3.3.1 SCHEDULE 1A

DESIGN CERTIFICATE - LAND DEVELOPMENT/SUBDIVISION

ISSUED BY:.....

(Approved certifier firm/suitably qualified design professional)

TO: .....

(Developer/owner)

TO BE SUPPLIED TO: .....

(Territorial authority)

FOR: .....

(Description of land development/subdivision)

AT:.....

.....

(Address)

..... has been engaged by .....

(Consultant/designer) *(Developer/owner)*

to provide..... services for the land development and/or subdivision described above.

I .....have the qualifications and experience relevant to this project as set out herein and have designed the land development/subdivision and confirm that the design is to current engineering practice, and that I believe on reasonable grounds that it satisfies all relevant resource consent conditions, all relevant .....(insert name of authority) requirements and applicable codes and standards.

I / My practice holds professional indemnity insurance to the amount of$.....and includes run-off cover.

.....Date.....

(Signature of approved certifier on behalf of the approved certifier firm)

.....

(Name, title, and professional qualifications)

Note: This statement shall only be relied upon by the territorial authority named above. Liability under this statement accrues to the approved certifier firm only. The total maximum amount of damages payable arising from this statement and all other statements provided to the territorial authority on this land development/subdivision, whether in contract, tort, or otherwise (including negligence), is limited to the sum of$.....(insert)

3.3.2 SCHEDULE 1B

CONTRACTOR'S CERTIFICATE UPON COMPLETION OF LAND DEVELOPMENT/SUBDIVISION

ISSUED BY:.....

(Contractor)

TO:

.....

(Principal)

TO BE SUPPLIED TO:.....

(Territorial authority)

FOR: .....

(Description of land development/subdivision)

AT:.....

.....

(Address)

..... has contracted to .....

(Contractor) *(Principal)*

to carry out and complete certain land development and/or subdivision construction in accordance with a contract, titled Contract No..... for..... ('the contract').

I ..... a duly authorised representative of .....

(Duly authorised agent) *(Contractor)*

hereby certify that ..... has carried out and completed

(Contractor)

the construction, other than those outstanding works listed below, in accordance with the contract and in accordance with approved engineering drawings and specifications.

..... Date .....

(Signature of authorised agent on behalf of)

.....

(Contractor)

....

(Address)

Outstanding works

.....

.....

.....

.....

3.3.3 SCHEDULE 1C
CERTIFICATION UPON COMPLETION OF LAND DEVELOPMENT/SUBDIVISION

ISSUED BY:.....
(Contractor)

TO:
.....
(Principal)

TO BE SUPPLIED TO:.....
(Territorial authority)

FOR: .....
(Description of land development/subdivision)

AT:.....
.....
(Address)

..... has been engaged by .....
(Consultant/designer) *(Developer/owner)*

to provide construction observation review and certification services for the above subdivision which is described in the specification and shown on the drawings numbered

..... accepted by.....
(Territorial authority)

I have sighted the .....consent and conditions of subdivision
(Territorial authority)

and the accepted specification and drawings.

On the basis of periodic reviews of the construction and information supplied by the contractor in the course of the construction, I believe on reasonable grounds that the infrastructure other than those outstanding works listed below, is complete and has been constructed in accordance with:

(a) The approved engineering drawings and specifications and any approved amendments;
(b) The Council's Engineering Standards; and
(c) The manufacturer's instructions

..... Date.....
(Signature of approved certifier on behalf of the approved certifier firm)

....
(Name, title, and professional qualifications)

Outstanding works
.....
.....

SCHEDULE 1D

AS-BUILT PLANS

Information given on as-built drawings, whether submitted electronically or as paper plans, shall include but shall not be limited to:

(a) Stormwater and wastewater reticulation – including the coordinated positions of manholes, manhole inverts, inverts of pipes and lid levels, measurements to house connections, and laterals and their length and position. Positions of connections and laterals shall be both coordinated and referenced to adjacent manhole lids and boundary pegs. All levels shall be in terms of datum approved by the TA;

(b) Stormwater management devices – as-built plans for low impact stormwater management devices and non-reticulated components;

(c) Flood and secondary flow information, flood water levels and the extent of any overland secondary flows shall be shown where these have been obtained or derived during the design;

(d) Water reticulation – including the position of mains, location of hydrants, valves, tees, reducers, connections, tobies, water meters, and specials. All features shall be accurately dimensioned, coordinated, and referenced so that they can be accurately relocated in the field;

(e) Ducts – measurements to ducts installed by the developer for utilities;

(f) Labelling of pipes and ducts to cover diameter, pipe material and class, year laid, jointing type;

(g) Road names where available – as approved by the TA;

(h) Coordinates and levels of all utility surface features to be taken over by the TA, including tobies, and water meters;

(i) The coordinates of at least two points on each plan in terms of an appropriate geodetic or cadastral datum and the origin of the plan level datum;

(j) Geotechnical completion report and as-built drawings as detailed in 2.6.1 and 2.6.2 of NZS 4404:2010. As-built surface contours covering all areas of disturbed and cut/fill ground;

(k) Road construction, including location, structural details, and details of road marking, signals, lighting, and signs, landscape features, seating, and other amenities and features;

(l) Road pavement and surfacing information;

(m) Landscape features, seating, and other amenities and features.

3.4 Schedule 1D As-Built Plans

3.5 Handover Process and Contacts (Pre-Section 224(c))

At the time of completion of civil works when all quality assurance checks having been completed and accepted by the Developer's Representative, an application for handover can be made. The handover process is made at the time of 224c certification.

The handover process shall involve a final inspection with the relevant department representatives and Land Development Engineer as follows:

Roading both existing road upgrades and roads to vest - Transportation Operations Manager

Vehicular Crossings – Transportation Network Control Officer

3 Waters – Three Waters Operations Manager

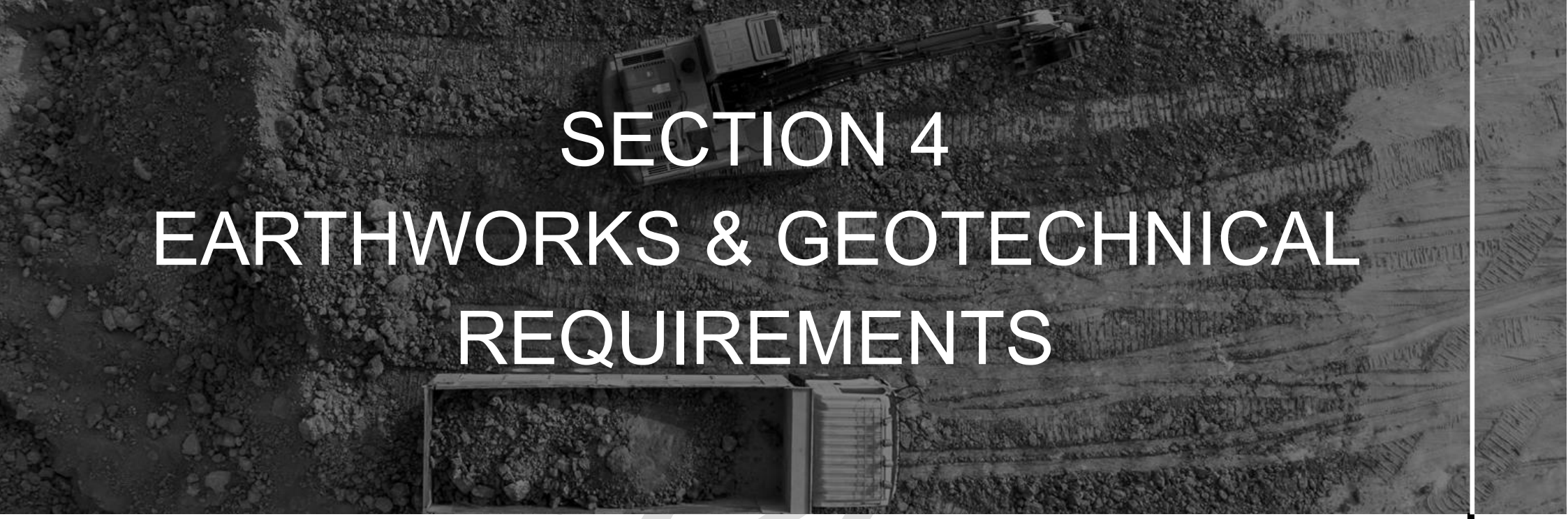
Private ways, private roads, and other private accesses – Land Development Engineer.

Special structures, bridges and major facilities – Head of Infrastructure Operations

Reserves and planting – Greenspace Operations Manager

Note any prior acceptance of works by Council officers will be taken into account at the handover stage but the final acceptance recommending works for 224c will not be made until the final handover process has been completed.

Note: Written confirmation of completed conditions at handover is to be provided to the Manager Planning by the developer by emailing it to planning@cluthadc.govt.nz using the resource consent number as the reference and quoting the condition that it relates to.



SECTION 4
EARTHWORKS & GEOTECHNICAL REQUIREMENTS

Section 4 Table of Contents

4.1 Scope

This section sets out requirements for the assessment of land stability and the design and control of earthworks to ensure a suitable stable platform for the construction of buildings, roads, and other structures with no adverse impacts. A low impact design approach is preferred. Geotechnical assessment shall be undertaken by a geo-professional as defined in this Code of Practice where:

1. The assessment of land stability requires specialist expertise.
2. The construction of earthworks associated with any development requires initial planning and design to ensure that banks and batters remain stable and that fill material is placed in such a way that it remains stable and can support the future loads imposed on it.
3. There is historical fill which has not been undertaken in accordance with any Bylaw or where natural slopes, banks, or batters are involved.
4. The assessment of ground for the foundations of buildings, roads, services, and other infrastructure requires specialist expertise as weak ground may require special design.
5. The wide range of soil types, physical conditions, and environmental factors applying in different areas make it difficult to specify precise or prescriptive requirements for land stability assessment or earthworks.

In setting design, construction requirements, or development limitations the designer shall take account of all relevant standards and Council requirements. Where geotechnical assessment isn't required earthworks must be carried out in such a manner that complies with this Code of Practice.

For clarification, the contents of this section do not apply to normal agricultural and forestry practices such as ploughing and root raking.

Note: NZS 4431 is applicable to the construction of earth fill for residential development including residential roading.

4.2 General

4.2.1 Objective

The objective of this section is to provide assurance that the RMA section 106 matters are satisfied, and all of the matters which need to be considered in planning and constructing a land development project. The aim is to provide information for professionals involved in designing and constructing a land development project and to require geotechnical expertise in projects where land stability could be an issue or where earthworks other than of a minor nature will occur.

The geo-professional needs to be involved in the choice of final landform. This decision depends on many factors which may be specific to the development.

These include the relationship with surrounding landscapes, the size of the development, the proposed and existing roading patterns, the preservation of natural features, wāhi tapu, and other historic and archaeological sites, the land stability and underlying structural geology, the function and purpose of the development and the potential for flooding, and erosion and other natural hazards and events including earthquakes.

The aim is to also give guidance on the identification of and assessment of the order of importance of the above factors which will vary from project to project.

4.2.2 Referenced Documents

A selection of useful guidance material on geotechnical and geo-mechanical issues in land development is set out in the Referenced Documents under Section 2 of this Code of Practice. Related documents list additional material that may be useful.

4.2.3 Council Geo-technical Requirements

Where any proposed development involves the assessment of slope stability or the detailed evaluation of the suitability of natural ground for the foundations of buildings, roading, and other structures, or the carrying out of bulk earthworks, then a geo-professional shall be appointed by the developer to carry out the following functions:

1. Check Regional and District Plans, records, and requirements prior to commencement of geotechnical assessment.
2. Prior to the detailed planning of any development, to undertake a site inspection and such investigations of subsurface conditions as may be required, and to identify geotechnical hazards affecting the land, including any special conditions that may affect the design of any pipelines, underground structures, or other utility services.
3. Before construction commences, to review the drawings and specifications defining any earthworks or other construction and to submit a written report to Council on the foundation and stability aspects of the project.
4. Before and during construction, to determine the extent of further geo-professional services required (including geological investigation).
5. Any work necessary to manage the risk of geotechnical instability during the construction process.
6. Before and during construction, to determine the methods, location, and frequency of construction control tests to be carried out, determine the reliability of the testing, and to evaluate the significance of test results and field inspection reports in assessing the quality of the finished work.
7. During construction, to undertake regular inspection consistent with the extent and geotechnical issues associated with the project.

On completion, to submit a written report (Geotechnical completion report and schedule 4A certificate) to Council attesting to the compliance of the earthworks with the specifications and to the suitability of the development for its proposed use including natural ground within the development area. Where NZS 4431 is applicable, the reporting requirements of that Standard shall be used as a minimum requirement.

4.3 Design

4.3.1 Design Factors

The design process shall include, but not be limited to:

a) Preliminary site evaluation.
b) Identification of special features to be retained/protected.
c) Low impact design considerations.
d) Selection of the choice of landform.
e) Stability assessment.
f) Assessment of special soil types where applicable. Setting of compaction standards for fill material.
g) Erosion, sediment, and dust control.
h) Seismic considerations.
i) Fault lines.
j) Geothermal issues where applicable.

4.3.2 Preliminary Site Evaluation

During the preliminary site evaluation phase the developer's professional advisor shall engage a geo- professional at an early stage to undertake a preliminary site evaluation and prepare a geotechnical assessment report.

In cases where more than a visual appraisal is deemed to be required, particular attention will need to be given to the following matters, as appropriate, which should normally be considered prior to preparing a proposal for development:

1. Low impact design factors:

The preliminary site evaluation needs to take into account low impact design factors. These include consideration of maintaining and improving natural waterway features and optimising waterway crossing locations. Protection of well-drained soils and natural soakage areas also need to be taken into account.

2. Drainage

Identify the existing natural drainage pattern of any area and locate any natural springs or seepage. Where any overland flow paths or natural surface or subsurface drainage paths are interfered with or altered by earthworks, then appropriate measures must be taken to ensure that adequate alternative drainage facilities are provided to ensure there is no increase in flood hazard risk to the site or adjoining properties.

3. **Slope stability:**

Some natural slopes exist in a state of only marginal stability and relatively minor disturbance such as trenching, excavation for streets or building platforms, removal of scrub and vegetation, or the erection of buildings, can lead to failure. Signs of instability include cracked or hummocky surfaces, crescent-shaped depressions, crooked fences, trees or power poles leaning uphill or downhill, uneven surfaces, swamps or wet ground in elevated positions, plants such as rushes growing down a slope, and water seeping from the ground. In addition, a simple desktop study of aerial photographs may show indications of historic failures as well as faulting, resulting in linear ground features. Refer to BRANZ Study Report 004, Crawford and Millar 1998, or the New Zealand Geotechnical Society publications Field description of soil and rock and Geotechnical issues in land development. For a sample checklist for geotechnical assessments refer to Crawford and Millar 1998. Existing or potential surface creep effects also need to be investigated and reported upon.

4. **Foundation stability:**

A study of the general topography of the site and its surroundings may indicate areas which have previously been built up as a result of natural ground movement or by the del iberate placing of fill material. Unless such fill has been placed and compacted under proper control, instability or long-term differential settlement could occur causing damage to superimposed structures, roads, services, or other structures.

5. **Stream instability:**

There is a potential for instability through changes to the current ground conditions, such as stream erosion.

6. **Local conditions:**

A wide range of soil types exist throughout New Zealand which may need special consideration. Expansive soils, volcanic soils, soft alluvial sediments, and compressible soils are examples of these. Liquefaction of saturated non-cohesive soils should also be considered. Council may have information on the soil types in its area, including potentially contaminated land.

7. **Peer review:**

Where risk for the land prior to development is assessed as being medium to very high risk, a peer review of the geotechnical assessment for the proposed development may be required and this would need to be carried out by an independent geo-professional. For guidance see NZ Geomechanics News (Crawford and Millar) for risk classification and (Cook et al) for peer review.

4.3.3 Landform Selection

The final choice of landform shall represent the most desirable compromise between the development requirements and the preservation of natural features and the natural character and landscape amenity values of the site including the retention of natural watercourses. Landform selection needs to take into account low impact design principles including retention of existing landforms and natural features where possible and avoiding earthworks where there are existing habitats of indigenous species, wetlands, or areas of high natural character. The design shall take into account the following factors in making the selection of the final choice of the landform:

1. The choice of a suitable landform may be specific to a particular site. An earthworks approach that respects and reflects the natural topography of the site is preferred. Considerations for carrying out earthworks include:
    a. the minimization of the risk of damage to property and/or roads occurring through ground movement in the form of slips, subsidence, creep, erosion, or settlement;
    b. the minimization of the risk of damage to property and/or roads occurring through flooding, or surface water run-off;
    c. the development of a more desirable roading pattern with improved accessibility to and within the site and the creation of a better sense of orientation and identity for the area as a whole.
    d. the efficiency of overall land utilization including the quality of individual sites and amenity areas around buildings, the economics of providing engineering services, and the standard of roading and on-site vehicular access;
    e. the need to create suitably graded areas for playing fields and other community facilities.
    f. the enhancement of the general environmental character of the area.

2. The general nature and shape of the ground including:
    a. the geological nature and distribution of soils and rock.
    b. existing and proposed drainage conditions, and the likely effects on groundwater.
    c. previous history of ground movements in similar soils in the area
    d. performance of comparable cuts and fills (if any) in adjacent areas, and
    e. air photography and other sources of information which should be reviewed and incorporated into any slope stability assessment.

3. Soil data as applicable for areas which:
    a. are intended to form in-situ bases for fills.
    b. are intended to yield material for the construction of fills.
    c. are intended to be exposed as permanent batters; and
    d. are to remain as permanent slopes or cut areas.

4. Borings, probing's, or open cuts as necessary to:
    a. classify the soil strata by field and visual methods.
    b. evaluate the likely extent and variation in depths of the principal soil types; and
    c. establish the natural groundwater levels.

5. Soil information required for:
    a. further sampling and testing which may be required on representative soil types.
    b. relating subsequent soil test properties to relevant strata over the site.
    c. assessment and design for slope stability.
    d. assessment and design for foundations suitable for the finished site.
    e. assessment and design for road subgrades.

The test data appropriate in different areas should be determined by the geo-professional.

4.3.4 Stability Criteria

In making an assessment of the stability of slopes and earth fills, the geo-professional shall use accepted criteria and analysis methods. Stability criteria applicable to land development in New Zealand are published or recommended by the New Zealand Geotechnical Society (see Referenced Documents).

4.3.5 Special Soil Types

If special soil types are known to exist in a locality or are identified, then a geo -professional shall be engaged to advise on appropriate measures for incorporation of these soils into a development. Special soil types include, but are not limited to:

1. Soils with high shrinkage and expansion.
2. Compressible soils.
3. Volcanic soils.
4. Soils subject to liquefaction.
5. Soils prone to dispersion (such as loess).
6. Any excluded soils from the definition of good ground as defined in NZS3604:2011, as amended by B1/AS1 or its successor.

4.3.6 Compaction Standards for Fill Material

The standard of compaction and method of determination shall be as set out in NZS 4431. Where NZS 4431 is not applicable, the methods and standards of compaction shall be specified by the geo - professional.

Note: Commercial and industrial developments often have specialized requirements for fill materials and compaction. In these cases, the requirements of NZS 4431 may not be applicable. The geo- professional should set the fill standards and procedures for these developments.

4.3.7 Compaction Standards for Fill Material

The standard of compaction and method of determination shall be as set out in NZS 4431. Where NZS 4431 is not applicable, the methods and standards of compaction shall be specified by the geo - professional.

Note: Commercial and industrial developments often have specialized requirements for fill materials and compaction. In these cases, the requirements of NZS 4431 may not be applicable. The geo- professional should set the fill standards and procedures for these developments

4.3.8 Erosion, Sediment and Dust Control

4.3.8.1 Minimisation of Effects

Earthworks shall be designed and constructed in such a way as to minimize soil erosion and sediment discharge. Where necessary permanent provision shall be made to control erosion and sediment discharge from the area of the earthworks.

Generation of dust during and after the earthwork's operation shall be considered during the planning and design phase. If necessary, specific measures shall be incorporated to control dust.

4.3.8.2 Protection Measures

Where surface water could cause batter erosion or internal instability through infiltration into the soil, open interceptor drains shall be constructed in permanent materials, and benches in batter faces should be sloped back and graded longitudinally and transversely to reduce spillage of stormwater over the batter.

Water from stormwater systems shall be prevented from flowing into fill or into natural ground near the toe or sides of the fill.

No stormwater or wastewater soakage systems shall be constructed in fill or natural ground which could impair the stability of the ground.

Protection measures shall include the following as appropriate:

1. Erosion control mechanisms:
    a. temporary drains to be constructed at the toe of steep slopes to intercept surface run-off and to lead away for treatment where required before discharge to a stable watercourse or pipe stormwater system.
    b. surface water to be diverted away from or prevented from discharging over batter faces and other areas of bare earth by bunds formed to intercept surface run-off and treated where required prior to discharge through stable channels or pipes, preferably into stable watercourses or piped stormwater systems.
    c. the upper surface of fills to be shaped and compacted with rubber-tyred or smooth- wheeled plant when rain is impending, or when the site is to be left unattended to minimize water infiltration.
    d. the completed battered surfaces of fills to be topsoiled and vegetated, or otherwise resurfaced to reduce run-off velocities.
    e. control of erosion and sediment discharge may require planting, environmental matting, hydroseeding, drainage channels, or similar measures at an early stage in the earthwork's construction phase;
    f. dust control may require frequent watering during construction along with establishment of the permanent surface at an early stage in the construction phase.

2. Sediment management devices:
    a. the surfaces of fills and cuts to be graded to prevent ponding.
    b. sediment traps and retention ponds to be constructed where they are necessary. These should be cleaned out, as required, to ensure that adequate sediment storage is maintained, with appropriate plans for decommissioning.
    c. temporary barriers or silt fences using silt control geotextiles, to be used to reduce flow velocities and to trap sediment.
    d. sections of natural ground to be left unstripped to act as grass (or other vegetation) filters for run-off from adjacent areas.

4.3.9 Seismic Considerations

The geo-professional shall consider the seismic effects on earth fills, slopes, and liquefiable ground and shall take these into account in design and construction of any development in accordance with the scale of the development.

4.4 Final Documentation

4.4.1 Geotechnical Completion Report

For all developments where a geo-professional is engaged, the geo-professional shall submit a geotechnical completion report to the developer and Council accompanied by a statement of professional opinion as set out in Schedule 4A. The geotechnical report shall identify any specific design requirements which would necessitate the building design deviating from NZS 3604.

The expected level of site movement from reactive soil (expansive soils) under AS 2870:1996 shall be identified by their respective class and included in the geotechnical completion report. The soil properties used in determining the class are to be recorded in the report. The site subsoil class to the provisions of NZS 1170.5 Section 3 and NZS 1170.5 Supp 1 C3.1.3 shall be identified in the geotechnical completion report.

The report shall describe the extent of inspection, revisit and review all inferences and assumptions made during the investigation, assess the results of testing and state the geo -professional's professional opinion on the compliance of the development with the standards set by the geo - professional. The report shall also include all geotechnical reports prepared for the development.

Documentation on the testing of the soils for compaction shall be included in the geotechnical completion report. This documentation shall clearly show the areas in which compaction met the required standards, as well as any areas requiring retesting, and areas which did not meet the standards.

For developments where there are no earthworks the geotechnical completion report will comprise the geotechnical assessment report. For large or more complex developments where there may have been several stages of geotechnical reporting, all prior reports covering the subject area of land under certification shall be included in the geotechnical completion report. The geotechnical completion report shall identify areas that provide good ground as defined in NZS 3604. Those areas that require specific design for stability and foundation design shall also be noted.

4.4.2 As-Built Drawings for Earthworks and Subsoil Drains

Refer to Section 3.2.20 of this Code of Practice and the requirements in Schedule 3D.

Where earthworks have occurred, an as-built plan shall be prepared showing finished contours. The plans shall also show original contours where earthworks have occurred to illustrate the extent and depth of cuts and fills. Alternative methods of representing earthwork depths may be acceptable including plans showing lines joining all points of equal depth of cut and fill at appropriate vertical intervals.

The as-built plans shall also record the position, type, and size of all subsoil drains and their outlets, and show any areas of fill or natural ground which the geo-professional considers do not comply with this Standard or areas where the standards have been varied from the original construction specification.

These plans shall be made available to Council and the developer in conjunction with the geotechnical completion report.

4.5 Completion Documentation for Geotechnical Matters

SCHEDULE 2A

STATEMENT OF PROFESSIONAL OPINION ON SUITABILITY OF LAND FOR BUILDING CONSTRUCTION

Development .....

Developer .....

Location .....

I ..... of .....
(Full name) *(Name and address of firm)*

Hereby confirm that:

1. I am a geo-professional as defined in clause 1.2.2 of NZS 4404:2010 and was retained by the developer as the geo-professional on the above development.

2. The extent of my preliminary investigations are described in my Report(s) number ....., dated ....., and the conclusions and recommendations of that/those document(s) have been re-evaluated in the preparation of this report. The extent of my inspections during construction, and the results of all tests and/or re-evaluations carried out are as described in my geotechnical completion report dated .....

3. In my professional opinion, not to be construed as a guarantee, I consider that (delete as appropriate):

   (a) The earth fills shown on the attached Plan No..... have been placed in compliance with the requirements of the ..... Council and my specification.

   (b) The completed works take into account land slope and foundation stability considerations, subject to the appended foundation recommendations and earthworks restrictions, (which should be read in conjunction with the appended final site contour plan).

   (c) Subject to 3(a) and 3(b) of this Schedule, the original ground not affected by filling is suitable for the erection of buildings designed according to NZS 3604 provided that:

   (i) .....

   (ii) .....

   (d) Subject to 3(a) and 3(b) of this Schedule, the filled ground is suitable for the erection of buildings designed according to NZS 3604 provided that:

   (i) .....

   (ii) .....

   (e) The original ground not affected by filling and the filled ground are not subject to erosion, subsidence, or slippage in accordance with the provisions of section 106 of the Resource Management Act 1991 provided that:

   (i) .....

   (ii) .....

NOTE – These subclauses may be deleted or added to as appropriate, to include such considerations as expansive soils where excluded from NZS 3604, and site seismic characteristics as covered in clause 3.1.3 of NZS 1170.5.

4. This professional opinion is furnished to the TA and the developer for their purposes alone on the express condition that it will not be relied upon by any other person and does not remove the necessity for the normal inspection of foundation conditions at the time of erection of any building.
5. This certificate shall be read in conjunction with my geotechnical report referred to in clause 2 above and shall not be copied or reproduced except in conjunction with the full geotechnical completion report.

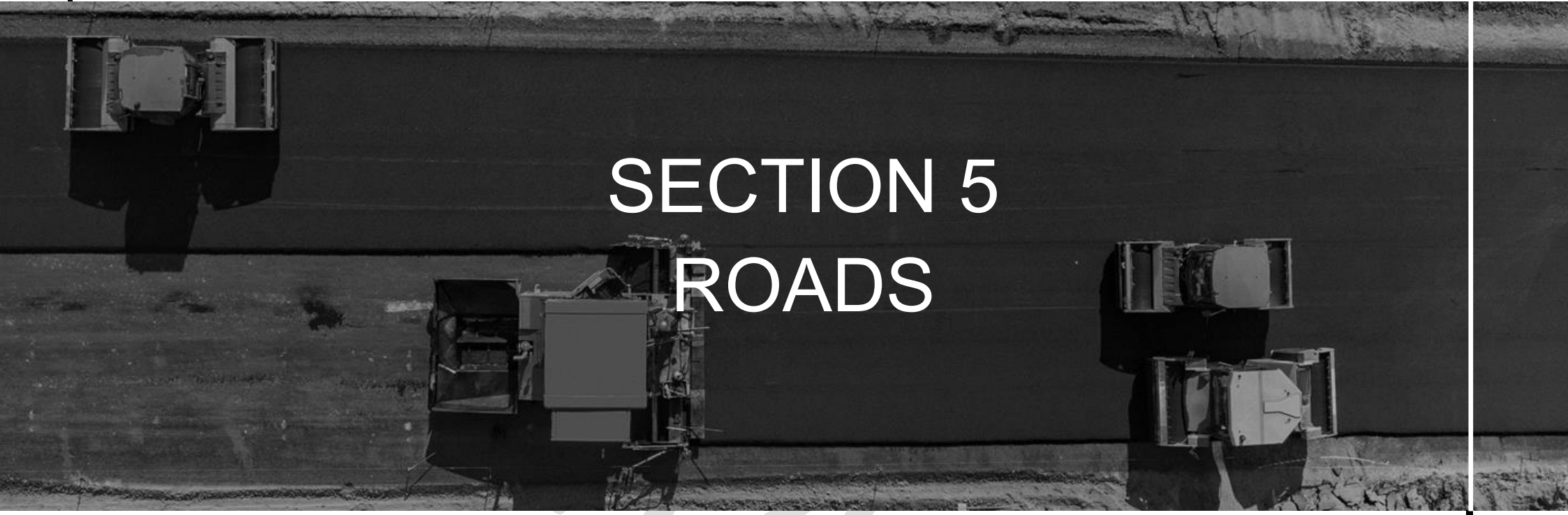
Signed ..... Date .....

.....

.....

.....

(Name, title, and professional qualifications)



SECTION 5
ROADS

Section 5 Table of Contents

5.5 Parking and Access Layouts

5.5.1 Accessway Sight Lines

5.5.2 Railway Sight Line Restriction

5.1 Scope

This section sets out requirements for the design and construction of roads for land use, development and subdivision. It provides engineering design and construction guidance, information on requirements, and references Roading Standard Details in Appendix B-Standard Drawings.

5.2 General

5.2.1 Objective

The objective is to provide roads that are safe for all road users and designed to the context of their environment. Roads shall be capable and of sufficient width for carrying all utility services underground, provide for the management of stormwater, and contribute to quality urban design.

To this end a design report shall be prepared and submitted for Council Approval in respect of any new road, or road upgrade. The report shall include the design philosophy applied and confirmation of how the following design aspects have been resolved/selected. It should include the proposed materials to be used for the construction. The report shall also include a full set of design drawings.

5.2.2 Related Standards and Guidelines

A selection of currently available documents which provide an appropriate basis for road design is set out in the referenced documents. Related documents also list additional material that may be useful. These are not exclusive and other Standards, guidelines, design responses may be used where appropriate but must be accepted by Council.

Reference shall also be made to CDC's Roading Bylaw 2018, or any future updates to the same.

5.2.3 Road Purpose

Roads serve a number of purposes that enhance quality of life in neighbourhoods, towns and cities - improve opportunities for business in commercial areas; and meet a range of local, regional, and national goals for access, mobility, and land use. More explanation is available in NZS4404 Section 3. A road will serve the following functions:

- Creating physical and Legal access
- Providing a link for connection and movement of people via commercial or private vehicles, public transport, on foot, by bicycle or by other modes
- As a corridor for utility and amenity infrastructure

5.2.4 Classification Framework

Waka Kotahi (NZTA) has recently issued a One Network Framework which is the new national classification system to assist council in benchmarking their roads. It looks to ensure the network is fit for purpose for all modes of transport placing an emphasis on movement and place, integrating transportation with urban planning. Council intends to incorporate the principles into its planning hierarchy. Appendix A of the One Network Framework – current classification guidance provides a classification tables which identifies the route metrics, the land use zones and street categories.

Table 5: Road Functional Criteria (Land Use and Area Type Matrix – Describing Typical Place and Context)

ROUTE FUCTION	ROUTE DESCRIPTOR						
		M1	**M1**	**M2**	**M3**	**M4**	**M5**
	Movement Significance	Major	Major	Significant	Moderate	Minor	Low
	Sale of People Movement	Typically >20,000 per day	Typically >20,000 per day	10,000 to 25,000 per day	3,000 to 12,000 per day	300 to 4,000 per day	Typically < 500 per day
	Link – Place Context	Link Function	→			←	Place Function
	Through Traffic	Highest capacity routes which have the greatest through movement	Provides high capacity through movement between and within Regions and between Key Places within Districts	Carries predominantly medium capacity through traffic movements between and within Districts between Places	Collects traffic from local streets in order to connect with arterials	Primary role is to serve adjacent property	Primary role is to serve adjacent property, minimal through traffic
	Network Connectivity	Connects Regions and Nationally Significant: Airports, Ports and Economic Activity Generators	Connects Regions and Principal Sectors of the Region and Activity Centres within a district	Connects Major Places withing a District	Connect two arterials, or access roads with arterial links	Connect to other Roads, Streets, Lanes and Collector Roads	Primarily connects to Roads, Streets and Other Lanes
	Frontage Access	Provides little or no access to adjoining land	Provides controlled access adjoining land	Managed accesses but many also serve adjacent activities	May provide access to adjacent Key Activities. Significant access to adjoining properties	Access to adjoining Local Shops, Trade Units, Residential and Rural Properties	Property frontage may be shared with movement lane
	Goods Movement (Freight)	Provides highest capacity to our facilities to promote safe and efficient freight carriage	Provides quality access to facilities that promote safe and efficient freight carriage	Provides access to Facilities that promote safe and efficient freight carriage where there is enduring demand	Provides for transport of neighborhood related freight		
	Tourism	Provides high service levels (North Island) and amenity (South Island(with reliable journey times for long distance tourist traffic	Provides access to Tourist Facilities in areas of high tourist demand such as Rest Stops and Viewing Points	Provides access to Tourist Facilities in areas of high tourist demand including Rural Rest Stops and Viewing Points	Provides for transport of neighborhood related freight		

- For Customer Levels of Service, Road User and Place Service Levels refers to Table 6 and Table 7.
- For additional Neighbourhood Place, Services Levels and Private Roads refer to NZS 4404:2010 Land Development and Subdivision Infrastructure, Part 3 Roads

Note:

1. The most appropriate Route Descriptor in Table A is best identified as the one closest aligned with the most functions
2. The most appropriate Route Descriptor may reflect a planned future state rather than the present state
3. A route may change its Route Descriptor along its length (e.g. M1 Major to M2 Significant)
4. If the most appropriate Route Descriptor is identified as say an M1 – Major BUT has one significantly lower function, it suggests this function needs addressing

Table 6: Customer Level of Service

		ROUTE DESCRIPTOR					
LEVELS OF SERVICE		**Major**	**Major**	**Significant**	**Moderate**	**Minor**	**Low**
	Safety		Fatal, Serious Crash and RISA Risk addressed and Crime Prevention through Environmental Design Principles applied in Risk Priority Order				
	Journey Time	High speed travel environment	Generally moderate to fast travel time environment in urban and rural areas	Generally moderate travel time environment in urban areas. Moderate to high speed in rural areas	Generally moderate travel time environment with short lengths of lowered speed in urban areas. Moderate to high speed in rural areas	Generally low speed environment in urban areas. Moderate speed in rural areas.	Walking pace environment in urban areas. Low speed in rural areas.
	Delay Predictability	Minimal delays to journey times achieved	Minimal delays during peak journey times achieved outside holiday seasons and events.	May experience predictable significant delays depending on other activities on the network and conditions.	May experience predictable significant delays depending on other activities on the network and conditions.	May experience significant delays accessing higher level roads	Variable delays experienced
	Frontage Access	Limited friction from adjoining land	Controlled side friction from adjoining land	Managed side friction from adjacent properties	Side friction from adjoining property		
	Resilience and Security	Mitigate the risk to connectivity by providing robust Infrastructure in Emergency Response Plans	Mitigate the risk to connectivity by providing robust Infrastructure in Emergency Response Plans	Vehicle access available for foreseeable events	Vehicle access available for foreseeable events		

For Road User Service Levels refer to Table 7 and NZS 4404 Land Development and Subdivision Infrastructure, Part 3 Roads.

Table 7: Service Level

	ROAD USER MOVEMENT			MOVEMENT AND PLACE			PLACE	
Table	**Public Transport**	**Freight**	**General Traffic**	**Cycle**	**Pedestrian Crossing**	**Parking, Loading and Stopping**	**Walking**	**Amenity and Utilities**
A	No trip delay. All day frequent service. Always runs to timetable, may be on separate lanes	No delays or trip variability may be on separate lanes	No delays or trip variability may be on separate lanes	Separate Cycle Path. Minimal delays	Crossing regularly available. 40 km/hr operating speed. Minimal delays	Adequate parking. Loading and stopping facilities	Quality Pedestrian Facilities in Pedestrian Friendly Speed Environment	Quality Furniture, hard and soft Landscaping both sides in Pedestrian Friendly speed environment. Accessible Utilities
B	No route delay, Peak Period frequent Service. Always runs to timetable, may be on shared HOV Lane	No delays or trip variability may be on shared HOV Lane	No delays or trip variability	Separation Lane with minimal delays, less than 45km/hr operating speed	Crossing is available in required locations. Less than 45 km/hr operating speed. Minimal delays	Parking and Stopping restrictions generally provided to meet demand	Pedestrian Facilities provide to meet demand. Less than 45 km/hr operating speed	Soft and hard Landscape both side in Pedestrian Friendly speed environment. Accessible Utilities
C	Some route delay, 85% runs to timetable. Peak Period frequent Service and separate	Some route delays minimal trip variability. Share HOV Lane	Some route delays minimal trip variability. Shared lanes	Separate on Road Cycle Lane. Greater than 45 km/hr operating speed	Crossing available in managed locations. Average peak period crossing delay 45	Parking and Stopping restrictions during business hours to assist travel times	Formed and sealed Footpaths each side of the Road. Less than 45 km/hr operating speed	Hard Landscape with minimal planting both sides. Accessible Utilities
D	Off peak runs to timetable. Shared facilities	Peak stop at every intersection. Shared lanes	Peak stop at every intersection. Shared lanes	Separate on Road Cycle Lane. Less than 60 km/hr operating speed	Controlled crossings available in required locations. Average peak period crossing delay 45 seconds. May be over 50 km/hr operating speed	Time Limit Parking and Stopping. Peak period Clearways	Formed and sealed footpath one side of the Road	Hard Landscape both sides. Accessible Utilities
E	Peak stop at every intersection. Shared lanes	Peak stop at every intersection. Shared lanes	Peak stop at every intersection. Shared lanes	Bicycle share wide movement lane. Greater than 60 km/hr operating speed	Crossing generally limited to controlled locations. Greater than 50 km/hr operating speed	Loading and Stopping off peak only	Formed Footpath one side of the Road	Hard Landscape one side. Utilities may be in the footpath or movement lane
F	No separate facility, at least 5 minutes to clear intersection during Peak Periods.	No separate facility, at least 5 minutes to clear intersection	Shared movement lane. Takes at least 5 minutes to clear intersection	Bicycle share movement lane. Greater than 60 km/hr operating speed	Crossings limited to controlled locations. Average peak period crossing delay 120 seconds	None permitted	No footpaths	No Amenity Strip. Utilities in movement lane

Note: This Table is indicative only and will be fully developed by a Network Operating Framework Working Group

5.2.5 Network Connectivity

Well-connected networks (roads and other links) are achieved with smaller block sizes and regular connections. Network connectivity shall be designed to achieve:

1. Shorter travel distances.
2. An increased number of alternative routes for all types of users.
3. Increased opportunity for interaction.
4. Improved access to public transport, cycling and walking networks, and access to destinations.
5. Access to and from state highways limited to arterial routes, or as agreed with Waka Kotahi (NZTA).

The design process shall ensure the following maximum walking distances from a lot to a Connector/Collector or Arterial Road:

1. Rural: No maximum distance. The design should maximize future connectivity to a suburban network.
2. Suburban: 400 metres. A shorter distance shall be considered near centers and major public transport routes.
3. Urban: 300 metres.

Where factors, such as topography or barriers, limit the ability to achieve the network connectivity standard, the designer shall optimize network connectivity and access to the maximum extent practical. The designer shall maximize connectivity to existing development.

5.2.6 Design and Access Statement

A design and access statement shall be submitted with the application for design approval.

The statement shall cover all relevant aspects of Section 5.2 and 5.3 of this Code of Practice and specifically address:

1. Road dimensions and layout.
2. Link and place functions.
3. Connectivity.
4. How target operating speeds will be achieved.
5. How Low Impact Development (LID) principles have been considered for stormwater run-off from the roads.

In addition, a design and access statement shall evaluate the effects of the proposed development at its ultimate extent (and staged, where applicable) on the surrounding communities and transportation network.

Design and access statements allow the basis of the road design to be independently reviewed and should be sufficient to illustrate the reasons for the design selections.

5.2.7 Road Safety Audit

Proposals that provide for new roads to vest in Council shall be subject to the Waka Kotahi (NZTA) Road safety audit procedures for projects unless Council decides that audits are not required at any or all of the stages. The developer's professional advisor may recommend that audits are not required at any or all of the stages and complete an 'exemption declaration' as described in the procedures and submit it as part of the application process to be considered by Council. The 'exemption declaration' shall be prepared by a suitably qualified road safety auditor.

Safety audits should cover all road users, including the needs of pedestrians, cyclists, and disabled/elderly users. Where appropriate, the requirements of these groups may demand specific audit procedures. The records and documentation from safety audits must be submitted to Council as part of the asset handover process.

5.3 Design

5.3.1 General Requirements

The Design of Roads covered by this document shall be in accordance with the Waka Kotahi (NZTA) One Network Framework.

5.3.1.1 Cross Section

In the case of urban and peri-urban roads (as defined in the Waka Kotahi (NZTA) One Network Framework), road widths shall be selected to ensure that adequate movement lanes, footpaths, berms, and batters can be provided to retain amenity values (including landscaping) and enable utility services to be provided safely and in economically accessible locations and making due allowance for surface features such as name plate posts, surface boxes and lamp posts.

For rural roads design shall consider for the carriageway:

- Sealed Shoulders and;
- Space for the control of road surface water runoff.
- Stable batter cut/fill slopes able to be mowed and;
- Clear space to allow for services as detailed in the standard details

Road widths shall be planned to cope with estimated long-term traffic volumes and account for community needs even though construction may be carried out only to shorter-term requirements. For guidance, the minimum cross section requirements including tot al road reserve widths are shown in

Figure 3: Turning Areas for No-Exit Roads

However, it should be noted that greater widths may be required to address the following situations:

- Potential frequent use by heavy vehicles or commercial vehicles
- Potential frequent use by vehicles towing boat trailers.
- Compatibility with existing road widths in the community.
- Widening where the geometry may influence sight distance of rural roads.
- The provision of cycle ways or shared paths where present or planned on the adjoining roadway.
- Specific width requirements needed to accommodate service authority's
- Specific requirements for public transport
- For other provisions such as on street parking

Alternative carriageway widths may be adopted to suit design considerations. The submitted proposal shall be subject to specific design consideration and approval by Council. Road cross sections may include landscaped features, painted median facilities, or variations to parking provision.

5.3.1.2 Carriageway Width

Carriageway widths should be in accordance with

Figure 3: Turning Areas for No-Exit Roads

In urban areas, carriageways with a width of 5.6m will require parking bays on at least one side of the carriageway for part or all of the road length.

In the case of a rear access lane, the concept relies heavily on minimal garage setback from the lane frontage. Rear access lanes are required to provide for manoeuvring for access to/from garages. Where the garages are located on or close to the lane edge the manoeuvring requirement may necessitate a wider lane dimension or increased setback. In this sense, a key

function of the lane is to operate akin to an aisle within a car parking area and needs to be designed accordingly. A single lane sealed width with widening at the garage locations for turning is the minimum requirement. Sealing the entire lane increases opportunities for the lane to be used in a social sense. It is therefore desirable for the entire lane to be sealed. It is accepted that a narrow berm for services may be necessary.

The designer shall consider the environment, purpose, and function of the road being designed. In developing a design cross-section the designer shall consider the relationships between speed, parking and its frequency, and the shared or recessed nature of parking in the movement lanes. Alternative carriageway widths may be adopted to suit design considerations. These shall be subject to specific design consideration and approval by Council. Such cross sections may include landscaped features, painted median facilities, or variations to parking provision.

5.3.1.3 Traffic Lanes

No more than one movement lane in each direction is typical. Streets in urban areas and centres may include a single movement lane operating as a one-way street.

5.3.1.4 Cyclists

Cyclists shall be provided with separate movement lanes if identified in a local or regional cycle network.

5.3.1.5 Side Roads

Side and rear access should not be the primary access. All metaled surfaced carriageways shall be sealed for a minimum length of 20 metres from the intersection with another road. This may need to be extended due to topography requirements.

5.3.1.6 Rural Roads

Shoulder widths on rural roads need to be assessed for each project based on the speed environment of the area, terrain including geometry, and crash history. The minimum shoulder width is 1.5m.

Figure 3: Turning Areas for No-Exit Roads

5.3.1.7 Provision for Utility Providers

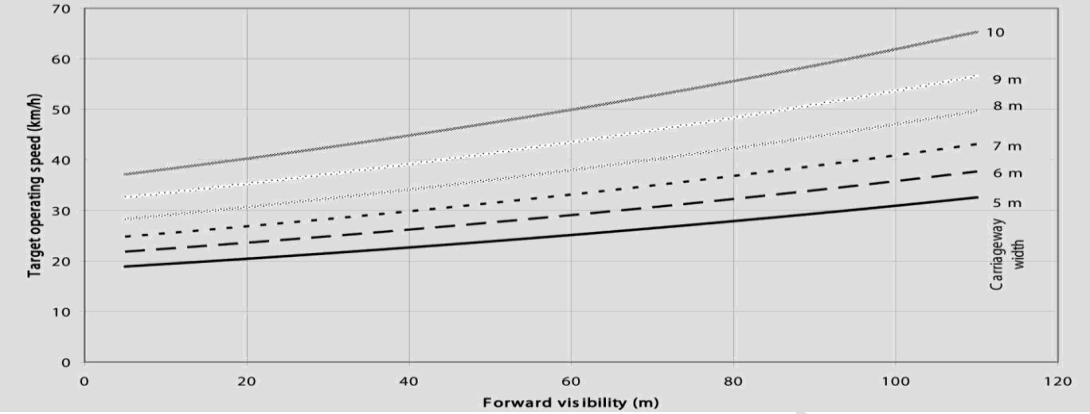
In some circumstances an increased overall road reserve may be necessary for utilities provision or increased amenity, landscape or urban design element. Specific design shall be undertaken and agreed with the territorial authority where road reserves are to be reduced. In other circumstances, reserve widths may be reduced if a one-way road, or development is on one side of the road.

5.3.2 Target Operating Speed

Traffic management shall be included in road design to ensure that the target operating speed shown in Influence of Road Geometry on Speed is achieved. Target operating speed can be managed by physical and psychological devices such as narrowed movement lanes, reduced forward visibility, parking, slow points, build outs, leg lengths, chicanes, raised platforms, planting and landscaping, and street furniture and art works. However, the target operating speed shall not be out of context with adjoining or neighbouring roads.

The Austroads Guide to traffic management - Part 8: Local area traffic management provides suitable guidance for designing to a target operating speed. Reference can also be made to the Manual for streets (UK Department for Transport 2007).

Figure 1: Influence of Road Geometry on Speed



5.3.3 Road Geometric Design

5.3.3.1 Design Parameters

Roads shall be designed to accepted standards generally satisfied by

Figure 3: Turning Areas for No-Exit Roads

of this Code of Practice, relevant Austroads guides, and guides listed in Referenced Documents and Related Documents for other facilities. If there is potential for expansion through the subdivision, then the appropriate standard shall be used to cater for this potential.

Specific Geometric design parameters shall firstly be in accordance with the Austroads Guide to Road Design - Part 3: Geometric design, and as detailed in this Code of Practice.

5.3.3.2 Sight Distances

All roads shall be designed with sight distances that match the target operating speed. Where necessary, engineering measures may be undertaken to reinforce driver behaviour and appropriate speeds.

On M4 connector/M3 collector and M1 – M2 arterial roads (see Table 5), sight distance criteria at intersections as well as for stopping, overtaking, on curves, and to avoid obstructions should be applied in accordance with the relevant Austroads guides; primarily Part 3: Geometric Design, and 4A: Intersections and Crossings - General..

5.3.3.3 Widening on Horizontal Curves

In some areas the developed road geometry may be constrained, horizontal alignments may involve low radius curves, or the proportion of commercial vehicles may predominate. In such instances, movement lanes shall be assessed to determine the need for localized additional width, for example on low radius horizontal curves where the passage of vehicles has the potential to reduce safety.

5.3.3.4 Vertical Grade

The minimum preferred gradient is 0.5%. A minimum gradient of 0.4% may be considered in circumstances where it can be demonstrated it is appropriate and a gradient of 0.5% cannot be reasonably achieved. Maximum gradients shall be as per Section **Error! Reference source not found.** Steeper gradients may be acceptable for shorter lengths of road in hilly country or low overall speed environments subject to Council approval. Where the gradient of a public road is steeper than 12.5%, specific Council approval will be required.

5.3.3.5 Crossfall

A movement lane may include a single lane operating in a one-way configuration or in two directions. Normal camber for sealed roads is 3%, and 6% for unsealed roads. Maximum super elevation is 6% for sealed and unsealed roads, unless required due to site constraints, which may be agreed with Council as an exception.

Table 8: Road Design – Cross Section Standards

Sealed Roads									
Urban Residential									
Movement Significance	**Street Type**	**Units Served (Indicative Only)**	**Average Daily Traffic AADT (v/day)**	**Parking Lanes (m)**	**Traffic Lanes (m)**	**Carriageway Width (m)**	**Kerb Type**	**Footpath No. x m**	**Minimum Legal Width**
M2-Significant	Arterial	N/A	8,0000 +	2 x 2.5	2 x 2.35	12	Vertical	Boths sides, sealed full width from kerb to property boundary (min. 1.4 m)	20
M3-Moderate	Collector	N/A	< 8,000	1 x 2.5	2 x 2.35	9.5	Vertical	Both sides, sealed full width from kerb to property boundary (min. 1.4 m)	20
M4-Minor	Local	N/A	< 1,000	2 x 2.5	1 x 3	8	Vertical	Both sides, sealed full width from kerb to property boundary (min1.4 m)	17

Sealed Roads									
Urban Residential									
Movement Significance	**Street Type**	**Units Served (Indicative Only)**	**Average Daily Traffic AADT (v/day)**	**Parking Lanes (m)**	**Traffic Lanes (m)**	**Carriageway Width (m)**	**Kerb Type**	**Footpath No. x m**	**Minimum Legal Width**
M2-Significant	Arterial	100 +	8,000+	2 x 2.5	2 x 3.5	12	Vertical	Concrete: 2 x 1.5 Asphalt: 2 x 1.8	20
M3-Moderate	Collector	< 800	<8,000	2 x 2.5	2 x 3	11	Vertical	Concrete: 2 x 1.5 Asphalt: 2 x 1.8	20
M4-Minor	Local	< 200	<2,000	2 x 2.5 (recessed)	2 x 3	6	Vertical or mountable	Concrete: 2 x 1.5 Asphalt: 2 x 1.8	20
M5-Low	Cul-de-sac	≤ 20	< 200	1 x 2.5 (recessed)	2 x 3	6	Vertical or mountable	Concrete: 1 x 1.5 Asphalt: 1 x 1.8	15
M5-Low	Private (Right of Way)	4 to 6	N/A	Nil	1 x 3	3*	Nil	Nil	4.5
M5-Low	Private (Right of Way)	1 to 3	N/A	Nil	1 x 3	3	Nil	Nil	3.5

*Passing bays (with a minimum 5. 6 m carriageway width) are required every 50m in urban areas, and every 100 m in rural areas. Where a private way adjoins a Collector or higher, it shall also have a 5.6m carriageway width for a minimum length of 10m from the road boundary.

**Kerb and channel or dished channel may be required for scour protection.

***Footpaths may not be required in rural and rural /residential situations.

Note 1 – All rights of way fronting a sealed road shall be hard surfaced to at least 10.0m inside the property boundary.

Note 2 - Carriageway width is defined as kerb-face to kerb-face in urban situations. It does not include shoulder width for rural/rural lifestyle, or unsealed roads.

Note 3 – Dedicated provision for cyclists will be required on identified cycling routes for any Collector Road and above. See Section 5.3.12.2 for further guidance.

This table is to be used as a guide only and will be subject to Council requirements for each situation. NB. Urban/Rural definition is based on speed limit, i.e., urban roads are those with a speed limit of 70 km/hr or less, rural > 70 km/hr.

5.3.3.6 Stormwater

Roads shall be designed to account for stormwater and keep potential groundwater below structural pavement layers. Urban roads will generally be designed to take secondary flows while rural roads will generally be designed not to flood. On rural roads, this may be accomplished through the use of side drains or swales. All roads, including footpaths and cycleways, shall be adequately drained in accordance with good engineering practice. Roads also have the potential to provide stormwater ponding and overland flow paths in extreme events.

In soils of adequate permeability and favourable topography, the use of low impact design soakage systems and devices shall be considered to provide benefits of attenuating peak flows and improving run- off quality. For detailed design criteria for soakage systems and devices see 5.3.20, 6.3.8.6, and 6.3.8.9.

Any design should be coordinated with the relevant landscape design requirements covered in Section 10 of this Code of Practice.

5.3.4 Pavement Structural Design

Generally, pavements shall be flexible designs. Other types of pavements shall be subject to Council approval. Pavements shall be designed in accordance with the Austroads and Waka Kotahi guides with a design life of 25 years.

C5.3.4
The structural design of all roads shall be undertaken by a suitably qualified person. Mechanistic or other industry standard chart-based methods may be used depending on the function of the road and expected traffic volumes.

5.3.4.1 California Bearing Ratio Design Method for Rigid and Flexible Pavements

Soaked California bearing ratio (CBR) values of the pavement subgrade shall be used and the pavement designed for the estimated number of equivalent standard axle (ESA) loadings over a 25- year design life.

5.3.4.2 California Bearing Ratio Tests

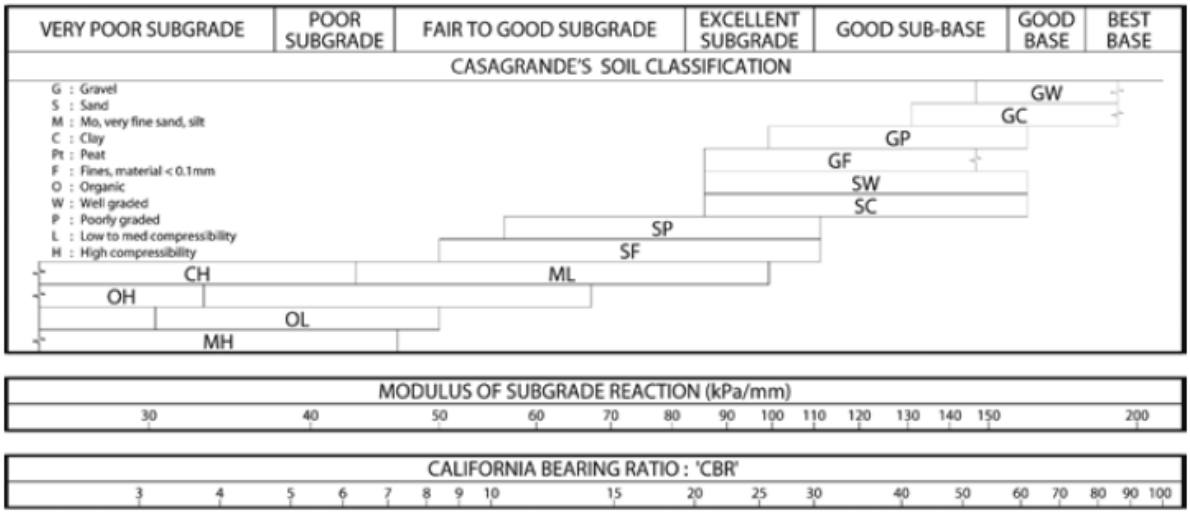
For local roads the method of determining subgrade CBR in non-granular materials in-situ by Scala Penetrometer is normally acceptable for clay and colluvial materials. Figure 5-2 shows a correlation between Scala penetration and CBR values. This should be used conservatively.

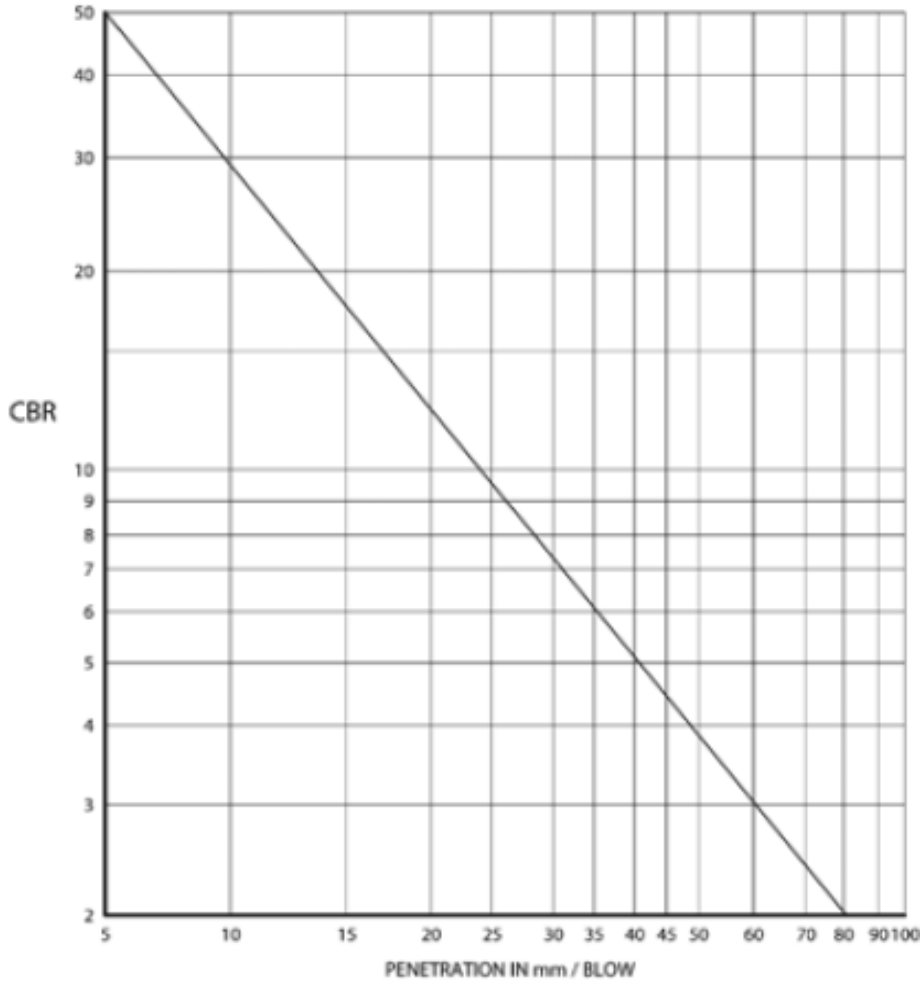
CBR values determined in the laboratory, in accordance with 6.1 of NZS 4402.6, may be required for high volume roads, or where deemed necessary by a geo-professional or by Council.

The CBR value used in the design shall be the 10th percentile value of the CBR tests taken on the subgrade material. A selection of tests shall be taken at 150, 300, and 450 mm below final subgrade level and included with the reporting.

Where CBR values are required for aggregates, these shall be based on laboratory tests prepared on the fraction passing the 19 mm sieve but a CBR of more than 30 shall never be used for design. The use of CBR on metal layers shall only be in conjunction with consideration of the CBR and stiffness of lower layers.

Table 9: Parameter Relationships





CORRELATION OF DYNAMIC CONE mm PER BLOW AND CALIFORNIAN BEARING RATIO (SCALA PENETROMETER)

5.3.4.3 Pavement Surfacing

Acceptable surfacing for carriageways includes asphaltic concrete (40 mm minimum thickness), chip seals, in situ concrete or concrete pavers. Surface texture and skid resistance should comply with T/10 requirements. Unsealed carriageways may be accepted in rural areas at the discretion of Council. The whole of life cost for the surfacing treatment shall be shown by the designer.

All movement lanes shall be provided with a permanent, hard wearing surface layer, which shall be either impermeable or formed over an impermeable base. The surfacing shall be capable of carrying all stresses expected during its lifetime.

Acceptable surfacing options may include:

a. Hot laid asphaltic concrete of minimum compacted thickness 40mm , laid over waterproofing sealcoat
b. Other asphaltic concrete mixes such as friction course or macadam wearing mix laid over a waterproofing coat
c. Chip seals of various types, providing the equivalent of two bound chip coatings
d. Running course, a free-flowing stone aggregate with a maximum material size of 19.0mm, is an acceptable road surfacing option for gravel/unsealed roads an rural right of ways carrying out farming activities
e. Concrete block pavers, and
f. Stone block surfacing where designed for aesthetic effects.

Options d, e and f are subject to Clutha District Council approval.

To resist scuffing and local load effects, minimum surfacing standards apply as per this code.

Use of concrete or stone block paving in public traffic areas shall require specific approval from Clutha District Council.

5.3.5 Safety Barrier Provisions

5.3.5.1 Pedestrian Protection

Where safety barriers for pedestrian and cyclists are necessary, they shall comply with the design requirements of the New Zealand Building Code and NZS/AS 1657 Fixed platforms, walkways, stairways and ladders. Design, construction and installation.

5.3.5.2 Vehicle Barriers

Where safety barriers for vehicles in urban areas are necessary, they shall comply with the design requirements of Austroads Guide to Road design Part 6 Roadside Design, Safety and Barriers and use Waka Kotahi NZTA approved systems as stated in M/23. Further guidance can be found in Waka Kotahi (NZTA) RTS 11: Urban roadside barriers and alternative treatments.

5.3.5.3 Rural Vehicle Barriers

Where safety barriers for vehicles in rural areas are necessary, they shall comply with the design requirements in AS/NZS 3845.

5.3.6 Parking, Passing and Loading

Parking and loading can be provided either on or off-street. Facilities shall meet the needs of the area and the requirements of Council as per Section 5.5 this Code of Practice and shall be addressed in the design and access statement (see Section 5.2.6. Further guidance can be found on the Trips Database Bureau website https://www.transportationgroup.nz/trips-database-bureau.

Passing provision shall be in accordance with requirements of Council.

Acceptable and alternative on-street carpark and loading dimensions should be taken from AS 2890.5 and/or Austroads guides. Off-street carpark and loading dimensions should be taken from the New Zealand Building Code and the District Plan.

Parking and loading shall avoid the potential to obstruct the movement of emergency or service vehicles along a road. Alternate provision within sites may be demonstrated in addition to the requirements of the District Plan, particularly when establishing rules for new subdivisions.

5.3.6.1 Parking Provision

On-street parking shall be in accordance with Figure 3: Turning Areas for No-Exit Roads Road Design, Cross Section Standards.

5.3.6.2 Parking Bays

Each parking area shall be a minimum 2.1 m x 6 m, and if used for loading it shall be a minimum 2.5 m x 12 m, each with appropriate entry and departure tapers outside of the movement lane.

5.3.7 Intersection and Alignment Design

The angle of intersection should be 90°, although a minimum angle of 70° can be used when justified by other constraints. Carriageway alignment may be offset within the street reserve to achieve the required target operating speed for the road. Minimum separation distances for intersections on a Connector/Collector or Arterial shall be assessed by an appropriately qualified person. For other road types, the minimum separation distance shall be 40m (measured centreline to centreline).

All road intersections in residential areas below M2 (arterial) class shall have a kerb radius at intersections of 9 m. An alternative and reduced kerb radius may be considered to enhance pedestrian facility in low-speed environments and shall be subject to the approval of Council.

Intersections in all other 50 km/hr or lower speed environments shall have the lot corners splayed by a minimum of 4 m along both boundaries, although these may be dispensed with in low target operating speed situations provided that there is adequate provision for pedestrians and utility services. Corner boundary splays shall be subject to specific design in higher speed environments, to ensure safe visibility at intersections.

All major intersections, and those in rural, industrial or commercial areas, should have a minimum kerb radius of 15 m with corner splays of 6 m, or subject to specific design. Reference can also be made to Austroads guides.

Intersections between M4 (connector)/M3 (collector) roads or intersections of M4 (connector)/ M3 (collector) roads with M2 (arterials) shall be a minimum distance of 150 m apart, centre line to centre line.

5.3.8 No Exit Roads

'No-exit' roads should not be provided where through roads and connected networks can be designed. Where no-exit roads are provided, they should ensure connectivity for pedestrians and cyclists.

No-exit roads and lanes shall provide for road turning at the end of the road for an appropriate vehicle as described in RTS 18: New Zealand on-road tracking curves for heavy vehicles.

The design of turning facilities for light vehicles shall be in accordance with AS 2890.5. See Figure 2 and Figure 3: Turning Areas for No-Exit Roads for acceptable solutions.

An on-road turning area may provide for parking or landscaping in the centre of the turning area. The minimum kerb gradient around turning heads shall be 0.5%. Appropriate drainage shall be provided.

5.3.9 Bus Stops

Bus stops shall be provided for on connector/collector roads or arterials in accordance with Council direction in consultation with the regional transport authority. Bus stops may be designed in accordance with the Waka Kotahi public transport design guidance (https://www.nzta.govt.nz/walking- cycling-and-public-transport/public-transport/public-transport-design-guidance/).

5.3.10 Services within the Road

Refer to Section 9.3.2 requirements on locations for transformers and other utility components, mailboxes, and refuse collection.

5.3.11 Special Road and Footpath Provisions near Places of Assembly

Designs for areas adjacent to places of public assembly including schools, hospitals, shopping areas, and public halls, shall incorporate special provisions such as extra parking spaces, stopping lay-bys, widened footpaths, bus and taxi stops,

pedestrian crossings, loading zones, and any associated facilities to ensure the safety of concentrations of vehicles and pedestrians. These designs shall be subject to Council's approval.

5.3.12 Footpaths, Accessways. Cycle Paths and Berms

Pedestrians, cyclists, and berms shall be provided for in accordance with Figure 3: Turning Areas for No-Exit Roads and associated notes. Dimensions, strength, durability, and finish shall be appropriate to their use and expected loadings. Paths shall be designed in accordance with Austroads guides and Waka Kotahi (NZTA) design guidelines (https://www.nzta.govt.nz/walking-cycling-and-public- transport/walking/walking-standards-and-guidelines/), and Standard Drawings in Appendix B.

Where accessways separate from the roads are to be illuminated, they shall be to the standard of illumination recommended in AS/NZS 1158.3.1.

5.3.12.1 Footpaths and Accessways

Footpaths may be required on one or both sides of the carriageway. Generally, footpaths shall be provided where potentially more than six households will be serviced. (Refer to *Figure 3: Turning Areas for No-Exit Roads).*

The width of footpaths shall be appropriate to the expected foot traffic, with guidelines as follows:

In all cul-de-sacs or other roads with a legal width of 15 m or less, footpaths shall preferably be located immediately behind the kerbs. In other locations a grass berm may separate the footpath and the kerb. Refer Standard Drawing Fig. R3.

Footpaths shall be a minimum of 1.5 m wide in concrete, or 1.8 m wide in asphalt, surfaced over their full width. The crossfall should be no greater than 2% and approval is required by Council to vary this. No crossfall shall exceed 4%. Wider footpaths or areas of local widening will often be required by Council where higher use or other needs dictate such widening. If a footpath is shared as a cycle path width shall be as per Section 5.3.12.2.

Accessways should be provided at no-exit roads or where necessary to improve connectivity. They shall be designed for user safety using crime prevention through environmental design (CPTED) principles and should:

1. Be direct and no greater than two properties long.
2. Have good sight lines for passive surveillance with fences a maximum height of 1.2 m for 10 m from the road frontage, or no fencing.
3. Be sited to ensure high levels of community use.
4. Be amenity landscaped without compromising safety.
5. Have provision for the disposal of stormwater.
6. Be provided with pedestrian level lighting.
7. Have a legal width not less than 5.5 m.

5.3.12.2 Cycle Paths

Separate cycle paths shall be provided where good design requires separation from the carriageway or a different route to be selected. Cycle facilities shall be designed to the standards as set out in the Austroads guides and the Waka Kotahi (NZTA) Cycling Network Guidance (Cycling standards and guidance | Waka Kotahi NZ Transport Agency (nzta.govt.nz)).

Stormwater disposal shall be provided to all off-road cycle paths. Lighting is to be provided where appropriate.

5.3.12.3 Footpath and Cycle Path Surfacing

The choice of surface finish shall be to Council's approval with a general guideline being that the finish should match with adjacent footpath finishes.

All footpaths and cycle paths shall be surfaced with a permanent surfacing layer appropriate to the surrounding environment and level of use expected.

Acceptable surfacing for footpaths and cycle paths are:

1. Concrete.
2. Asphaltic concrete.

Other acceptable surfacing for footpaths are:

1. Pavers only as approved by Council.
2. Metal surfaces may be appropriate in rural areas, where the carriageway is metaled. Where the carriageway is sealed then for low volume use a metal footpath may be acceptable.

In all cases the surfacing shall be placed over compacted basecourse which in turn shall be placed over a firm subgrade with all organic soft material removed.

5.3.12.4 Berms

Grassed or planted berms between the road legal boundary and carriageway shall be provided in accordance with the landscape character intent for each street type within the development. For streets with high pedestrian activity, a full footpath (with no berms) may be more appropriate. Residential streets with a lower pedestrian activity may have a ribbon footpath (planted berms between footpath and carriageway, and between footpath and road boundary).

In all cases the combined berm and footpath width shall be as required by Council to be adequate to enable landscaping and all current and expected services to be installed.

Where a berm crossfall greater than 1 in 12.5 is proposed, the designer shall produce a cross section along suitable individual property access locations to show that the sag or summit curves at crossings can be satisfactorily negotiated by a 99th percentile car.

Berms shall be at least 1.0m wide between the footpath and property boundary, and at least 0.5m wide between the road and footpath, unless otherwise approved. They must also be of adequate width to:

1. Achieve safe clearances between the carriageway edge and any obstacle.
2. Allow running of utility services and placing of lighting poles within the berm unless approved otherwise by the utility provider or Council.
3. Provide adequate space between the road reserve boundary and the carriageway edge to enable residents to safely enter the road traffic.
4. Allow room for efficient road edge and edge drain maintenance.
5. Allow adequate space for the effective operation and maintenance of any form of stormwater management device.

5.3.13 Traffic Signs, Road Markings and Road Furniture

The design shall incorporate all required road marking, signs, and other facilities as per NZTA's Traffic Control Devices Rule (TCD) and other appropriate standards. Roads should be designed to minimise the need for traffic signs and marking.

Designs shall satisfy the Waka Kotahi (NZTA) manual TCD Part 5, and Transport Rule (Traffic Control Devices) 2004 and linked traffic sign specification, and the Waka Kotahi (NZTA) Pedestrian planning and design guide.

Road markings shall be installed in accordance with MOTSAM Part 2. All road markings and traffic signs shall be approved by Council.

All fire hydrants shall be marked in accordance with NZS/BS 750.

Road name signs shall comply with Council's current road names standards and their mounting shall be provided by the developer to Council's requirements.

Developers are encouraged to suggest names for new roads. However, all names for new roads, including named private ways, are to be approved by Council. Refer Clutha District Councils Road and Street Naming Policy 2025. Names must comply with the New Zealand Geographic Board's rules. Road names should be short (25 characters or less), not hyphenated or multiple words, readily pronounced and spelt and not resemble other existing names (including geographic feature names) in either spelling or pronunciation.

A road name will be required for every private access lane servicing more than eight properties, in order to facilitate easy property addressing.

Seats, signs, and other street furniture shall be designed and placed in accordance with Council's requirements. Furniture should, unless expressly approved otherwise, be compatible with Council's existing street furniture.

Rapid numbers will be issued by Council at the time of 224c approval.

Also refer to Appendix B for Council's requirements on signs, markings and road furniture. Any changes from the details must be approved by Council.

5.3.14 Trees and Landscaping

Refer to Section 10 for specific guidance on trees and landscaping. The following principles should also be considered:

1. **Safety Issues, including**:
    a. shading of the road
    b. sight distances at intersections
    c. entrances and curves
    d. clarification of road definitions
    e. shade light effect of the planting
    f. frost shading
    g. clearance to high voltage power lines
2. **Asset preservation, including**:
    a. water channel and drain integrity
    b. seal and road surface integrity
3. **Utility Protection, including**:
    a. Water, wastewater, telephone
    b. stormwater, tile drainage, power and telephone
    c. high voltage power lines
4. Equity issues to ensure a fair approach to existing and new planting proposals.

Ownership and maintenance. There shall be clear demarcation and agreement identifying who will own and maintain the landscaping once the maintenance period is completed. A title Consent Notice may be necessary.

5.3.15 Road Lighting

All road lighting shall be designed and installed in compliance with the recommendations of AS/NZS 1158, Ausgrid technical specification for Public Lighting Equipment – LED luminaires, Oct 2014, Austroads road design chapter 6 guides, or other guidelines adopted by Council at the particular time of design.

A lighting design which shall include an Isolux diagram is to be submitted to Council, for checking and approval prior to construction. This shall include all the necessary certification documentation such as a Producer Statement.

Lighting designs are required to be completed with NZTA M/30 compliant luminaires that are appropriate to be used in the Council's lighting network. Luminaires shall be dark skies compliant (3000k).

All lighting shall be LED category PR3, PP3 or V3 and in compliance with AS/NZS 1158. All lighting is to be installed in compliance with NZTA M/26 specification for lighting columns unless approved by Council. Higher Standards may need to be applied based on the function of the road, path or car park in the roading network. New Road intersections will require Flag lighting.

5.3.16 Bridges and Culverts

Bridges and culverts may require separate resource and building consents. All bridges and culverts shall be designed in accordance with the Waka Kotahi (NZTA) Bridge manual.

Particular features to be considered/covered include:

1. **Widths/lengths**: All bridges and culverts shall be designed with a width to accommodate movement lane, cycle, and pedestrian needs of the road and guardrails which accommodate over width vehicles.
2. **Roadside barriers**: See Section 5.3.5

3. **Batter slope protection**: All culverts shall have anti-scour structures to protect batter slopes, berms, and carriageways.
4. **Clearance over traffic lanes**: Where passing above traffic lanes, bridges shall have the full clearance of 5.2 m to provide clearance for over dimension vehicles able to operate without a permit.
5. **Foundations**: All bridges and culverts shall be founded to resist settlement or scour. Abutments shall be designed to ensure bank stability and provide erosion or scour protection as applicable.
6. **Waterway design**: see Section 6
7. **All road culverts:** Must be 300mm diameter minimum size.

5.3.17 Private Ways, Private Roads and Other Private Accesses

Access to all lots, dwellings, or multi-unit developments shall be considered at the time of subdivision/development and should where possible be formed at that time.

Where access to the lot is to a garage or car deck to be constructed as part of the buildings this shall be noted on the design drawings. This is likely to have been considered as part of the resource consent process.

Accesses shall be designed and constructed to the following requirements or in accordance with Council's specific requirements including those within District Plans (if applicable), unless alternative designs by the developer's professional advisor are approved by Council.

Figure 3 should be used as a guide to the width of elements required for accesses and crossings.

A maximum 3-point turning head in the common area shall be provided at the end of all accesses serving three or more rear lots or dwelling units. Circular, L, T, or Y shaped heads are acceptable. Suitable dimensions are shown in Figure 2 and

Figure 3: Turning Areas for No-Exit Roads

For accesses serving fewer than three lots or 3 dwelling units, turning heads in the common area are not required where it can be shown that adequate turning area is available within each lot or private area.

Centre line grades should:

1. Not be steeper than 1 in 5 although gradients of 1 in 4.5 may be used on straight lengths of access over distances of up to 20 m. The first 5 m of any access shall be not steeper than 1 in 8. A greater length of transition shall be provided where necessary on non-residential accesses.
2. Not be less than 1 in 250.

1. and 2. – Council may approve exceptions provided the design includes suitable vertical transitions and adequate safety at the point where the access meets the footpath or road.

All accesses shall be shaped with either crown or crossfall of not less than 2%.

To allow vehicles to pass, single lane accesses shall have widening to not less than 6 m over a 7.5 m length (plus tapers) at not more than 50 m spacing. Rural accesses may have the same dimension passing bays at up to 100 m distances where visibility is available from bay to bay.

5.3.17.1 Stormwater Design

All shared urban accesses shall have their edges defined by a structural edge, normally standard kerb and channel. The design shall demonstrate consideration of a sustainable approach to stormwater management rather than kerbed collection, channelling, and disposal, if possible.

Rural accesses shall be formed with safe water tables/edge drains along but adequately clear of each side of the access carriageway (minimum 1m).

Accesses sloping up from the road and where the catchment is greater than 6m2, shall have a stormwater collection system at the road reserve boundary so as to avoid stormwater run-off and debris migration onto the public road. Except in rural areas, stormwater shall discharge via an appropriately sized and designed stormwater system acceptable to Council. Rural side drains may discharge directly to the roadside drain or where accesses pass over the side drain they shall be provided with a culvert of a size appropriate for the design flow and approved by Council.

Accesses that slope down from the road and interrupt the road drainage shall be designed to ensure that road stormwater is not able to pass down the access. Side drainage in context with the area shall be provided to stop the concentration and discharge of stormwater and debris onto adjacent properties or any land which could be at risk of instability or erosion. Where an overland flow path departs from the road reserve, accesses shall be designed to direct secondary flow away from building floors and to discharge to natural and/or designed overland flow paths.

Commercial and industrial accesses and yards shall drain from their sumps through a lead directly or through a stormwater treatment device to a public stormwater main.

5.3.17.2 Pavement Design

Private pavements shall be designed as for public roads, residential/rural pavements shall have a minimum formation thickness in accordance with Austroads Guidelines.

All road pavements shall be provided with adequate supporting design to ensure that it will have a life of 25 years.

Acceptable surfacing for accesses includes asphaltic concrete (25mm minimum thickness) chip seals, in- situ concrete, or concrete pavers. Note that compacted gravel is not considered to be a hard surface as required by

Figure *3: Turning Areas for* No-Exit *Roads*

In some rural areas where an access off an existing sealed road serves 3 or less lifestyle Lots a metaled surface is acceptable. Where a dust problem may arise, sealing will be required.

Figure 2: Dimensions of No-Exit Road Turning Areas

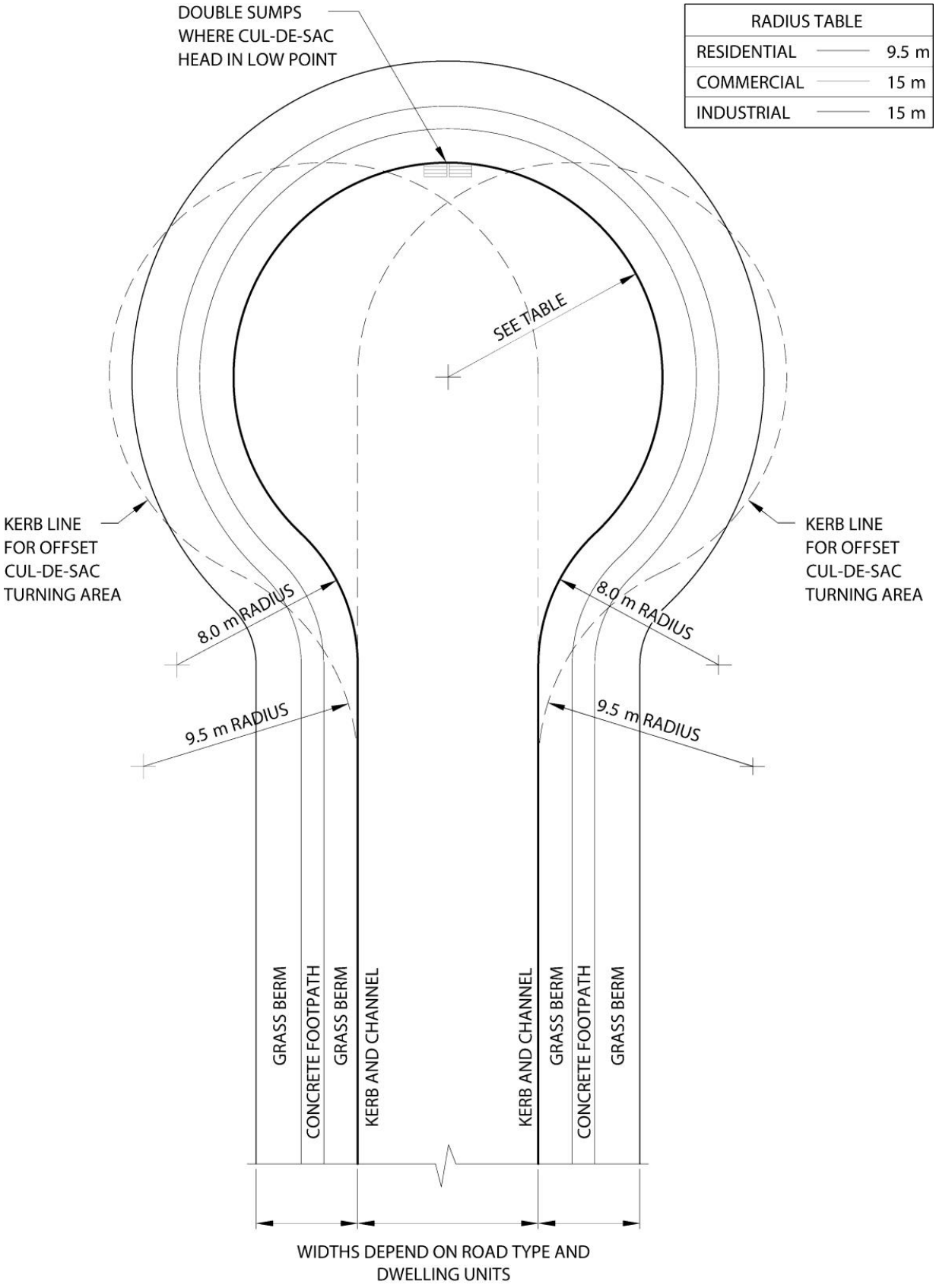
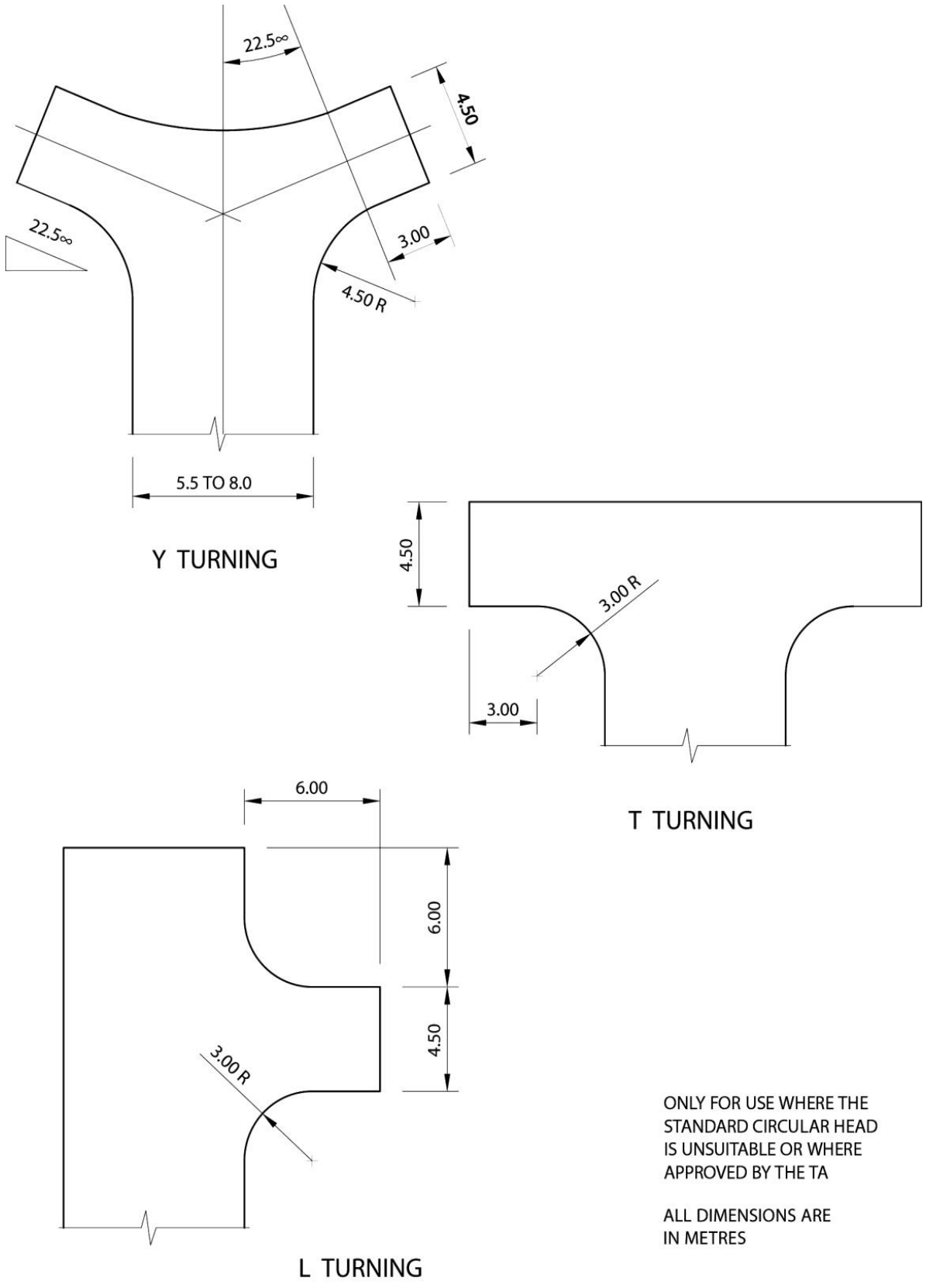


Figure 3: Turning Areas for No-Exit Roads



5.3.18 Vehicle Crossings

All regularly used vehicle crossings (e.g. urban, rural, residential, commercial and industrial) are to be formed, surfaced and drained to allow safe and effective vehicle access from carriageway to the property boundary and constructed in locations giving visibility equal to the safe stopping distance for the carriageway speed limit.

Vehicle crossings shall be constructed in accordance with Standard Drawings R21 – R23 in urban areas, and R28 – R30 in rural areas.

The sight distances outlined in the "Sight Distances" figure in Section 5.5.1 shall be used as a guide when assessing the adequacy of visibility at new accessways. No access to an individual plot shall be located within a clear distance of 5m from any corner (channel line) or intersection in the road that it connects to. The preferred separation wherever possible is 9m from the tangent of the intersection.

At the time of subdivision or development, any existing crossing providing access to the road shall be assessed to determine whether upgrade to Council's standard is required, or if permanent removal is appropriate.

5.3.18.1 Urban

Vehicle crossings shall be provided between the edge of the movement lane and the road boundary at the entrance to all private ways and lanes to any lots, front or rear where access points are clearly identifiable at the subdivision or development stage, and in all commercial and industrial areas,

Where access points are not clearly identifiable at the subdivision or development stage, crossings shall be constructed at the building consent stage.

Vehicle crossings shall be designed to enable the 99th percentile car to use them without grounding any part of the vehicle and shall be designed in accordance with the Waka Kotahi (NZTA) Pedestrian planning and design guide. In no case shall the change in grade be greater than 14%. Structural design shall be adequate to carry the loads to be expected over its design life. All crossings shall be surfaced with asphalt , concrete, or paving stone as approved by Council. The default crossing type shall be a Drop Crossing, a Slot Crossing may be specified where the 14% gradient change requirement cannot be met with a Drop Crossing design.

Where stormwater drainage is provided by swale or open drain, drainage crossings shall be provided as specified in 5.3.17.1

5.3.18.2 Rural

All shared crossings and any crossings where the location is obvious at the design stage shall be installed at the development stage. Other crossings shall be provided at the building consent stage.

Crossings shall be provided between the surfaced road edge and the lot boundary at a defined and formed access point to every rural lot. Structural design shall be adequate to carry the loads to be expected over its design life. The crossing shall be sealed to not less than the standard of the adjacent road surface and to the road boundary or to a maximum distance of 10 m. If the access slopes up from the road the crossing shall be sealed to a minimum distance of 10 m from the edge of the carriageway.

The crossing shall not obstruct the side drain. Where the side drain is shallow and only carries small flows during rain, the crossing may pass through the side drain. Where the side drain is of an unsuitable shape or carries flows for significant parts of the year the side drain shall be piped under the crossing. Pipes shall be sized appropriately for the catchment intercepted but shall be a minimum of 300 mm diameter. Culverts shall extend a minimum of 1 m beyond the edges of the crossing and be finished with a compliant end treatment.

Rural crossings shall be designed so that vertical curvature transitions are suitable for the passage of the 99th percentile car and control of stormwater and debris run-off (suitable sag curve).

5.3.19 Fencing

Fencing shall be provided along the road reserve boundaries of all rural subdivisions unless agreed otherwise by Council. Standards and requirements shall be in accordance with Council's fencing policy at the time, or in the absence of a policy shall be agreed to with the Council. This shall also apply to fencing of pedestrian, cycle, and reserve accesses in rural areas.

5.3.20 Road Run-off

5.3.20.1 Integration of Road Run-off with Development Stormwater

Stormwater management for a subdivision needs to integrate the control of stormwater from the proposed roading network with the overall stormwater system for the land development phase and final subdivision layout. Such planning needs to integrate the control of stormwater peak flows and pollutant removal as set out in Section 6 of this Code of Practice with the aim of minimizing downstream negative effects and mitigating road instability and erosion problems. Some guidance on integrated catchment management is set out in Waka Kotahi (NZTA) Stormwater treatment standard for State Highway Infrastructure.

5.3.20.2 Design

Roads shall be shaped with cross fall to shed water off the carriageway. Roads shall have longitudinal fall sufficient to convey surface water to low points along kerb line or other surface water channels depending on the site context. For stormwater run-off design see Section 6 of this Code of Practice.

5.3.20.3 Subsurface Drains

Where considered necessary by Council or the developer's professional advisor, piped subsurface drainage shall be provided to protect road formation and subgrades from deterioration or loss of strength caused by high water-tables. Swale stormwater systems or surface water channels must be sufficiently deep to allow the subsoil drains to operate efficiently. Design shall be in accordance with Waka Kotahi (NZTA) specification F/2.

Piped subsurface drains shall be provided on each side of all urban roads where the natural subsoils have inadequate permeability or unacceptably high-water table to enable long term strength of the new pavement to be maintained. Piped subsurface drains shall be provided on the upslope side of all urban roads in hill areas and on the down-side also where the down slope is in cut.

All piped subsurface drains shall discharge by gravity into a suitable component of the public stormwater system or approved discharge point.

For two typical details of under-kerb drainage and subsoil drainage see Figure 4: Subsoil Drains

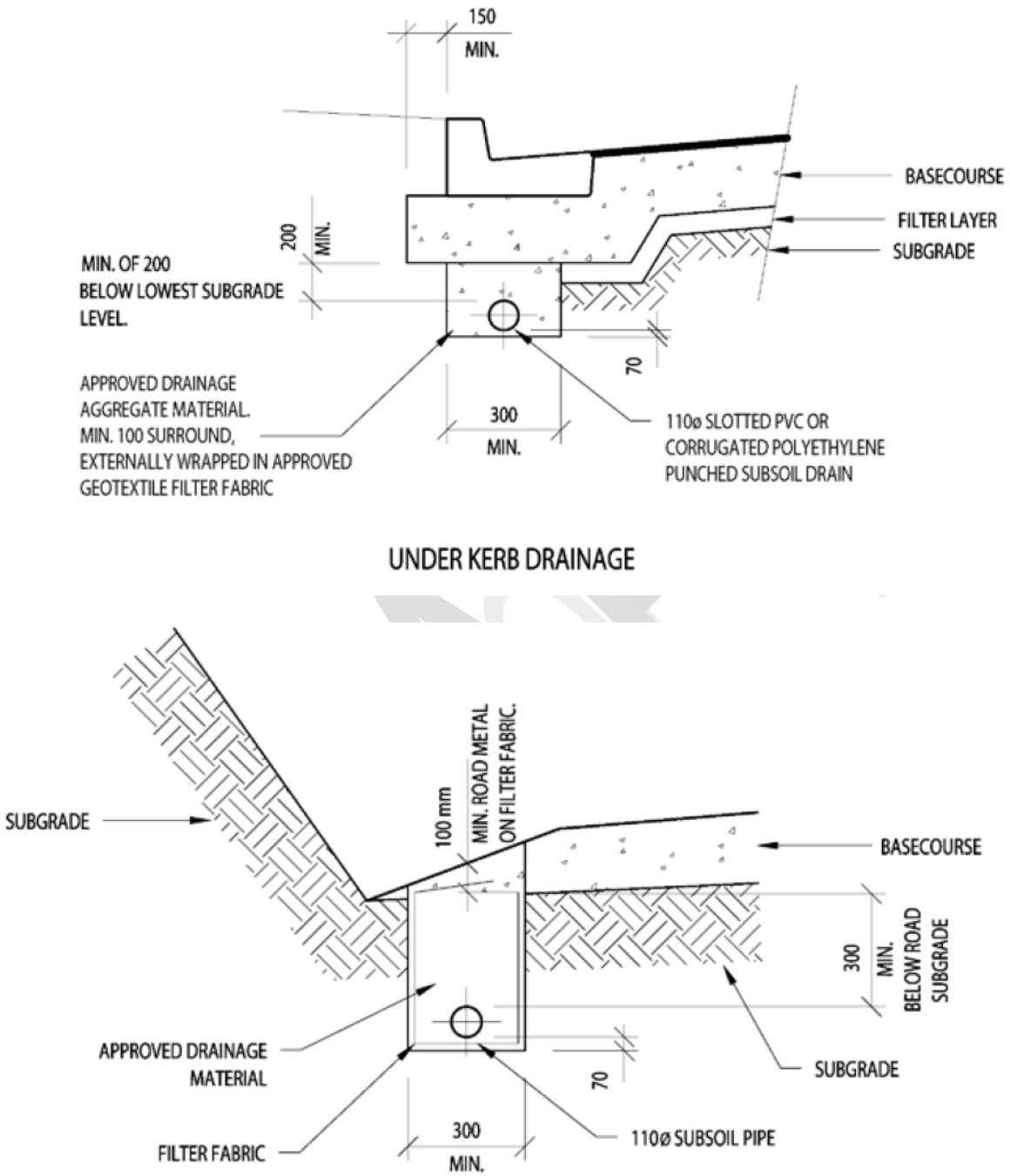
5.3.20.4 Side Drains/ Water Tables

Rural roads shall have normal camber (see Standard Drawings) to side drains/water tables formed on each side of the carriageway except where the road is on embankment above adjacent land without available formed drains. In such cases the road may be designed so as to provide for sheet run -off to the adjacent land surface provided natural pre-existing drainage patterns are not altered.

For all situations where side drains are required, they shall be sized to suit the flows discharging to them. Side drains shall be intercepted at regular intervals and discharge via open drains or pipes to an appropriate discharge point. All discharge points shall be clearly identified and have outlets protected from scour and shall be located to minimize the risk of slope instability.

Such discharges shall be subject to the approval of affected property owners at the design approval stage and be shown to be neither diverting catchments nor significantly changing peak flows or flow patterns.

Figure 4: Subsoil Drains



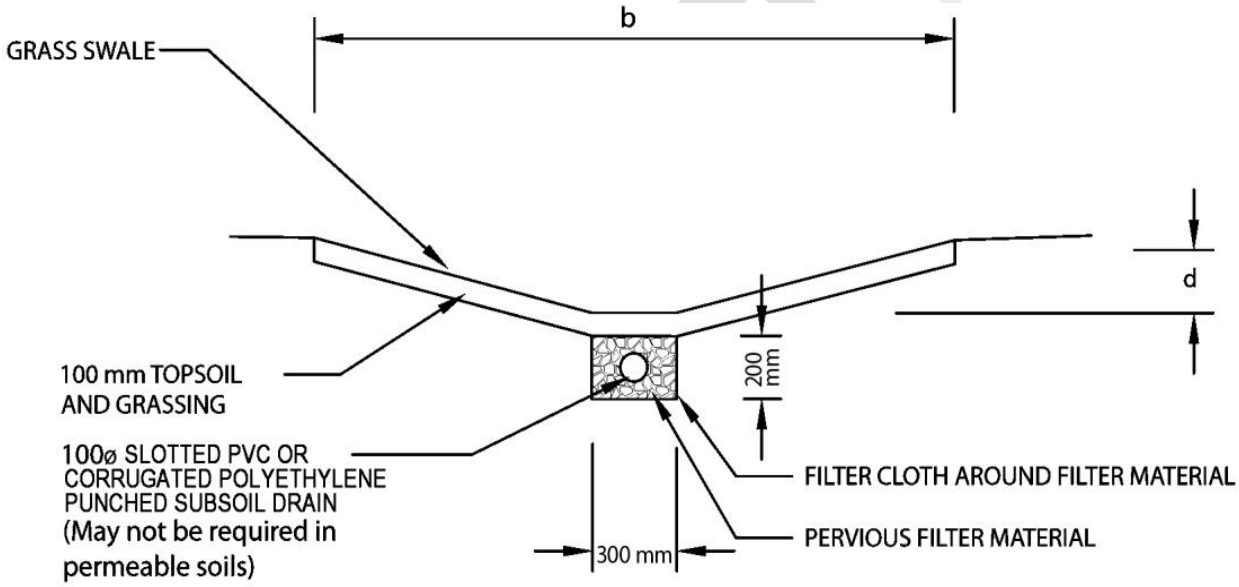
5.3.20.5 Swales

Swales should be used wherever appropriate to allow for infiltration to reduce peak discharge flows and to provide stormwater treatment. They can be located either in the berm area or in the centre island of dual carriageways and must be of sufficient width to accommodate services (if needed), plant growth and maintenance.

Where swales are used, they shall be designed by a suitably qualified person in accordance with Council requirements or one of the publications listed in Referenced Documents or Related Documents that cover swale design. Typical details that may be used in swale design are shown in Figure 5 to Figure 6.

See Section 6.3.8.6 for swale design and Section 10 on landscaping design and practice.

Figure 5: Typical Swale Detail



SWALE CROSS SECTION

NOTE –

1. Effective catchment area drained = impervious area + 0.72 x pervious area.
2. Maximum swale slope up to 5%. Steeper swales require check dams (see figures 3.6(B) and 3.6(C)).
3. Dimensions 'b' and 'd' to be sized for conveyance of 10% AEP event.
4. Existing ground is regraded, compacted, topsoiled (100 mm depth), and grassed.
5. Side slopes no steeper than 1v:3h if planted (not mown).
6. Side slopes no steeper than 1v:5h if grassed (mown).

Figure 6: Typical Check Dams in Swale Detail

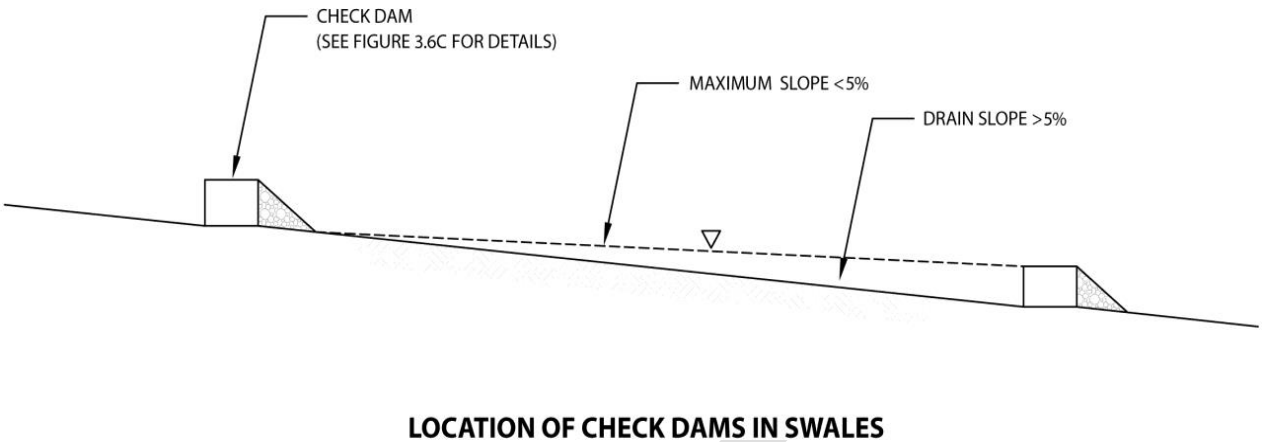
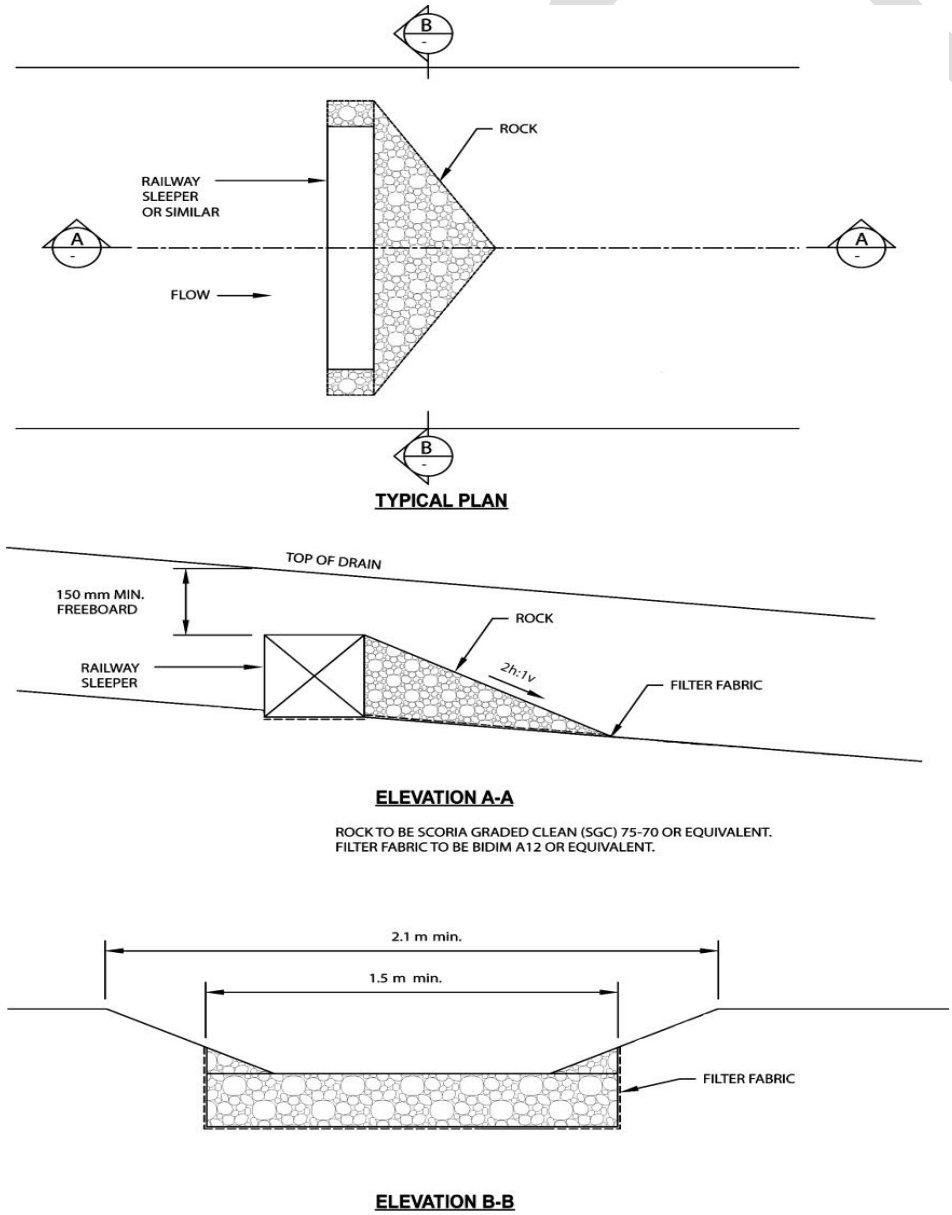


Figure 7: Typical Check Dam Detail



5.3.20.6 Kerbs and Channels

Where kerbs and channels are to be provided on carriageways they should comply with Standard Drawing R5 to R7. Mountable or nib kerbs, or their slip-formed equivalent may be used subject to the approval of Council. Mountable kerbs shall be constructed in accordance with Standard Drawing R7. Pedestrian crossings (pram crossing) should be provided for disability access at regular intervals and at locations where pedestrians are reasonably expected to transition between footpaths and the street, including all road intersections and pedestrian crossings. Tactile indicators will be required.

The crossings shall be sited to facilitate normal pedestrian movements in the road and where possible sumps shall be sited so as to reduce the flow of stormwater in the channel at the crossing entrance. Pram and wheelchair crossings shall conform to Standard Drawing R5, and satisfy the Waka Kotahi (NZTA) Pedestrian planning and design guide..

5.3.20.7 Sumps

Sumps used in all public places shall comply with Council's current standard details.

Stormwater sumps are classified as three types according to the design of their inlets:

1. Grated only inlet sumps: Grated inlets are effective in intercepting gutter flows. They also provide access openings for maintenance. Grated inlets are prone to blockage and problems of increased pavement maintenance in the immediate vicinity of the inlet, therefore, their use in street gutters are discouraged. They are suitable for non-kerbed situations such as yards, end of ditches, open car parks, accessways, driveways, medians, and ponding areas. Standard Drawings D12-14 show details of common types of grated inlet.
2. Back entry inlet sumps: Back entry inlets are less affected by blockage, and they are more effective in intercepting flows in sag areas.
3. Combined grates and back entry inlet sumps: This system of combining a back entry with the traditional grated inlet significantly improves flow intake and is less prone to blockage from debris. This type of inlet should be used in all situations where possible. Standard Drawing R13A shows a typical example of this type of inlet.
4. For particular sites a filter may be required to be fitted.

These diagrams are for typical Clutha geometry and catchments. Where situations are atypical (steep hills, extreme rainfall), the Engineer may require a modification to or an alternative design to accommodate these needs.

5.3.20.7.1 Sumps shall be Located

1. To ensure that the total system design flow enters the pipe system and that surface flows across intersections are minimized. In hill areas the total design flow shall include run-off from any upslope hillsides that are not specifically drained. In many cases this will mean the use of closely spaced or specially designed sumps to ensure that the flow to which the pipe system is designed can actually get into the system.
2. At all points in a surface system where a change in gradient is liable to result in ponding due to change in flow velocities or on bends where there may be a tendency for water to leave the kerb and channel.
3. Not further apart than 90 m along any surface system.

5.3.20.7.2 Sump Design

1. General safety requirements

a) Provide for the safety of the public from being swept into the stormwater system; the maximum allowable opening shall not exceed 100 mm in width;

b) Openings be sized and oriented to provide for safety of pedestrians and cyclists. Cycle - friendly sump grates shall be used where required by Council. These grates may be built either with bars transverse to the side channel direction or closely spaced bars in a wavy pattern in a longitudinal direction.

2. Sump inlet capacities

Inlet capacities of any sump used should be determined using manufacturers' and suppliers' data which should be based on either rational analysis or first principle calculations, otherwise sump inlet capacities should be calculated using approved design methods where applicable. When no proper data is available, the capacity of the single 675 x 450 back entry sump with standard grating should be limited to 28 L/s.

The calculated sump inlet capacities should be reduced to account for partial blockage of the inlet with debris as follow s:

On-grade grated back entry sump	10% reduction
On-grade grated sump	50% reduction
On-sag grated sump	50% reduction
On-sag grated back entry sump	Include back entry capacity only

3. **Silt traps**
   a) is encouraged in all sumps to provide partial treatment to stormwater at the source, but;
   b) in all cases, trapped sumps should be used where discharge to a soakage device is permitted.

5.3.20.7.3 Sump Grating

Sump grating areas shall be sized generously to allow for partial blockage to ensure that flows within the channel do not bypass sumps when velocities are high.

Cycle-friendly sump grates shall be used where cyclists can be expected or when required by Council. These gratings may be built either with bars transverse to the side-channel direction or closely spaced bars in a wavy pattern in a longitudinal direction.

5.3.20.7.4 Sump Leads

Leads should be designed to be of sufficient size to convey all the design capacity of the sump to the system. The size of the lead for all types of sumps shall be a minimum of 150 mm diameter.

5.3.20.7.5 Secondary Flow Provisions

At all points where sump blockage may occur, or where design capacity of the primary drainage network may be exceeded thereby leading to overland flows into private property, the provision of designed secondary flow paths protected by public ownership or easement shall be made (see Section 6.3.4).

5.4 Construction

5.4.1 Introduction

These requirements apply to flexible pavements. For rigid pavements, such as concrete pavements refer to Austroads guides, and the Guide to residential streets and paths as listed in Referenced Documents.

Roads shall be constructed to the alignments and standards detailed in the approved drawings using approved materials, using construction specifications to provide the required design life.

Road construction includes all associated construction required to complete adjacent footpaths, berms, and road reserve areas.

Road Construction shall comply with the requirements of Council and as a minimum to the Waka Kotahi standards set out in Section 5 of this Code of Practice.

5.4.2 Materials for Flexible Pavements

5.4.2.1 Transition Layer

A transition layer may be required for traffic loading in excess of 1 x 105 ESA where the subgrade is soft, to prevent ingress of the soft soils into the pavement layers. The use of geogrid, geotextile filter fabric or similar for the transition layer shall only be used at the approval of Council. The transition layer shall be compatible with the grading of adjacent layers and be regarded as part of the total depth of the sub-base layer.

5.4.2.2 Sub-base

The sub-base layer immediately beneath the basecourse shall have a permeability of at least 10 - 4 m/s for a depth of at least 100 mm.

The material used as sub-base shall be hard rock material with the largest aggregate size not larger than 60% of the depth of the layer or 65 mm. The material shall be sufficiently free draining so as not to be susceptible to undue weakening at highest in-service moisture content.

5.4.2.3 Basecourse

The thickness of the basecourse layer when used with other metal aggregate layers shall not be less than 100 mm.

Acceptable basecourse specifications are:

1. Complying with M/4 specification.
2. Local basecourse acceptable to Council.

Basecourse (2.) may be used for local roads and footpaths, kerb crossings, and shared accessways.

5.4.2.4 Road Surfacing

Unless specified otherwise, all roads and private ways within urban areas shall be finished with a chip sealed surface. Other accepted surface materials such as asphalt, paving blocks, or similar impervious treatments will require the approval of Council. The designer shall provide the whole of life cost for the surfacing selected. Note where chip seal is to be utilised, a two coat system seal will be required. Council will at a later stage apply a reseal between 10 to 12 years after the initial sealing date. Council may require a bond where a second coat is required within 1 to 4 years.

The carriageway of roads in rural lifestyle blocks shall be sealed if:

1. The subdivision is immediately adjacent to an existing developed urban resource area and has the potential to create a dust nuisance.
2. The subdivision accessway adjoins an urban sealed Road.
3. The longitudinal grade on roading is greater than 8% or scour is likely to be a problem because of the nature of the ground or of the construction materials.
4. The number of allotments serviced by a rural private road is greater than 3.

Council may also require the carriageway to be sealed if there is a strong possibility that the number of allotments serviced will exceed 10 through further subdivision within 10 years.

Council may waive sealing if the road servicing the development adjoins an existing unsealed road.

5.4.2.5 Acceptable Surfacing Materials

All movement lanes shall be provided with a permanent, hard wearing surfacing layer, which shall be either impermeable or formed over an impermeable base. The surfacing shall be capable of carrying all stresses expected during its lifetime. Acceptable surfacing options may include:

1. Hot laid asphaltic concrete of minimum compacted thickness of 40 mm, laid over a waterproofing sealcoat.
    a. Asphaltic concrete of at least 25 mm, but subject to specific design, may be used as an alternative to chip sealing.
    b. The asphaltic concrete shall comply with Waka Kotahi Specifications M10 or M27.
2. Other asphaltic concrete mixes such as friction course or macadam wearing mix laid over a waterproofing coat.
3. Chip seals of various types, providing the equivalent of two bound chip coatings. A second coat seal will be required between 12 - 24 months after the first coat installation. The second coat seal sealing date will be subject to Council approval.
4. For subdivision “roads to be vested”, surfacing shall be a first coat two coat seal using grade 3 and 5 chip. A second coat after 12 - 24 months will not be required unless bonded for.
5.
6. The following are less preferred but if promoted the Council will look for additional materials/contributions for maintenance of such.
    a. Concrete block pavers.
    b. Stone block surfacing where designed for aesthetic effects.

Interlocking paving blocks may be used on cul-de-sacs or wherever traffic speeds are generally less than 50 km/hr so that the tyre noise does not become obtrusive. Blocks shall be manufactured in accordance with NZS 3116 and shall be of

minimum 50 MPa crushing strength and minimum 80 mm thickness. The blocks shall be laid in a herringbone pattern. The road design and block abrasion resistance shall be approved by the Engineer.

To resist scuffing and local load effects, minimum surfacing standards as given in Table 10shall apply to the named facilities.

Use of concrete or stone block paving in public traffic areas shall require the specific approval of Council.

Table 10: Recommended Surfacing Standards

Facility	Minimum Surfacing
Residential turning head	• Segmental concrete pavers, concrete, 40mm asphaltic concrete
Public carparks (excl. parallel parks)	• Segmental concrete pavers, concrete, 40mm • Asphaltic concrete
Commercial and industrial turning head	• Segmental concrete pavers, concrete, 50mm asphaltic concrete
Traffic islands and bus stops	• Segmental concrete pavers, concrete, 50mm asphaltic concrete

5.4.2.6 Road Surface Tolerances and Texture

The finished surface of new roads shall meet the roughness requirements specified under the TNZ TM 7003 v1. This includes a maximum roughness no greater than 70 NAASRA counts/km to a 100m rolling average, with the target value being 60 NAASRA counts/km . No abrupt or abnormal deviations shall occur and no areas shall pond water. The surface shall be of uniform texture expected by best trade practice and satisfy density standards applicable to the surfacing being used. The skid resistance and surface texture of roads where design speeds exceed 70 km/hr, shall comply with Waka Kotahi (NZTA) specification T/10 and its accompanying notes.

Where hard surfacing is required for areas that are not movement lanes, alternative materials and porous pavements that achieve the durability, maintenance, and amenity requirements are acceptable with the approval of Council.

C5.4.2.6 In cases of narrow Traffic Islands and Bus Stops where loading is concentrated, the use of stabilised base course is also desirable.

5.4.2.7 Road Surfacing Materials

All materials used in road surfacing shall comply with the appropriate Waka Kotahi (NZTA) specifications. Proposed specification details shall be provided to Council prior to construction.

The following surfacing options will be acceptable for roads covered by this Code of Practice.

5.4.2.8 Chip Seal Surfacing

A first coat seal is the initial seal on a prepared unsealed surface, which is usually a basecourse. The first coat seal may either be a:

1. Single coat chipseal: a single sprayed application of sealing binder followed immediately with a single application of chip which is spread and rolled into place or
2. Two coat chipseal: also known as a “first coat two coat” is a chipseal with two applications of binder and two applications of chip applied in the following sequence:
    a. an application of sprayed binder followed immediately with an application of a large size chip;
    b. a second application of sprayed binder, and another application of finer chip.
    c. Both coats are applied one after the other with little to no time delay between coats.

Two coat chip seals are usually constructed using grade 3 and 5 chips (Waka Kotahi M/6) and 180/200 penetration grade bitumen (Waka Kotahi M/1) in accordance with Waka Kotahi Specifications P/3 and P/4. The binder application rate for the seals shall be designed to suit the conditions and chip size.

Acceptable and compatible chip sizes for two coat chip seals are::

- Local roads: First coat: Grade 4, second coat: grade 6
- Other roads:First coat: Grade 3, second coat: grade 5 or 6.
- For cycle and parking lanes the chip size for the second application of chip for a two coat chipseal shall be a grade 6 size.

5.4.2.9 Reseals/ Second Coat Seals

The developer shall allow for a second coat seal to be carried out between 12 - 24 months after the first coat installation. The second coat seal sealing date will be subject to Council approval. These are to be constructed in accordance with Waka Kotahi specifications M/6, M/1 and P/4.

A reseal is typically applied after a second coat seal on an existing sealed, asphalt, concrete or timber surface. These shall be constructed in accordance with Waka Kotahi specifications M/6, M/1 and P/4..

5.4.2.10 Hot Laid Asphaltic Concrete Surfacing

Hot laid asphaltic concrete surfacing shall comply with Waka Kotahi (NZTA) specification M/10, M/27 or equivalent approved by Council. The mix used shall be appropriate to the end use and thickness being placed. When using Waka Kotahi (NZTA) specification M/10 AC series mixes (AC10/AC14/AC20), these shall be paver laid to avoid an open or segregated surface.

A waterproofing seal coat, using asphaltic binder or emulsion, and grade 5 chip, with the requirement that the seal coat comprises a minimum of 1.0 L/m 2 of residual penetration grade bitumen, shall be laid prior to surfacing with asphaltic concrete of 50 mm or lesser thickness. No cut back shall be used in such coats as it can cause flushing of the asphalt overlay.

When using Waka Kotahi (NZTA) specification M/10 compliant mixes on roads of connector/collector class, Waka Kotahi (NZTA) guidelines on skid resistance and surface texture shall be incorporated in the mix design.

5.4.2.11 Other Asphalt Mixes

For special uses other asphalt-based hot mixes may be used such as open grade porous asphalt or macadam wearing mix. When used they shall be placed over a waterproof under layer and shall be designed according to current specifications and guides. In no case shall the laid thickness be less than 25 mm.

5.4.2.12 Concrete

All concrete for roads shall come from a special grade plant as defined in NZS 3109. Concrete of not less than 30 MP at 28-day strength shall be used for any road or crossing slabs.

Concrete for kerbs and channels shall be of not less than 20 MPa, 28-day strength except for vehicle crossings and mountable kerb, which require 30Mpa at 28-day strength.

5.4.2.13 Concrete Pavers

Design and material standards shall comply with NZS 3116. Paver thickness shall be as defined in NZS 3116 for the appropriate traffic loading classification.

When used in roads the basecourse underlayer shall be given a waterproofing seal coat before the sand and pavers are laid, except where part of a porous pavement is approved by Council.

When used for bus stops or at raised crossings the basecourse shall be cement stabilised under the raised zone and for at least 3 m on either side of the raised zone.

Pavers shall be laid to 5 mm above the lips of channels and other draining features.

5.4.3 Subgrade Preparation

The top of subgrade level should be formed to the road shape to ensure water drains effectively. For full details of subgrade preparation refer to Waka Kotahi (NZTA) F/1 specification.

Even in cases where the subgrade has been tested as part of the design its condition shall be reviewed on exposure during construction, by a suitably qualified person, and pavement thicknesses adjusted accordingly.

The results of such testing or review along with any consequent adjustments to pavement layer thicknesses shall be advised to Council before placing of pavement layers commences. Any adjustment of pavement layers shall not be less than the approved pavement design.

Any identified wet spots in the subgrade shall be drained to the under-channel drainage system. Where the wet area is below the level of the under-channel drain, it shall be drained using approved filter drainpipes connected to the nearest stormwater system.

Between the date the subgrade is completed and the application of the first metal-course aggregate, the subgrade shall be maintained true to grade and cross section. Should potholes, soft spots or rutting develop in the subgrade, the area so affected shall be scarified and clean material added and recompacted.

5.4.4 Spreading and Compaction of Metal Course Aggregates

The metal course aggregates shall be placed on the prepared subgrade in layers no thicker than 2.5 times the maximum aggregate size. The aggregate layers shall be of adequate thickness and stiffness to ensure that with adequate compaction the minimum required deflections are achieved.

5.4.5 Sub-Base

Sub-base material shall be placed in layers thin enough to ensure requisite compaction and CBR standards are achieved. Sub-base shall be compacted in accordance with Waka Kotahi (NZTA) B/2 specification to achieve a mean of 95% of maximum dry density (MDD) and a minimum of 92% of MDD.

The layers shall be so placed that when compacted they will be true to the grades and levels required. The laying procedure shall be arranged to minimize segregation. Grader use shall be restricted to essential shaping and final trimming, with minimum working of the final surface.

The sub-base layer may be used by construction traffic, but such traffic shall be managed to ensure no detrimental effects to the final road construction.

While not mandatory, it is recommended that the sub-base deflection be tested in addition to testing of the basecourse deflections.

5.4.6 Basecourse

Basecourse shall be placed in layers not exceeding 150 mm. It shall be placed and compacted to Waka Kotahi (NZTA) B/2 specification density requirements to achieve a mean of 98% MDD and a minimum of 95% MDD.

Where approved by Council, cement stabilized basecourses should be placed and compacted in accordance with the Waka Kotahi (NZTA) B/5 specification.

To assist compaction, water may be added as a fine mist spray to achieve optimum moisture content. Particular care shall be taken to avoid excess water reaching the formation or sub-base course.

Fine aggregate may be hand spread in a comparatively dry state over any open textured portion of the final compacted aggregate surface. The fine aggregate shall be vibrated or rolled into the interstices of the basecourse. The use of such surface choking material shall be kept to a minimum. Special attention shall be paid to the consolidation of the edges of the basecourse.

The construction of the basecourse shall be carried out in a manner that will ensure the production of a stone mosaic surface after sweeping.

5.4.7 Maintenance of Basecourse

The finished aggregate surface shall be maintained at all times true to grade and cross section by placement of a 'running course', watering as required, trimming, planning, rolling, and taking appropriate measures to ensure the even distribution of traffic.

Every precaution shall be taken to ensure that the surface of the basecourse does not pothole, unravel, rut or become uneven, but should any of these conditions become apparent, the surface shall be patched with suitable aggregate and completely scarified and recompacted. The basecourse shall be maintained to the specified standards until covered with an impermeable surfacing layer.

5.4.8 Basecourse Preparation for Surfacing

Any loose or caked material shall be removed from the surface without disturbing the compacted base, and the material so removed shall be disposed of. The surface shall then be swept clean of any dust, dirt, animal deposits, or other deleterious matter. The surface of the road at the time of surfacing shall be clean, dry and uniform, tightly compacted, and shall present a stone mosaic appearance. Immediately prior to any form of surfacing a strip 600 mm wide contiguous to each channel or seal edge shall be sprayed with an approved ground sterilising weed killer at the manufacturer's recommended rate of application.

For second coat sealing, repairs shall be carried out prior to sealing. Areas to be patched shall be cleaned and loose material removed before application of an emulsion tack coat and asphaltic patching material. The repairs shall provide a finished surface flush with the levels and grades of the surrounding pavement, and shall not hold water.

Where repairs are required to the carriageway and dense graded hot mix asphalt is used, a texturing coat maybe required. Where it is required, a minimum stand down period of 6 months should be undertaken to limit the potential for flushing of the texturing coat.

Prior to commencement of sealing the surface preparation shall be inspected by Council. Shoulders are to be compacted to Waka Kotahi B/02 specifications.

5.4.9 Deflection Testing prior to Surfacing

Where required by Council prior to placing the surfacing layer (except for cast in situ concrete roads) deflections shall be tested by the Benkelman beam method (see Table 5-). At least 95% of all tests shall comply with the standards appropriate to the road type. Where Council does not have its own deflection standards Table 5-6 shall be considered as a minimum standard. In addition no test shall give deflections greater than 25% above the specified maximum.

Table 11: Benkleman Beam Standards

Residential	Deflections		Commercial Industrial Rural	Deflections	
	Average	Maximum		Average	Maximum
M5- Low - Lane	1.50mm	1.80mm	Lane	1.00mm	1.20mm
M4 – Local Road	1.50mm	1.80mm	Local Road	1.00mm	1.20mm
Connector/Collector	1.25mm	1.50mm	Connector/Collector	1.00mm	1.20mm
Arterial	1.00mm	1.20mm	Arterial	1.00mm	1.20mm

Readings shall be taken in the wheel path in both lanes and at a maximum interval of 10 m. Other methods of determining deflection such as Falling Weight Deflectometer shall be acceptable if designed in accordance with the appropriate Austroads Guides.

5.4.10 Surfacing Specification

Chip sealing construction standards shall comply with Waka Kotahi (NZTA) specifications P/3 and P/4.

Asphaltic concrete construction standards shall comply with Waka Kotahi (NZTA) specification M/10..

5.4.11 Bitumen Application Rate

Bitumen application rate for Chipseal and tack coats shall be assessed based on current Waka Kotahi (NZTA) design methods and ambient weather conditions at the time of construction.

5.4.12 Footpaths and Cycle Paths

Standard Drawing R5 provides a guide to Council footpath construction standards. Reference shall also be made to Waka Kotahi RTS 14 – Guidelines for facilities for blind and vision impaired pedestrians for the design and installation of tactile ground surface indicators. Footpaths shall have a minimum CBR test value of 5 (allowable bearing pressure of approximately 80 kPa).

5.4.12.1 Concrete

Concrete footpaths and cycle paths shall be formed over not less than 100 mm of compacted AP20 crushed gravel. The formation is to be thoroughly compacted by rolling before any concrete is placed. Porous areas shall be blinded with sand prior to placing concrete.

The foundation shall be evenly trimmed to a crossfall of 1 in 50. If the foundation is dry, it shall be moistened in advance of placing concrete.

The concrete paths shall be laid with construction joints at intervals of not greater than 3 m. If paths are constructed by continuous pour techniques, clean, true, well-oiled 5 mm thick steel strips at least 40 mm deep shall be inserted at 3 m intervals to facilitate controlled cracking. These strips shall be carefully removed after the concrete has set. Alternatively, the joints may be cut by means of a concrete-cutting saw. In this case the cutting shall be carried out not more than 48 hours after pouring and shall be to a depth of 40 mm. These joints may also be typically tooled into the concrete when the concrete is still plastic. Alternatively, the use of metal crack inducers may be used with the approval of Council.

Expansion joints shall be constructed every 4.8m and shall be capable of 10mm of movement.

Minimum concrete thickness for paths is 100 mm. Concrete in both footpaths and kerb and channel shall be cured for at least seven days during dry weather.

Concrete used in footpaths shall be of at least 20 MPa, 28-day strength. Concrete for crossings shall be 30 MPa, 28-day strength as detailed in 5.4.2.12.

Concrete used in footpaths shall be of at least 20 MPa, 28-day strength, except for the following situations that require minimum compressive strength of 30Mpa, with a 125 mm depth reinforced with SE72 mesh.

- Vehicle crossings,
- Where the mountable kerb is used
- Areas specified by the engineer

Where required, vehicle and pedestrian crossings shall be constructed in accordance with Council Standard Drawings. Tactile ground stud indicators may be required at pedestrian kerb crossings.

5.4.12.2 Asphaltic Concrete

Asphaltic concrete footpaths and cycle paths shall be placed over not less than 100 mm of compacted AP20 over AP40 (or AP65 where depths allow) crushed gravel sub-base as per table on Standard Drawing R11 after removal of all organic and soft subgrade. Asphaltic concrete shall be laid in a minimum layer thickness of 25 mm of DG7 M/10 material. Asphalt

concrete paths shall not puddle water, and shall be edged with either concrete or ground treated timber where hand laid and abutting berms or other grassed areas.

5.4.12.3 Concrete Pavers

The designer must show the whole of life cost of concrete pavers in relation to concrete and asphaltic concrete footpath construction. Where concrete pavers are the preferred treatment, they shall be 80 mm depth of 50 MPa interlocking paving blocks shall be placed on 30 mm of sand with not less than

150 mm of compacted basecourse of AP40 crushed gravel after removal of all organic and soft subgrade. Laying shall be in accordance with NZS 3116. Pavers shall be laid to 5 mm above tops of channels and other drainage features.

Where a footpath is constructed around the head of a cul-de-sac turning head the depth of construction shall be increased to accommodate wheel loads from turning trucks as follows:

a. 125 mm concrete reinforced with SE72 mesh.
b. 50 mm of asphaltic concrete on 300 mm depth of AP 40 crushed compacted gravel.
c. 80 mm paving blocks on 30 mm of sand on 250 mm of AP 40 with 150 mm x 250 mm concrete edgings.

5.4.12.4 Surface Finish Tolerances

Surface finish and tolerances on footpaths shall comply with the appropriate design requirements.

5.4.13 Construction – Vehicle Crossings

5.4.13.1 Residential

Residential crossings serving one Lot shall be 125 mm thick concrete reinforced with central SE72 mesh with a 30Mpa 28-day strength, on a compacted subgrade.

5.4.13.2 Commercial and Industrial and Multi-Use Accessways

Construction shall be 150 mm thick concrete reinforced with one layer of SE72 mesh placed centrally with a 30Mpa 28-day strength. Channels across the entrance of commercial/industrial crossings shall incorporate two D12 reinforcing bars full length. This standard shall be used where more than 2 urban Lots are served

Alternative vehicle crossing designs for residential, commercial and industrial areas using hotmix may be used subject to specific approval. See Standard Drawing R21-R23.

5.4.13.3 Rural

Rural crossings shall be constructed with an appropriate depth of compacted granular hardfill. For typical situations the accepted depth is 250 mm, but this should be varied to suit local ground conditions and actual truck loading.

The primary purpose of rural crossings is to protect the edge of existing seal and prevent loose material migrating to the main road. The crossing shall be formed to cover the anticipated or (in the case of existing unsealed crossings) the existing swept vehicle area, with the full area of vehicle exit and entry from the carriageway to the legal boundary being covered. Further sealing may be required beyond the legal boundary.

5.4.14 Kerb and Channel

Kerb and channel may be either cast in situ or extruded.

For cast in situ kerb and channel, formwork shall be clean dressed timber or steel sections adequately oiled or otherwise treated to allow ease of striking without staining or damaging of the stripped concrete surface.

No formwork shall be stripped until at least two days have elapsed from time of pouring concrete.

For extruded kerb and channel, concrete used shall be of such consistency that after extrusion it will maintain the kerb shape without support. The extrusion machine shall be operated to produce a well compacted mass of concrete free from surface pitting.

Concrete used in kerbs and channels shall be of at least 20 MPa, 28-day strength. Concrete for kerbs and channels at crossings, and all mountable kerbs, shall be 30 MPa, 28-day strength. The use of mountable kerb will require the prior approval of Council.

Finished tolerances and standards shall satisfy the design standards. Standard kerb and channel shapes are provided later in this Code of Practice. Refer to the standard detail drawings provided in Appendix B.

5.4.15 Berms and Landscaping

Berms shall be formed after all other construction has been completed. Berms once formed to the required shape (including batter slopes of 2:1(H:V) or less) shall include a 100 mm thick layer of topsoil free of weeds, stones, and other foreign matter and shall finish 15 mm above adjacent footpath level to allow for settlement.

After placing and spreading topsoil, the berm shall be either sown or planted, or both, and maintained free of weeds for the contract maintenance period. The seed mix shall be approved by Council.

When sown, rather than planted, grass coverage of not less than 90% shall be achieved within 1 month of sowing and before completion documentation will be accepted for processing by Council.

For additional requirements for swales see Section 5.3.20.6.

Any landscaping in the road reserve shall be in accordance with Section 10 of this Code of Practice.

Clear demarcation shall be required and agreed identifying who will own and hence maintain the berms and landscaping once the maintenance period is completed.

5.4.16 Surface Finish and Tolerances on Kerbs, Paths and Accessways

5.4.16.1 Kerbs and Channel

All curves both horizontal and vertical shall be tangential to straights and the lines and levels of kerbs

shall be such as to give the finished kerbs smooth lines free of kinks and angles. Construction joints shall be placed in all unreinforced kerb and channel at 10 m centres.

Workmanship standards shall be such that, on straights, kerbing shall not deviate from a straight line by more than 6 mm in any length of 3 m. Similar standards shall apply to the gradient line. No visible ponding in new channels shall occur.

The exposed faces of the kerb and channel shall present smooth, uniform appearance free from honey-combing or other blemishes to at least U3 standard in NZS 3114.

5.4.16.2 Paths and Accessways

Concrete paths and accessways shall be finished with a crossfall to shed water and an even non -skid brush surface to finish U5 in NZS 3114.

The surface of other paths/accessways shall be of uniform texture as would be expected from best trade standards for the surfacing used. Crossfalls of 2% shall be provided or by agreement with Council.

The surface of all paths/accessways shall not deviate by more than 6 mm from a 3 m straight edge at any point and no abrupt changes in line or level shall occur. No path/accessway shall pond water.

5.4.17 Progress Inspections

The contractor shall give notice to Council as appropriate to allow the conduct of all inspections required to facilitate eventual acceptance of the project by Council.

5.4.18 Installation of Traffic Services, Road Furniture, Benchmarks

Traffic lines and utility services shall be painted and marked after initial surfacing and sweeping has been completed. Road furniture and survey reference marks shall be installed, prior to final inspections being made by Council.

5.4.19 As-Built and Completion Documentation

On completion of construction, information and documents as required by Council shall be provided by the developer's professional advisor. (See Schedule 2D and Section 3.2.20 for further information.) The information provided shall provide sufficient detail to enable Council to complete the road assessment and maintenance management database, ThinkProject (previously RAMM), input.

5.5 Parking and Access Layouts

Figure 8: Angle Parking Layout

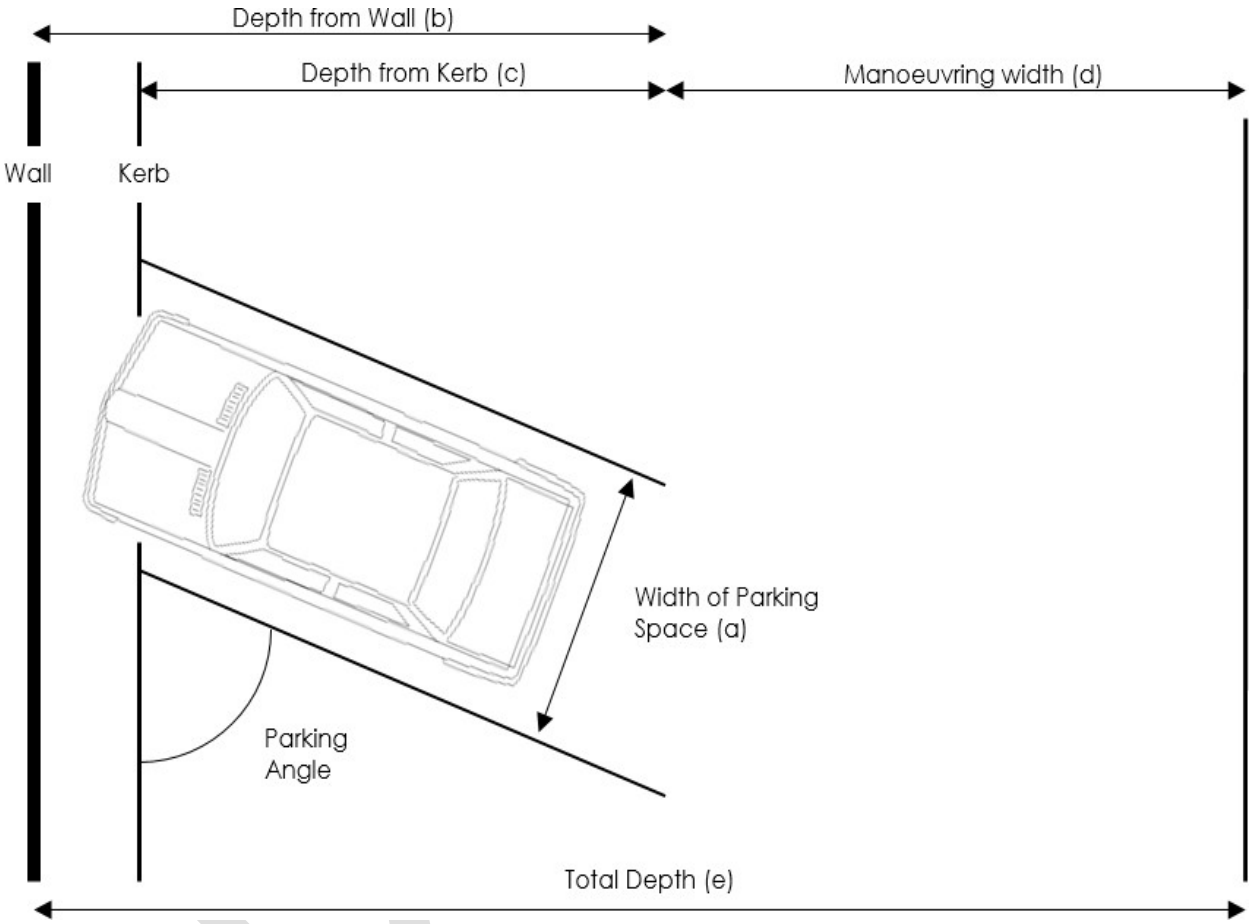


Table 12: Parking Dimensions

Type of Parking		Stall Width (a)	Stall Depth		Manoeuvre Width (d)	Total Depth (e)	
			From Wall (b)	From Kerb (c)		One Row	Two Rows
Parking Angle	Type	All Measurements are in Metres					
90°	Nose In	2.4	5.1	4.1	7.9	13.0	18.1
		2.5			7.6	12.7	17.8
		2.6			7.2	12.3	17.4
		2.7			6.8	11.9	17.0
75°	Nose In	2.4	5.4	4.4	6.4	11.8	17.3
		2.5			5.8	11.2	16.6
		2.6			5.2	10.6	16.0
		2.7			4.6	10.0	15.4
60°	Nose In	2.4	5.4	4.5	4.5	9.9	15.3
		2.5			4.2	9.6	15.0
		2.6			3.9	9.3	14.7
		2.7			3.6	9.0	14.4
45°	Nose In	2.4	5.1	4.2	3.6	8.6	13.6
		2.5			3.5	8.5	13.5
		2.6			3.4	8.4	13.4
		2.7			3.3	8.3	13.3
30°	Nose In	2.4	4.3	3.7	3.0	7.3	11.6
		2.5					
		2.6					
		2.7					
0°	Nose In	2.5	Stall Length 6.0 m		3.7	6.2	8.7

1. Parallel parking spaces (Parking angle – 0o) shall be 6.0 m long, except where one end of the space is not obstructed in which case the length of a space may be reduced to 5.0 m.
2. Minimum aisle and accessway widths shall be 3.0 m for one way flow and 5.5 m for two way flow. Recommended aisle and accessway widths are 3.5 m for one way flow and 6.0 m for two way flow.
3. Maximum kerb height = 150 mm.
4. In addition to the minimum requirements for a standard car, as shown above, a minimum stall width of 3.0 m shall be allowed for angled accessible parking.
5. The above table and diagram provide details on minimum car-park widths as a general guide. Consideration needs to be made of the use of the parking, for example where there are likely to be a high incidence of campervans or SUVs, parks may need to be wider. Guidelines on lighting, carpark surface and other issues may be found in the Traffic Control Devices Manual Part 13 (https://www.nzta.govt.nz/resources/traffic-control-devices-manual/) and should be considered in the overall scheme.
6. On-road parking requirements shall meet the requirements of the Traffic Control devices manual.

Accessible parking requirements and spaces shall comply with NZS 4121 Code of practice for design for access and use of buildings and facilities by disabled persons.

The following are the minimum number of accessible carparks required which must meet a minimum width of 3.0 m.

Table 13: Accessible Parking Numbers

Total Number of Carparks	Number of Accessible Carparks Required
1 to 20	Not less than 1
21 to 50	Not less than 2
For every additional 50 Carparks	Not less than 1

5.5.1 Accessway Sight Lines

For new accessways onto existing roads, the location shall consider the available sight lines to approaching main road traffic to ensure safety for exiting and entering vehicles. Sightlines shall be provided in accordance to the operating speed of the main road. Sight lines shall be created by clearing vegetation and other obstructions to the satisfaction of Council.

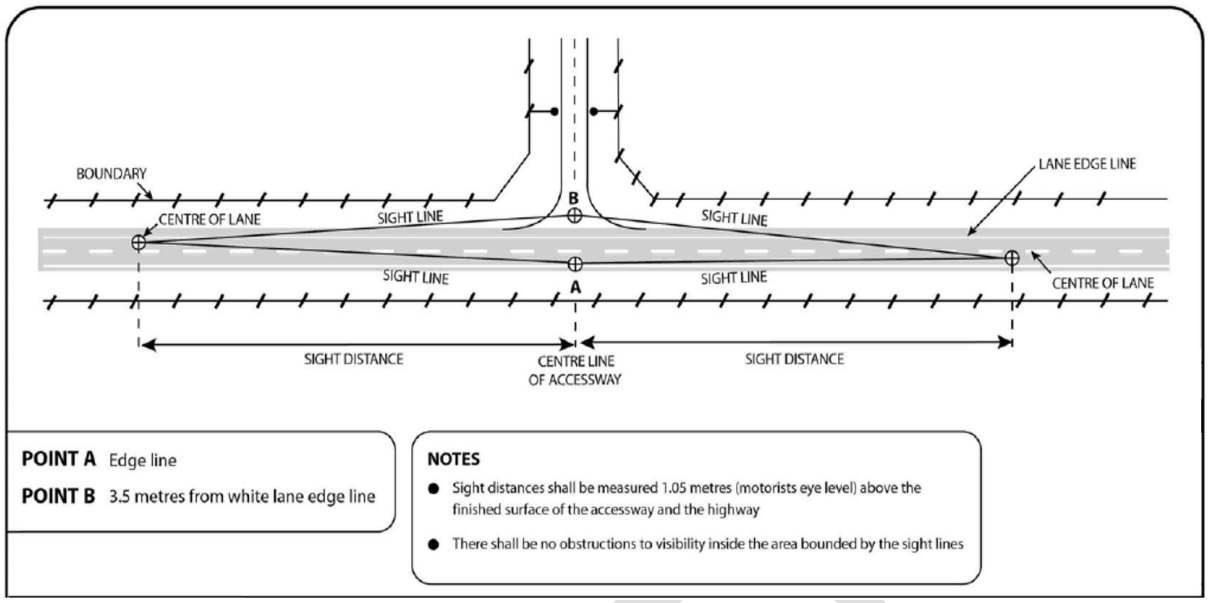
For both rural and urban locations sight lines shall be provided in accordance with Figure 5-10 below. Further review is required with Council if these requirements cannot be met.

Note: The 85th percentile speed is defined as the speed which is not exceeded by 85% of the vehicles travelling over that particular route.

Table 14: Minimum Sight Distances

85th Percentile Operating Speed (km/h)	Minimum Sight Distance (m)		
	Local Road	Collector Road	Arterial Road
40	30	35	70
50	40	45	90
60	55	65	115
70	85	85	140
80	105	105	175
90	130	130	210
100	160	160	250
110	190	190	290
120	230	230	330

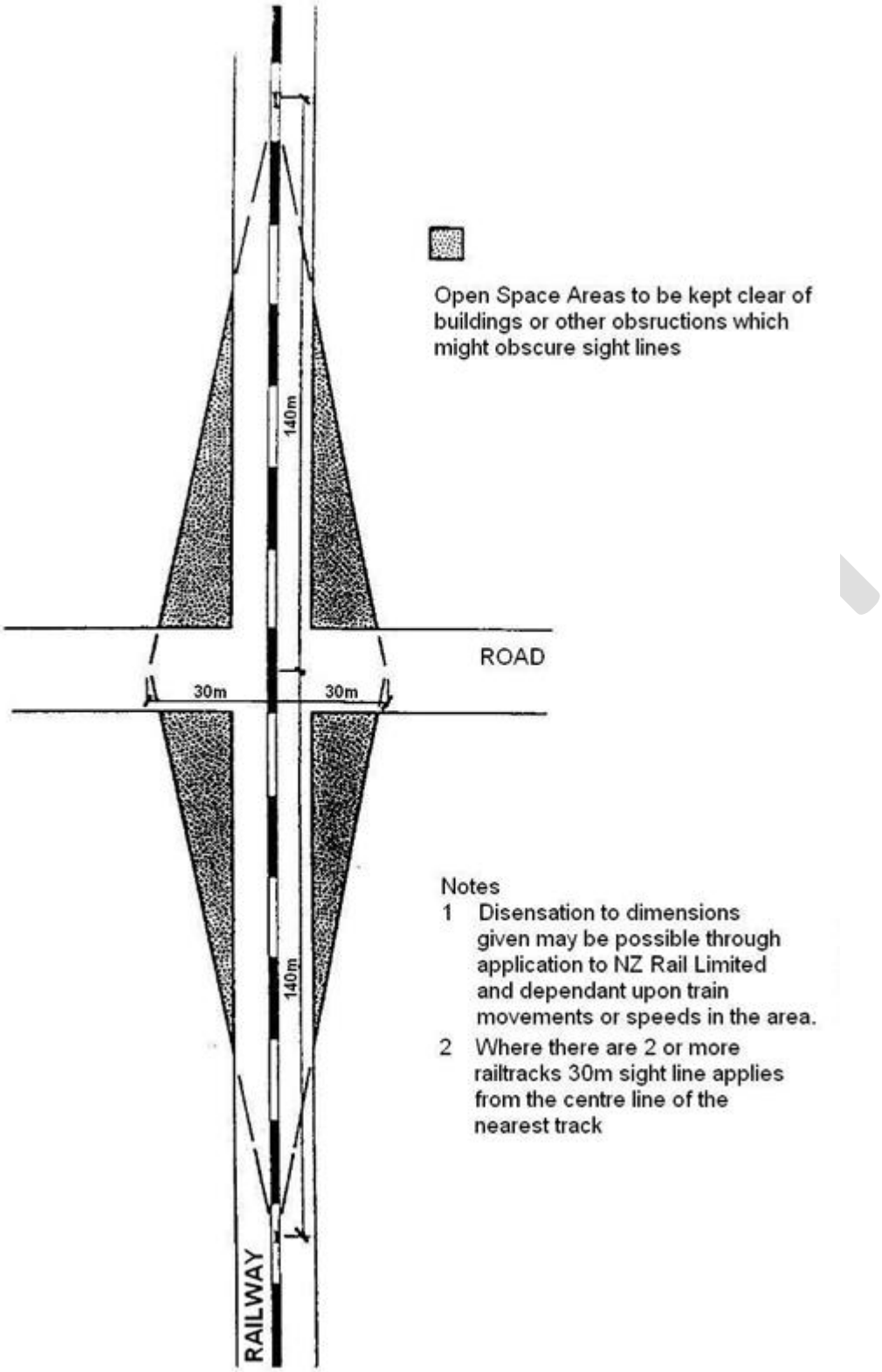
Figure 9: Accessway Sight Line Requirements

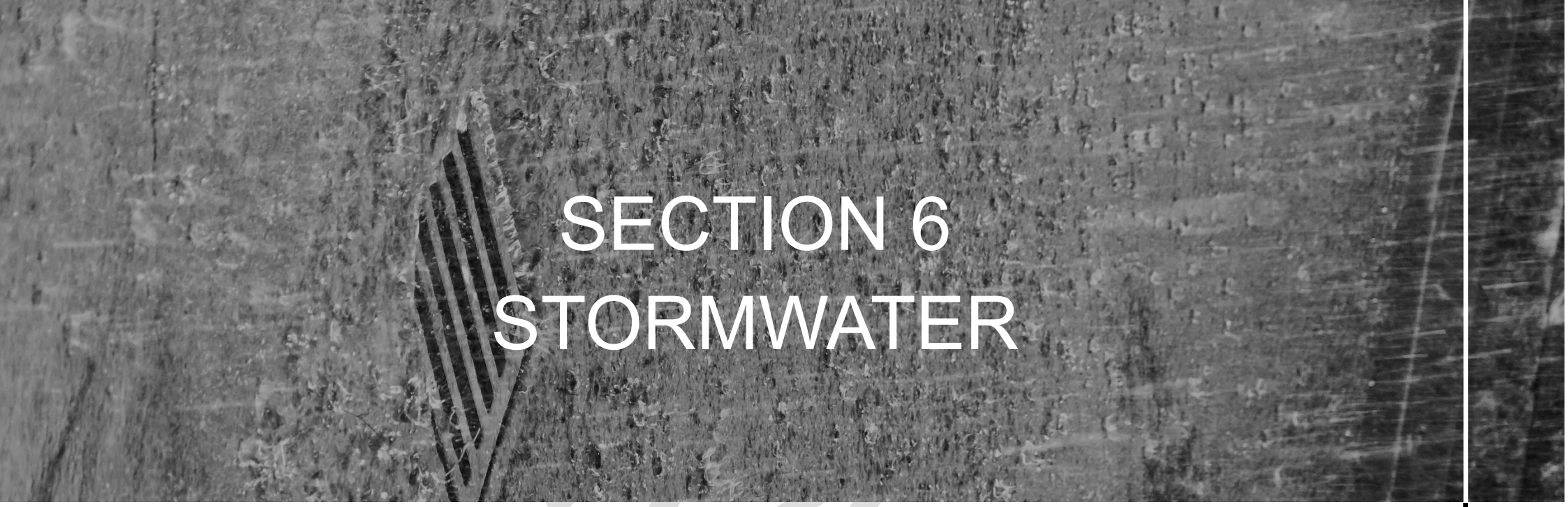


5.5.2 Railway Sight Line Restriction

Any building or vegetation located within an area bounded by lines connecting points of 30 metres along the centreline of the road measured in each direction from the centreline of the nearest railway track to points 140 metres along the nearest railway track measured in each direction from the centreline of the road as more particularly shown in Figure 13 shall be a non-complying activity

Figure 10: Railway Sight Lines





SECTION 6
STORMWATER

Section 6 Table of Contents

6.1 Scope

This section sets out requirements for the design and construction of stormwater systems for land development and subdivision. The significant issues for stormwater management are the protection of people, property, infrastructure, and the receiving environment. Stormwater management requires the integration of land use, roading, and ecological factors. A catchment-based approach is required with consideration of changes in catchment hydrology, rainfall patterns, and sea level rise from climate change effects.

Opportunities exist with stormwater design to use or replicate the natural drainage system. Grassed swales, natural or artificial waterways, ponds and wetlands, for example, may in certain circumstances be not only part of the stormwater system, but also a preferred solution especially if low impact on receiving waters downstream is critical. Low impact design is the preferred approach, particularly where there is a requirement to replicate the pre-development hydrological regime. Nevertheless, piped stormwater systems will often be required either in support of low impact systems or as the primary system.

Sustainable drainage solutions aim to store, treat, dissipate, and reuse at source as much as is possible. Thereby reducing total volumes being transported via networks away from the development. The tools listed below all work towards this end.

Stormwater systems serve a number of purposes including the management of storm surface water run-off, treatment of such run-off, and groundwater control. All aspects need to be considered in design and achieved with minimal adverse effects on the environment.

6.2 General

6.2.1 Objectives

The primary objective of a stormwater system is to manage storm surface water run-off thereby to minimise adverse effects on the environment.

The stormwater system shall include provision for:

1. A level of service to Council's customers in accordance with the authority's policies.
2. Minimized adverse environmental and community impact.
3. Protection from potential adverse effects to aquatic ecosystems.
4. Compliance with environmental requirements.
5. Adequate system capacity to service the fully developed catchment with allowance over the design life for increased flows and frequency caused by climate change.
6. Long service life with consideration of maintenance and whole life-cycle costs. Including resistance to tree root invasion, external corrosion, suitable structural strength.
7. Application of low impact design solutions.

6.2.2 Legislation and Guidance manuals

Referenced legislation is listed in Section 2 of this Code of Practice.

A selection of guidance manuals which may provide a useful resource or basis for stormwater design and management is set out in the referenced documents. They are non-statutory but may be required to be complied with under this Code of Practice and/or the Regional or District Plans.

6.2.3 Effects of Land Use on Receiving Waters

Impervious surfaces and piped stormwater systems associated with development have an effect on catchment hydrology. Faster run-off of storm flows, reduction in base flows, and accelerated channel erosion and depositions alter the hydrology and adversely affect the quality of receiving waters.

Development should aim to minimize the increase in the frequency at which pre-development discharges are exceeded across a range of design rainfall events as this has implications for the biodiversity of the aquatic biological community.

The effects of rural development on receiving waters are generally less significant. The modification to stream hydrology is generally minor. However, any reduction in riparian vegetation increases sediment loads and nutrient concentrations are likely to reduce aquatic biodiversity.

6.2.4 Catchment Management Planning

Stormwater management planning should be carried out on a sub-catchment or catchment -wide basis. Where the proposed development is in an area covered by a local authority comprehensive catchment management plan, designers will be required to comply with the design philosophy in the plan.

If there is no catchment management plan for the area of the proposed development, the stormwater planning requirements should be discussed with Council at an early stage.

The implications of future development on adjoining land should be on the basis of replicating the pre- development hydrological regime whereby the maximum rate of discharge and peak flood levels post -development are no greater than pre-development.

Any catchment management planning issues should be discussed with Council at an early stage.

6.2.5 Systems Components

The stormwater system conveys storm surface run-off and shallow groundwater from the point of interception to soakage areas, attenuation areas, or the point of discharge to receiving waters. Components of the primary system may include roadside channels, swales and sumps, stormwater pipelines, subsoil drains, outlet structures, soakage areas, wetlands, ponds, and water quantity and quality control structures. Secondary surface flow paths to convey primary system overflows and blockage of inlets overflows are an essential component.

These different system components are set out on standard construction drawings contained in Appendix B. The drawings are copyright waived and may be adapted by subdivision developers for incorporation into specific designs.

6.2.6 Catchments and Off-site Effects

All stormwater systems shall provide for the management of stormwater run-off from within the land being developed together with any run-off from upstream catchments. In designing downstream facilities the upstream catchment shall be considered to be fully developed to the extent defined in the operative District Plan or structure plan unless Council advises that the upstream catchment will be required to be controlled for off-site effects at the time of its development.

For all land development infrastructure (including projects involving changes in land use or coverage) the design of the stormwater system shall include the evaluation of stormwater run-off changes on upstream and downstream properties. This evaluation will be required at the resource consent stage and may be linked to a requirement to replicate the pre-development hydrological regime.

Upstream flood levels shall not be increased by any downstream development unless any increase can be shown to have not more than a minor impact on the upstream properties.

Downstream impacts could include (but are not limited to) changes in flow peaks and patterns, flood water levels, contamination levels and erosion or silting effects, and effects on the existing stormwater system. Where such impacts are more than minor, mitigation measures such as peak flow attenuation, velocity control, and treatment devices will be required.

Fish passage shall be designed and maintained in accordance with the National Environmental Standards for Freshwater. This is also likely to be a requirement of any authorization from the Regional Council.

6.2.7 Water Quality

Stormwater treatment devices may be required to avoid adverse water quality effects on receiving waters. The type of potential contaminants should be identified and then treatment devices designed to address the particular issues. The need for treatment devices should be considered for every discharge even when it is not a direct discharge to a receiving water, for instance where the discharge is to an existing network. In this instance specific approval from the Council will be required.

The type of potential contaminants should be identified, and treatment devices designed, to address the particular issues relevant to the receiving environment.

6.2.8 Climate Change

Climate change is expected to increase the intensity and frequency of heavy rainfall events, even in areas where mean annual rainfall is predicted to decrease. In low -lying coastal areas higher sea levels will also affect rivers, streams, and stormwater outfalls. The performance of stormwater systems in these areas will need to take into account higher predicted downstream sea levels.

- Rainfall design charts shall be adjusted to take into account the predicted increase in rainfall intensities from the effects of climate change. To do this the designer shall use the following factors:
- Temperature increase of 1.5ºC
- Design Horizon of 2050 – (NZ has signed up to the Kyoto agreement to limit to 1.5ºC at 2050)
- RCP 6 (representative concentration pathway)
- Design event duration 6hrs

Using the NIWA – Hirds website = https://niwa.co.nz/information-services/hirds/help

A percentage increase on the design rainfall depth can be identified.

(Example 2020 design is a 30-year design horizon (up to 2050) which from the Hirds table for a 1ºC increase gives a factor of 11.2%. This then needs to be multiplied by 1.5 (for the design temperature rise) which gives an overall climate change multiplication factor of 16.8%).

C6.2.8

Refer to the following Ministry for the Environment publications for guidance on climate change: 'Preparing for climate change - A guide for local government in New Zealand' for guidance on adjusting rainfall design charts at selected locations within each regional council area.

'Preparing for coastal change - A guide for local government in New Zealand' for guidance on coastal hazards and climate change.

'Tools for estimating the effects of climate change on flood flow - A guidance manual for local government in New Zealand' for incorporating climate change in flood flow estimation. 'Preparing for future flooding - A guide for local government in New Zealand' provides an overview of the expected impacts of climate change on flooding.

6.3 Design

Council should be consulted to confirm design requirements to suit each and any development site. The designer shall liaise with Council, prior to commencement of design, to ensure that sufficient prerequisite information is available to undertake the design.

6.3.1 Design Life

All stormwater systems shall be designed and constructed for an asset life of at least 100 years. Some low impact design devices such as rain gardens and other soakage systems may require earlier renovation or replacement. In addition Monitoring and Evaluation systems have a finite design life depending upon the components.

6.3.2 Structure Plan

Council may require a structure plan setting out certain information to be used in design, such as flows, sizing, upstream controls, pipe layout, treatment, or mitigation requirements. Otago Regional Council's Water Plan, and its future Water and Land Plan, detail the appropriate stormwater management options for the given structure plan area. Where a structure plan is not provided, the designer shall determine the information by investigation using any water plans for the area, this Code of Practice, and any requirements of Council, as appropriate.

6.3.3 Future Development

Where further subdivision, upstream of the one under consideration, is provided for in the district or regional plan, Council may require stormwater infrastructure to be constructed to the upper limits of the subdivision.

Additionally, Council may require further capacity to be provided in the stormwater system to cater for existing or future development upstream.

6.3.4 System Design

Stormwater systems shall be considered as the total system protecting people, land, infrastructure, and the receiving environment.

A stormwater system consists of primary and secondary systems outlined as below.

6.3.4.1 Primary Systems

A primary system designed to accommodate flows up to a specified design rainfall event. In the Clutha District this is defined as a 1 in 10-year event, also known as a 10% Annual Exceedance Probability (AEP) event.

In addition, depending upon the site, there is normally a requirement to limit the discharge from the site to a particular flow rate. This will need to be defined in discussion with Council as each catchment will have different objectives for attenuation (e.g. stream stability, flooding control or mitigation, pipe capacity limitations etc). The initial starting point for attenuating is typically to ensure the existing peak pre- development flow rate is not exceeded in the primary AEP storms. Further attenuation may be necessary to align with wider catchment time of concentration or other site-specific objectives.

6.3.4.2 Secondary Systems

A secondary system is intended to manage excess runoff over and above the primary network capacity. Thereby ensuring that the effects of stormwater run-off from events that exceed the capacity of the primary system, are managed. This includes occasions when there are blockages in the primary system limiting its capacity. This is defined as being for flows between the 1 in 10 year and a 1 in 100 year events (i.e. between a 10% and a 1% AEP event).

Secondary systems shall consist of ponding areas and overland flow paths to manage excess run -off. Where possible, secondary systems shall be located utilizing the development highways and/or on land that is or is proposed to become public land. If located on private land, the secondary system shall be protected by legal easements in favour of Council or by other encumbrances prohibiting earthworks, fences, or other structures that may restrict the flows.

Secondary systems shall be designed so that erosion or land instability will not occur. Where necessary the design shall incorporate special measures to protect the land against such events.

Ponding or secondary flow on local urban roads shall be limited to a 100 mm maximum height at the centre line during the 1 in 100- year event and flows such that the carriageway is passable in a 1 in 20-year event (5% AEP) design storm.

C6.3.4

The Austroads ‘Guide to Road Design – Part 5: Drainage Design provides more information on major and minor stormwater design and acceptable volume and velocity for surface flow.

6.3.5 Design Criteria

The designer should liaise with Council, prior to commencement of design, to ensure that sufficient prerequisite information is available to undertake the design.

When the design process includes the use of a hydrological or hydraulic model, all underlying assumptions (such as run-off coefficients, time of concentration, and catchment areas) shall be clearly stated so that a manual check of calculations is possible. A copy of the model may be required by Council for either review or records or both.

1. The designer shall undertake the necessary design and prepare design drawings compatible with Council's design and performance parameters. Designers shall ensure the following aspects have been considered and where appropriate included in the design:
2. The size of pipes, ponds, swales, wetlands, and other devices in the proposed stormwater management system.
3. How the roading stormwater design is integrated into the overall stormwater system.
4. The type and class of materials proposed to be used.
5. System layouts and alignments including:
    a. Route selection;
    b. Topographical (defining sub-catchments) and environmental aspects (defining runoff coefficients) (see Section 7.3.4.3);
    c. Easements;
    d. Clearances from underground services and structures (see Section 7.3.7.9 and 7.3.7.10);
    e. Provision for future extensions;
    f. Location of secondary flow paths.
6. Hydraulic adequacy (see Section 6.3.10.5)
7. Property service connection locations and sizes (see Section 6.3.13)

For catchments less than 50 ha, surface water run-off using the Rational Method will generally be accepted. For larger catchments, or where significant storage elements (such as ponds) are incorporated, surface water run-off should be determined using an appropriate hydrological or hydraulic model.

The design shall be based on the Rational Formula: ie: $Q=k*C*i*A$, where;

Q is the design flow rate in litres/sec k is 2.78 x 10-3

A is the area (hectares) of the catchment above the point being considered

i is the rainfall intensity (mm/hr)

C is the coefficient of run-off having the following values:

Table 15: Run-off Co-efficient for Various Surface Types

Description of Surface	C
Natural Surface Types	
Bare impermeable clay with no interception channels or run-off control	0.70
Bare uncultivated soil of medium soakage	0.60
Heavy Clay Soil Types	
Pasture and Grass cover	0.40
Bush and Scrub cover	0.35
Cultivated	0.30
Medium Soakage Soil Types	
Pasture and Grass cover	0.30
Bush and Scrub cover	0.25
Cultivated	0.20
High Soakage Gravel, Sandy and Volcanic Soil Types	
Pasture and Grass cover	0.20
Bush and Scrub cover	0.15
Cultivated	0.10
Parks, Playgrounds and Reserves	
Mainly Grassed	0.30
Predominantly Bush	0.25
Gardens, Lawns, etc	0.25
Developed Surface Types	
Fully roofed and/or sealed developments	0.90
Steel and non-absorbent roof surfaces	0.90
Asphalt and concrete paved surfaces	0.85
Near flat and slightly absorbent roof surfaces	0.80
Stone, Brick and Pre-Cast Concrete Paving Panels	
With sealed joints	0.80
With open joints	0.60
Unsealed roads	0.50
Railway and Unsealed Yards and similar surfaces	0.35
Land Use Types	
Industrial, Commercial, Shopping Areas and Town House Developments	0.65
Residential areas where the impervious area is less than 36% of the Gross Area	0.45
Residential areas where the impervious area is 36% to 50% of the Gross Area	0.55

Note:

Where the impervious area exceeds 50% of the gross area the chosen run-off coefficient shall be based on the conditions likely to exist after the full catchment development allowable by the District Plan

The run-off coefficient C is the variable in the rational formula least able to be precisely determined and represents the integrated effects of such things as infiltration, storage, evaporation, natural retention and interception, all of which affect the time distribution and peak rate of run-off

The run-off coefficients given assume saturated ground conditions from previous rain and shall be used in the calculation of surface water run-off.

6.3.6 Design Storms

All new primary stormwater systems shall be designed to cope with climate change adjusted design storms (see 6.2.8 for definition) with a 1 in 10-year return period (10% AEP). All new secondary systems shall be designed to cope with a 1 in 100-year return period (1% AEP) design storm.

Rainfall intensity design charts developed from local data should be used if available. High Intensity Rainfall Design Systems (HIRDS) data available from NIWA is considered a suitable source for rainfall design data.

6.3.6.1 Freeboard

The minimum freeboard height additional to the computed top water flood level of the 1 in 100yr (1% AEP) design storm should be as follows or as specified in the District or Regional Plan:

Freeboard	Minimum Height (m)
Habitable dwellings (including attached garages unless allowance made)	0.6
Commercial and Industrial Buildings	0.3
Non-habitable Residential Buildings and Detached Garages	0.2

The minimum freeboard shall be measured from the top water level to the building platform level or the underside of the floor joists or underside of the floor slab, whichever is applicable.

6.3.6.2 Tidal Areas

In tidal areas, design criteria should be discussed with Council at an early stage. Storm surge, tsunami hazards, climate change, and sea level rise need to be taken into account in accordance with the Ministry for the Environment guidance manual Interim guidance on the use of new sea-level rise projection 2022.

6.3.6.3 Hydraulic Design of Stormwater Systems

The hydraulic design of stormwater pipes should be based on either the Colebrook -White formula or the Manning formula. System capacity shall be determined from the Colebrook -White or Manning coefficient as shown Table 16, though approximations of Colebrook-White may also be used where appropriate. The Colebrook-White and Manning formulae can be found in Metrication: Hydraulic data and formulae (Lamont). Manufacturers' specifications should also be referred to.

Refer to 'Roughness characteristics of New Zealand rivers' by D M Hicks and P D Mason for further guidance on the selection of Manning's 'n' values. This handbook emphasizes that the Manning's 'n' values can vary significantly with flow and the selected value should be based on the graphs of Manning's 'n' versus discharge presented for each site.

Table 16: Guide to Roughness, Co-efficient for Gravity Stormwater Pipes Concentrically Jointed and Clean

Description	Colebrook-White Co-efficient (k) (mm)	Manning Roughness Co- efficient (n)
Circular pipes		
PVC	0.6	0.011
PE Polypropylene	0.6	0.009 - 0.011
Vitreous clay	1.0	0.012
Concrete - machine made to AS/NZS 4058	1.5	0.012
Corrugated metal	-	0.024
GRP (glass reinforced plastic)	0.6	0.011
Culverts		
Concrete pre-cast (pipes and boxes)	1.5	0.012
Open Channel		
Straight uniform channel in earth and gravel in good condition	-	0.0225
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	-	0.030
Winding natural streams with generally clean bed but with some pools and shoals	-	0.035
Winding natural streams with irregular cross section and some obstruction with vegetation and debris	-	0.045
Irregular natural stream with obstruction from vegetation and debris	-	0.060
Very weedy irregular winding stream obstructed with significant overgrown vegetation and debris	-	0.100

Note:

Refer to Metrication: Hydraulic Data and formulae (Lamont)

6.3.6.4 Energy Loss through Structures

Energy loss is expressed as velocity head:

Energy loss: He = kV2/2g; where

- k is the entrance loss coefficient
- V is velocity (m/s)
- g= 9.81m/s2

The entrance loss coefficient table and energy loss coefficient graph in NZBC Clause E1/VM1 provide k values for flow through inlets and access chambers respectively.

For bends, see Table 17: Loss coefficients for Bends.

6.3.6.5 Determination of Water Surface Profiles

Stormwater systems shall be designed by calculating or computer modelling backwater profiles from an appropriate outfall water level. On steep gradients both inlet control and hydraulic grade line analysis shall be used and the more severe relevant condition adopted for design purposes. For pipe networks at manholes and other nodes, water levels computed at design flow shall not exceed finished ground level while allowing existing and future connections to function satisfactorily without surcharge.

In principle, each step in the determination of a water surface profile involves calculating a water level upstream (h2) for a given value of discharge and a given start water level downstream (h 1).

This can be represented as:

$$h_2 + V_2^2 / 2g = h_1 + V_1^2 / 2g + H_f + H_e$$

where;

- V is velocity,
- Hf is head loss due to boundary resistance within the reach (for pipes, unit head loss is read

from Manning's flow charts, for example),

- He is head loss within the reach due to changes in cross section and alignment (see Table 17 for Loss coefficients).

Table 17: Loss coefficients for Bends

Bends	k
MH properly benched with radius of bend	
1.5 x Pipe Diameter	0.5 to 1.0
Bend Angle	
90°	0.90
45°	0.60
22.5°	0.25

6.3.7 Stormwater Pumping

Stormwater pumping should be avoided wherever possible. However, in certain circumstances for low lying areas, and where gravity drainage is difficult to achieve, stormwater pumping may be required to achieve the appropriate levels of service and protection.

The consequences and risk of pump malfunction and power outages should be considered carefully.

Sea level rise scenarios may need to be assessed in line with the proposed NES on sea level rise and assessed in line with the Ministry for the Environment guidance manual Coastal hazards and climate change - Guidance manual for local government, Dec2017. Such assessments are likely to indicate the need to design for or at least plan for stormwater pumping in the future to ensure levels of service are maintained throughout asset life.

6.3.8 Low Impact Design

Low impact design (LID) aims to use natural processes such as vegetation and soil media to provide stormwater management solutions as well as adding value to urban environments. The main principles of low impact design are reducing stormwater generation by reducing impervious areas, minimizing site disturbance, and avoiding discharge of contaminants. Stormwater should be managed as close to the point of origin as possible to minimize collection and conveyance. Benefits include limiting discharges of silt, suspended solids, and other pollutants into receiving waters, and protecting and enhancing natural waterways.

Effective implementation of LID principles typically requires more planning and design input than piped stormwater systems. Aspects in the design process requiring specific consideration include provision of Attenuation, Swales, soakaways, secondary flow paths, land requirements, and provision for effective operation and maintenance.

The developer shall implement low impact design principles for the treatment of stormwater. Where the developer does not believe that low impact design methods will be suitable the developer shall provide reasons for this for approval by the Council.

Useful guidance on low impact design practices can be found in the Christchurch City Council's Waterways, Wetlands and Drainage Guide which sets out a philosophy that encourages people to work with natural features and processes in the landscape.

6.3.8.1 Low Impact Design Stormwater System

Low impact design is a type of stormwater system that aims to minimize environmental impacts by:

1. Reducing peak flow discharges by flow attenuation.
2. Eliminating or reducing discharges by infiltration or soakage (dependent upon ground conditions).
3. Improving water quality by filtration.
4. Installing detention devices for beneficial reuse (rainwater harvesting for irrigation and toilet flushing).

6.3.8.2 Low Impact Design Process

Key design considerations include:

1. **Design objective** - The need to be clear about what is being designed for is important to informing decisions on the type of device and maintenance approach that is appropriate in a given context. Low impact devices offer many opportunities to deliver multiple outcomes in addition to their stormwater functionality.
2. **Device selection** - The proper design and position of a product or device within the stormwater treatment train is important. It is critical to select a device or product that is fit for purpose, robust, and effective for delivering the design objective over its design life. Problems with the operation and maintenance of a device can occur when it is inappropriate for a given location or is undersized for its purpose. The respective position of the various components in the treatment train is an important consideration in ensuring the sustained effectiveness of the system.
3. **Integrated approach** - Ensure that those who will become responsible for the ongoing operation and maintenance of low impact devices are involved in the design process. This is critical to informing the development of a practical design that will enable ease of maintenance and develop ownership for ensuring the device performs as it was intended.
4. **Design for maintenance** - Maintenance of devices shall be considered early in the design process. This will assist in the identification of features that will facilitate the ease and efficiency of ongoing operation and maintenance of devices. Elements to consider in the design for the maintenance and operation of the systems include:
    a. Access;
    b. Vegetation;
    c. Mulch;
    d. Sediment;
    e. Mechanical components;
    f. Vandalism and safety.

6.3.8.3 Low Impact Design Devices

The types of low impact design devices that could be considered for use include:

1. Detention ponds.
2. Wetlands.
3. Vegetated swales.
4. Rain gardens.
5. Rainwater tanks.
6. Soakage devices (pits and soak holes).
7. Filter strips.
8. Infiltration trenches/basins.
9. Permeable paving.
10. Green roofs.
11. Tree pits.

6.3.8.4 Detention Ponds

Stormwater ponds are an accepted method of improving stormwater quality and reducing peak downstream flow rates to replicate the pre-development hydrological regime.

Detention ponds can be of the 'dry' (detention) or 'wet' (retention) type and can be 'on -line' or 'off- line'. The type of pond required should be discussed with Council at an early stage.

Specific matters to be considered in pond design include:

1. Side slope stability.
2. Shallow ledges or batters for safety.
3. Ease of access and maintenance including mowing and silt clean out.
4. Shape and contour for amenity and habitat value.
5. Effectiveness of inlet and outlet structures.
6. Overflow design and scour protection.
7. Fish passage.
8. Pest control (for example mosquitoes and blue-green algae).
9. Species to be planted.
10. Potential effect on downstream aquatic ecology and habitat.
11. Maintenance requirements.
12. Lifetime costs do not exceed those of a fully piped network.

If Council is to be responsible for pond maintenance it shall be located on land owned by, or to be vested in, Council or protected by an appropriate easement.

6.3.8.5 Wetlands

Constructed wetlands can be designed to provide flood protection, flow attenuation, water quality improvement, recreational and landscape amenity, and provision for wildlife habitat.

Specific matters to be considered in wetland design include:

1. Catchment area greater than 1 ha.
2. Size calculated to achieve water quality volume.
3. Forebay to capture coarse sediments.
4. Depth not to exceed 1 m.
5. Sufficient hydraulic capacity for flood flows.
6. Sufficient detention time for sediment retention (Low velocity flows).
7. Species to be planted.
8. Machine access for heavy maintenance.
9. Lifetime costs do not exceed those of a fully piped network.

If Council is to be responsible for wetlands maintenance it shall be located on land owned by, or to be vested in, Council or protected by an appropriate easement.

Reference shall be made to Christchurch City Councils Waterways, Wetlands and Drainage Guide which sets out a philosophy that encourages people to work with natural features and processes in the landscape. Management of a waterway or wetland frequently includes its restoration and protection. Stormwater drainage is integrated with all other 'values' (ecology, landscape, recreation, heritage and culture) to form the foundation of a philosophy that is multi - disciplinary and sustainable.

One key item to highlight is the need for suitable consultation with local communities and mana whenua.

6.3.8.6 Vegetated Swales

Vegetated swales are stormwater channels that are often located alongside roads or in reserves. While their primary function is conveyance, filtration through the vegetation provides some water quality treatment.

Specific matters to be considered in swale design include:

1. Catchment area not greater than 4 ha.
2. Longitudinal slope 1% - 5%.
3. Slopes flatter than 1% may require subsoil drainage.
4. Slopes greater than 5% may require check dams to reduce effective gradient to less than 5%.
5. Clutha District Council: Capacity for a 1 in 10 yr (10% AEP) event.
6. Velocity not greater than 1.5 m/s in the design primary storm event unless erosion protection is provided.
7. Grass length 50 mm - 100 mm.
8. Species to be planted.
9. Lifetime costs do not exceed those of a fully piped network.

An option for swales with very flat longitudinal slopes and high water tables is a wetland swale. Typical details that may be used in swale design are shown in Figure 5, Figure 6 and Figure 7.

6.3.8.7 Rain Gardens

Rain gardens are engineered bioretention systems designed to use the natural ability of flora and soils to reduce stormwater volumes, peak flows, and contamination loads. Rain gardens also provide value through attractive design and planting.

Specific matters to be considered in rain garden design include:

1. System designed to manage a 1 in 10 yr (10% AEP) event without significant scour or erosion.
2. Overland flow paths to accommodate flows in excess of the design storm.
3. Entry and overflow positions to restrict short circuiting.
4. Geotextile on side walls.
5. An underdrain with a minimum of 50 mm gravel cover.
6. Pavement design in vicinity of device.
7. Soil composition.
8. A ponding area.
9. Species to be planted.
10. Access for maintenance.
11. Lifetime costs do not exceed those of a fully piped network.

6.3.8.8 Rainwater Tanks

Rainwater tanks can be designed to harvest water for non-potable uses such as fire water, toilet flushing and irrigation, or for potable water in rural areas where reticulated supply is not available. Rainwater tanks in urban areas can also significantly reduce the demand on the potable water supply from Council. Where required by Council, rainwater tanks can be configured to provide peak flow attenuation, to reduce stream channel erosion and the load on the stormwater system, with or without reuse.

Specific matters to be considered in rainwater tank design include:

1. Capacity: Typically 2,000 L - 5,000 L for domestic reuse and 6,000 L - 9,000 L for dual reuse and attenuation.
2. Primary screening to keep out leaves and other coarse debris.
3. First-flush diverters to collect first 0.4 mm from roads and other potentially contaminated areas for treatment.
4. Backflow prevention.
5. Overflow outlet.
6. Gravity or pumped.
7. Tight-fitting cover.
8. Cool location.
9. Aesthetics and convenience.
10. Lifetime costs do not exceed those of a fully piped network.

6.3.8.9 Soakage Devices

Soakage devices such as soak pits and soak holes, filter strips, infiltration trenches/basins, permeable paving, green roofs, and tree pits can also be considered for managing stormwater from roofs, parking areas, and roads.

Specific matters to be considered in soakage system design include:

1. Capacity adequate for a 1 in 10 yr (10% AEP) event.
2. Rate of soakage determined through a soakage test with an appropriate reduction (safety factor) (of at least 0.5) applied to accommodate loss of performance over time.
3. Capacity to accommodate the maximum potential impermeable area.
4. Overland flow paths to accommodate flows more than the design storm.
5. Confirmation that the soakage system will not have an adverse effect on surrounding land and properties from land stability, seepage, or overland flow issues.
6. Soakage system to be located above static groundwater level and away from other critical elements that may be susceptible to flooding.
7. Pre-treatment device to minimize pollution (interception of hydrocarbons) and silt ingress will be required.
8. Access for maintenance.
9. Interception of hydrocarbons

For guidance on disposal using soakage on individual lots refer to NZBC clause E1/VM1.

Council requires a geotechnical assessment to be carried out by a suitably qualified professional to determine the suitability of soil and groundwater characteristics for any proposed soakage system.

A discharge permit may be required from the Regional Council for discharge to soakage.

National and international references that may be able to be used in the design and maintenance of such systems are listed in Referenced Documents and Related Documents.

6.3.9 Natural and Constructed Waterways

Where waterways are to be incorporated in the stormwater system, they shall be located within a reserve of sufficient width to contain the full 1 in100yr return period (1% AEP) design storm flow with a minimum freeboard of 500 mm.

Grass berms in reserves shall have a side slope of 1 in 10 where possible. A maximum side slope of up

1 in 5 may be accepted in extraordinary situations and will require agreement by the Council. Vehicular access to berms shall be provided for maintenance purposes.

Reserves should be designed to accommodate off-road pedestrian and cycle access for recreational use. Planted riparian margins should be provided each side of the waterway (see Section 10.2.4).

Where flow rates are going to change because of the works all channel infrastructure shall be assessed for the need for additional protection against scour and erosion of the stream banks and stream bed.

All stormwater infrastructure, where they traverse any vacant or occupied public or private properties, shall allow access for all equipment required for construction and future maintenance. If the watercourse is to be in private property and be maintained by Council, it shall be protected by an easement.

6.3.10 Pipelines and Culverts

6.3.10.1 Location and Alignment of Public Mains

The preferred location of public mains shall be within the road reserve or within other public land. Where required easements shall be provided for stormwater pipelines located on private property.

A straight alignment between manholes (MHs) is required unless there are special circumstances. See Sections 7.3.7.6 and 7.3.7.7 for further guidance on curved alignments for pipelines.

6.3.10.2 Materials

Section 8.7 sets out acceptable system uses for various pipe materials. Stormwater pipe types as listed, or as amended may be used for stormwater infrastructure.

For materials for which there is no New Zealand or Australian Standard the specific approval of Council is required.

6.3.10.3 Minimum Pipe Sizes

Minimum pipe sizes for public mains and sump laterals unless otherwise specified shall be:

- Single sump outlets150 mm internal diameter
- Public mains 150 mm internal diameter where only taking house laterals

6.3.10.4 Minimum Cover

Minimum cover shall be determined by the property connections which require a minimum depth at the property boundary of at least 1 m where the section contours grade to the road. Where there are no property connections to govern the cover over d e pt h o f the main the minimum cover shall be 600 mm in private property and 900 mm in the road reserve.

6.3.10.5 Minimum Gradients and Flow Velocities

In flat areas gradients should be as steep as possible to control silt deposition. The minimum velocity

should be at least 0.9 m/s at a 1 in 10 yr (10% AEP) design flow. For velocities greater than 3.0 m/s see 6.3.6.3.

6.3.10.6 Culverts

In designing culverts the effects of inlet and outlet (tailwater) controls shall be considered.

Culverts under fills shall be of suitable capacity to cope with the 1 in 10 yr (10% AEP) design storm with no surcharge at the inlet, unless the fill is part of a stormwater detention device or has been designed to act in surcharge. All culverts shall be provided with adequate wingwalls, headwalls, aprons, scour protection, removable debris traps or pits to prevent scouring or blocking. Special consideration shall be given to the effects of surcharging or blocking of culverts under fill.

Fish passage through culverts shall always be maintained.

Refer to the Waka Kotahi (NZTA) Bridge manual for waterway design at bridges and culverts and Austroads guide to bridge Technology Part 8: Hydraulic design of Waterway Structures.

6.3.10.7 Inlets and Outlets

On site disposal of stormwater may be permitted where:

1. No piped system is immediately available or will not be available within 10 years of the subdivision application.
2. No piped system is available immediately adjacent or within a reasonable distance of the site.
3. A Site and Soil survey confirms that disposal on site is able to be achieved.

For clarification of what constitutes a “reasonable distance” refer to Section 9.8 of this Code of Practice.

Where a pipeline discharges into a natural or constructed waterway, or vice versa, consideration shall be given to energy dissipation or losses, erosion control, and land instability. This is often achieved by an appropriately designed headwall structure.

For outlets the design shall ensure non-scouring velocities at the point of discharge. Acceptable outlet velocities will depend on soil conditions but should not exceed 2 m/s without specific provision for energy dissipation and velocity reduction.

Where inlets or outlets are located on or near natural waterways their appearance in the riparian landscape and likely effect on in-stream values shall be considered. Methods could include cutting off the pipe end at an oblique angle to match soil slope, constructing a headwall from local materials such as rock or boulders, planting close to the structure, and locating outlets well back from the water's edge.

Inlets and outlets shall include protection to prevent people entering them, especially during flood events. The design and approval of any flood gates, grills, and other such infrastructure shall be at the discretion of Council. When a grill or flood gate is installed on the downstream end, an upstream grill must be installed.

Direct discharge to a waterway or the sea may require a discharge consent from the Regional Council unless authorized by a comprehensive consent held by Council or is a permitted activity in a Regional Plan.

6.3.10.8 Outfall Water Levels

Where a pipeline or waterway discharges into a much larger system the peak flows generally do not

coincide. Backwater profiles should produce satisfactory water levels when assessed as follows:

Method 1

1. Determine the time of concentration and set the design rainfall event for the smaller system.
2. Determine the peak flow in the smaller system for the design event.
3. Determine receiving waterway peak water level for the design rainfall event in (a).
4. Starting with the level from (c) determine the smaller system profile at a flow of 75% of the flow from (b).

Method 2

(d) Determine the receiving waterway mean annual flood water level.
(e) Starting with the level from (e) determine the smaller system water profile at the flow from (b).

Results:

Select the higher of the two profiles determined for design purposes.

Similarly, for tidal outfalls, peak flow may or may not coincide with extreme high tide levels. A full dynamic analysis and probability assessment may be required. Sea level rise shall be taken into account (see Section 6.3.6.2).

6.3.10.9 Subsoil Drains

Subsoil drains are installed to control groundwater levels. Perforated or slotted pipe used under all areas subject to vehicular traffic loads shall comply with Waka Kotahi (NZTA) specification F/2 and Waka Kotahi (NZTA) F/2 notes. Alternative subsoil drainage pipes may be used, including smooth bore perforated drains, where approved by Council. It is good practice to provide regular inspection points.

Bedding and backfill material around a subsoil drainpipe shall be more free-draining than the in situ soil. If filter fabrics are used their susceptibility to clogging thereby reducing the through flow, should be considered.

Groundwater control shall always be considered when an open drain is piped.

In the absence of any other more appropriate criterion the design flow for subsoil systems shall be based on a standard of 1 mm/hr which gives us a flow of 2.78 L/s/ha.

Refer to manufacturer's literature for information on pipe materials, filter fabrics, bedding, and filter design.

6.3.10.10 Bulkheads for Pipes on Steep Grades

Bulkheads, or anti-scour blocks, shall be detailed on the design drawings and shall be in accordance with drawing CM – 003 of NZS 4404. Spacing of bulkheads shall be:

6.3.10.11 Trenchless Technology

See Section 7.3.6.8 for guidance on use of Trenchless Technology.

Table 18: Spacing of Bulkheads for Pipes on Steep Grades

Grade (%)	Requirement	Spacing(s)
15 to 35	Concrete Bulkhead	S = 100/Grade (%)
> 35	Special Design	Refer to the Territorial Authority

6.3.11 Manholes

6.3.11.1 Standard Manholes

Access chambers or Manholes (MHs) shall be provided at all changes of direction, gradient and pipe size, at branching lines and terminations and at a distance apart not exceeding 120 m unless approved otherwise. They shall be easily accessible and located clear of any boundary. All public mains shall terminate with a MH or Cleaning eye (CE) or Maintenance Shafts at the upstream end.

See Section 7.3.8.2 for further guidance on the location of MHs.

On pipelines equal to or greater than 1 m diameter, the spacing of MHs may be extended with the approval of Council.

Standard Drawings D12 - D21 for manholes shall be adopted for stormwater systems.

Manholes should not incorporate step irons or ladders on safety grounds, they tempt those un -trained in confined spaces to enter such chambers.

6.3.11.2 Manhole Materials

MHs may be manufactured in concrete, or from suitable plastics materials, including glass reinforced plastic (GRP), polyethylene, PVC or polypropylene, or from concrete/plastic lined composites. Backfill instructions from the manufacturer shall be complied with.

Manhole materials selection shall be suitable for the level of aggressiveness of the surrounding groundwater.

6.3.11.3 Size of Manholes

The standard internal diameter of circular Manhole is 1050 mm and preferred nominal internal diameters are 1050 mm, 1200 mm, and 1500 mm. For shallow systems, DN 375/400 or 600 mm minimum diameter (Inspection chambers) may be permitted (see Section 6.3.11.4).

When considering the appropriate Manhole diameter, consideration shall be given by the designer to the base layout to ensure hydraulic efficiency and adequate working space in the chamber. Where the effective working space is reduced by internal drop pipes, a larger diameter may be required. Where there are several inlets, consultation with Council on the layout of the chamber is recommended.

The base layout of MH's shall comply with Standard Drawings D12 - D21.

6.3.11.4 Shallow Manholes (or Inspection Chambers)

For shallow systems (less than 1.2 m to invert) a DN 375/400 or 600 mm minimum diameter Manhole may be permitted subject to approval by Council. Such small diameter MHs shall be classified as maintenance shafts (MSs) for the purposes of the spacing covered under this Standard. See Standard Drawing D22.

6.3.11.5 Manhole Connections

Open cascade is permitted into MHs over 2.0 m in depth and for pipes up to and including 300 mm diameter provided a portion of benching is clear of any cascade. Other situations may be considered and require Council approval.

The bases of all MHs shall be benched and haunched to a smooth finish to accommodate the inlet and outlet pipe.

New inlet pipes shall be cut back to the inside face of the MH and provided with a smooth finish. All chambers are to be made watertight with epoxy around all openings.

Minor pipelines connecting to a MH at or below design water level in the MH shall do so at an angle of not greater than 90o to the main pipeline direction of inflow. Soffit matching is preferable.

Minor pipelines connecting at above design water level may do so at any angle.

6.3.11.6 Flotation

In areas where liquefaction during an earthquake is likely or the water table is at a level that may adversely impact the infrastructure all Maintenance Structures shall be designed in accordance with Underground Utilities – Seismic Assessment and Design Guidelines and associated Technical Note 15 – Manhole Flotation (or subsequent amendment).

6.3.12 Connection to the Public System

Where the connection of individual lots and developments are to the public system they shall meet the following requirements:

1. Connection shall be by gravity flow via laterals to public mains or waterways, or to a swale, or rainwater tanks. Where there is no other option connection can be made to a roadside kerb subject to approval of Council.
2. All new urban lots shall be provided with individual service laterals, unless on-site disposal is approved by Council.
3. Each connection shall be capable of serving the whole of the lot. Where, for physical reasons, this is not practicable, a partial service to the building area only may be acceptable (subject to approval of Council).
4. The minimum internal diameter of connections shall be:
    a. 100 mm for residential lots
    b. 150 mm for commercial and industrial lots and connections serving two dwellings or residential lots
    c. The size of connections serving three or more dwellings or residential lots shall be based on calculations as per the design standards (unless otherwise approved by Council).
5. The connection shall be of a type capable of taking the spigot end of an approved pipe.
6. Where the stormwater pipeline is outside the lot to be served, a lateral pipeline shall be extended to the boundary of the lot and be marked by a 50 mm x 50 mm timber stake extending to 600 mm above ground level and painted blue.
7. Connection to stormwater systems such as vegetated swales, soak pits, or soakage basins is acceptable provided the system is approved by Council.
8. All connections to pipelines or MHs shall be sealed by removable caps until such time as they are required.
9. Connections shall be indicated accurately on as-built plans in accordance with the requirements set out in Section 3.
10. The minimum depth of the connection at the property boundary shall be 1 m unless otherwise approved by Council.

6.3.13 Connection of Lateral Pipelines to Public Mains

All connections to 150 mm diameter mains shall be via 45º “Y” junctions or London junctions. Mains greater than 150 mm diameter including 225 mm diameter shall be made using 45º “Y” junctions or saddles. For mains greater than 225 mm diameter, square (90º) saddles may be used. Cutting saddles into pipes shall be carried out via core drilling.

Saddles shall be specifically manufactured for the pipe they are being attached to, and appropriate allowances made for the pipe wall thickness. The saddle shall use epoxy, electro fusion, stainless steel bolts or straps to secure the saddle in place. Concrete encasement of the saddle to the exterior of the main pipe is required. Connection material shall protrude through to the inside of the main and shall be trimmed flush with the inside wall of the main.

A hole may be made in a 900 mm diameter and larger main to effect a connection. The connection shall be properly dressed and patch repaired (epoxy) from inside the main to ensure that no protrusions exist.

When the lateral being connected is larger than 300 mm in diameter it shall be connected to a Manhole.

6.4 Approval of Proposed Infrastructure

The approval process for land development and subdivision design and construction and documents and supporting information on stormwater drainage infrastructure to be provided at each stage of the process shall be in accordance with the requirements of this Code of Practice (primarily specified in Section 3).

6.4.1 Information to be Provided

1. A plan showing the proposed location of existing and proposed stormwater infrastructure.
2. Detailed long sections showing the levels and grades of proposed pipelines in terms of datum.
3. Long sections shall include full details of pipe and manhole materials and sizes.
4. Details and calculations prepared which demonstrate that agreed levels of service will be maintained.
5. Details and calculations prepared which clearly indicate any impact on adjacent area or catchment that the proposed infrastructure may have.
6. Appropriate operating manuals, pump information, and instructions for pump stations and pressure systems if proposed.]

6.5 Construction

6.5.1 Pipeline Construction

The construction of pipelines shall be carried out in accordance with the design and requirements of AS/NZS 2032 (PVC), AS/NZS 2033 (PE), AS/NZS 2566 Parts 1 and 2 (all buried flexible pipelines), or AS/NZS 3725 (concrete pipes).

6.5.2 Trenching

Guidance is provided in Standard Drawings D23-D24A.

Where a pipeline is to be constructed through areas with unsuitable foundations such material shall be removed and replaced with other approved material or alternatively, other methods of construction shall be carried out to the approval of Council to provide an adequate foundation, and side support, for the pipeline.

6.5.3 Reinstatement

Areas where construction has taken place shall be reinstated to the condition required by Council and shall be no less than the original condition pre-works.

6.5.4 Inspection and Acceptance

Pipe systems shall be inspected using closed circuit television (CCTV) prior to acceptance by Council.

CCTV inspections and deliverables shall be in accordance with New Zealand gravity pipe inspection manual (or its successor) and the requirements of Council.

Council may, at its discretion, also require an air or water test to be carried out. Such testing shall be carried out as specified in Section 2 of this Code of Practice and shall arrange with Council for the use of a hydrant for water supply for the test.

6.6 Acceptable Pipe and Fitting Materials

Table 6.5 gives information on acceptable pipe and fitting materials. The information is sourced with permission from the Water Services Association of Australia. Refer also to WSA 02 (Sewerage Code of Australia) and WSA 03 (Water Supply Code of Australia) for further information.

Table 19: Acceptable Pipe Materials and Standards

Pipe Material	Applicable Standard	Stormwater (Gravity)	Wastewater (Pressure Sewer/ Rising Main)	Wastewater (Gravity)	Water Supply (Pressure)	Notes
PVC-U	AS/NZS 1260 (Class SN 4, 8 or 16 as required by the Territorial Council)	✓	×	✓	×	• Gravity applications only. • Well established methods of repair. • Suitable for aggressive groundwater, anaerobic conditions and tidal zones. Can be used for trenchless installation with suitable end load resistant joints.
PVC-O	AS/NZS 4441 (Series 1or Series 2 as required by Council)	×	✓	×	✓	• Improved fracture toughness compared with PVC- U. • Improved fatigue resistance compared with PVC-U and PVC-M. **Note:** Use only DI fittings in pumped mains to achieve full fatigue resistance. Has increased hydraulic capacity compared with PVC-U and PVC-M. Suitable for aggressive groundwater, anaerobic conditions, and tidal zones. Specific design for dynamic stresses (fatigue) required for pressure sewer applications.
PVC-U	AS/NZS 1477 (pressure) (Series 1 or Series 2 as required by Council)	×	✓	×	✓	• Well established methods of repair. • Alternative installation techniques possible, for example slip lining. • Suitable for aggressive groundwater, anaerobic conditions, and tidal zones. Can be used for trenchless installation with suitable end load resistant joints. • Specific design for dynamic stresses (fatigue) required for pressure sewer applications.

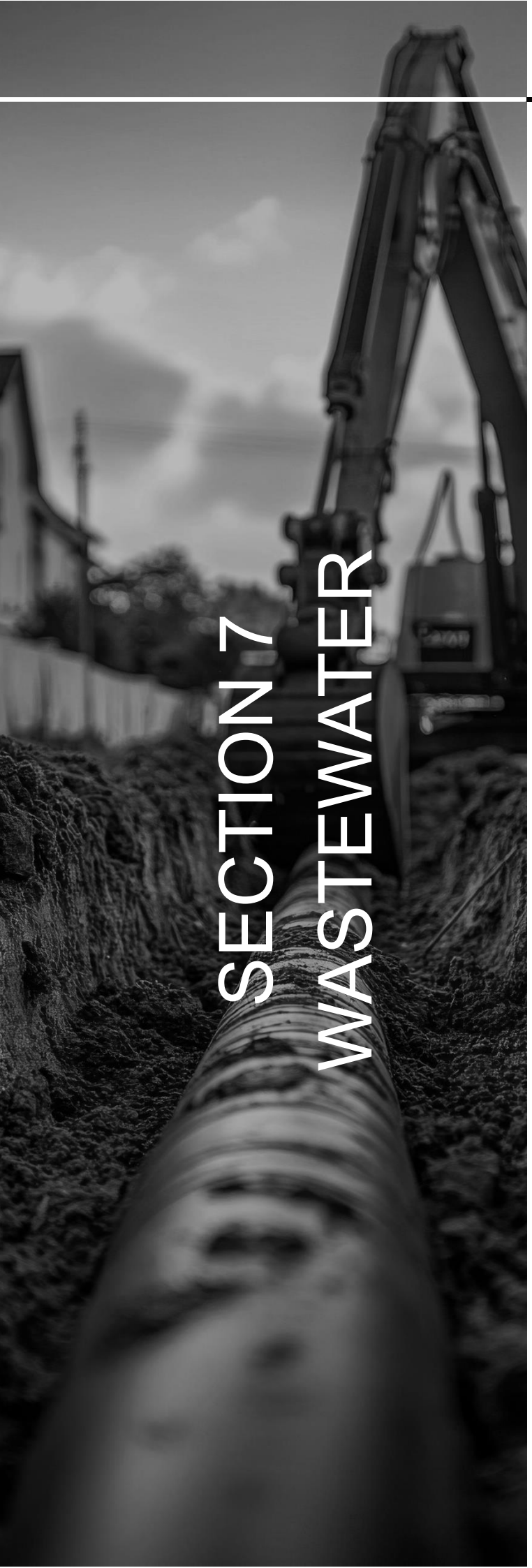
Pipe Material	Applicable Standard	Stormwater (Gravity)	Wastewater (Pressure Sewer/ Rising Main)	Wastewater (Gravity)	Water Supply (Pressure)	Notes
PVC-M	AS/NZS 4765 (Series 1 or Series 2 as required by Council)	×	✓	×	✓	• Improved fracture toughness compared with PVC- U. • Has increased hydraulic capacity compared with PVC-U. Inferior fatigue resistance compared with PVC-U and PVC-O. • Suitable for aggressive groundwater, anaerobic conditions and tidal zones. • Specific design for dynamic stresses (fatigue) required for pressure sewer applications.
PE (PE 80B or PE 100 as required by Council)	AS/NZS 4130	×	✓	×	✓	• Generally for pressure applications. • Can be easily curved to eliminate the need for bends. • Alternative installation techniques possible, for example pipe cracking, direction drilling, and slip lining. • Can be welded to form an end load resistant system. • Compression couplings and end load resistant f it t in g s are available in smaller diameters. • Pipe longitudinal flexibility accommodates large differential ground settlement. Fusion jointing requires skilled installers and special equipment. • Retrospective installation of fittings/repair complicated. • Specific design for dynamic stresses (fatigue) required for pressure sewer applications. • ≤ DN 125 available in long coiled lengths for fewer joints. • Suitable for aggressive groundwater, anaerobic conditions or tidal zones. • Suitable for ground with high subsidence potential, for example fill or mining areas.
PE (Stiffness Class SN 4, 8, 10 or 16 as required by Council)	AS/NZS 5065	✓	×	✓	×	• Only for gravity applications. Can be easily curved. • Alternative installation techniques possible, for example pipe cracking and slip lining. • Can be welded to form an end load resistant system. • Fusion jointing requires skilled installers and special equipment. Retrospective installation of fittings/repair complicated. • Smaller diameters available in long coiled lengths for fewer

Pipe Material	Applicable Standard	Stormwater (Gravity)	Wastewater (Pressure Sewer/ Rising Main)	Wastewater (Gravity)	Water Supply (Pressure)	Notes
						joints. • Suitable for aggressive groundwater, anaerobic conditions, or tidal zones.
GRP	AS 3571.1	✓	✓	✓	×	• Alternative installation techniques possible, for example slip lining. UV resistant (special product). • Custom made fittings can be manufactured. • Sitable for use without additional corrosion protection in areas where stray electrical currents occur. • Low impact resistance and ease of damage to thermosetting resin, makes GRP susceptible to damage during transportation, and installation, in above ground installations, from vandalism, or when damaged as a consequence of nearby excavation. • Suitable for aggressive groundwater, anaerobic conditions or tidal zones.
GRP	AS 3571.2	×	×	×	✓	• Alternative installation techniques possible, for example slip lining. UV resistant (special product). • Custom made fittings can be manufactured. • Suitable for use without additional corrosion protection in areas where stray electrical currents occur. • Low impact resistance and ease of damage to thermosetting resin, makes GRP susceptible to damage during transportation, and installation, in above ground installations, from vandalism, or when damaged as a consequence of nearby excavation. • Suitable for aggressive groundwater, anaerobic conditions, or tidal zones.

Pipe Material	Applicable Standard	Stormwater (Gravity)	Wastewater (Pressure Sewer/ Rising Main)	Wastewater (Gravity)	Water Supply (Pressure)	Notes
VC	BS EN 295	✓	×	✓	×	• Gravity applications only. • Has benefits for particularly aggressive industrial wastes. • Not recommended for active seismic (earthquake) zones, or unstable ground.
RRRC/RCRRJ (Rubber ring jointed reinforced cocrete)	AS/NZS 4058	✓	×	✓	×	• Requires protection from hydrogen sulphide attack in sewer applications, by plastic lining or selection of appropriate cement additives.
CLS (SCL) (Concrete lined welded steel)	NZS 4442 AS 1579	×	✓	×	✓	• Cement mortar lined, PE coating below ground or heavy duty coating above ground High mechanical strength and toughness. • Available in long lengths. • RRJ and welded joints available. • Custom made, specially configured steel fittings can be made to order. • Can be welded to form a system that will resist end load and joint permeation. UV resistant/vandal proof/impact resistant (where PE coated). • Cathodic protection (CP) can be applied to electrically continuous pipelines to provide enhanced corrosion protection. PE lined and coated - RRJ • As above for CLS (SCL). • Suitable for conveying soft water. Corrosion resistant under all conditions. General notes • Standard Portland cement mortar not resistant to H^2S attack, at any high points or discharge points in the main. High alumina cement has improved resistance. • Welded joints require skilled installers and special equipment. Welded joints require reinstatement of protection systems on site.

Pipe Material	Applicable Standard	Stormwater (Gravity)	Wastewater (Pressure Sewer/ Rising Main)	Wastewater (Gravity)	Water Supply (Pressure)	Notes
						• Special design required for welded installations parallel, and adjacent to high voltage (> 66 kV) transmission lines. • Cathodic protection requires regular monitoring and maintenance. • Seal coating may be required over cement mortar linings, when conveying soft water, or in low flow extremities of reticulation mains, to prevent potentially high PH. • Suitable for high load applications such as railway crossings and major roads. Large diameters are available. • Suitable for aerial or suspended pipeline applications.
DI (Ductile Iron Pipe)	AS/NZS 2280 AS 3681	×	✓	×	✓	• Fatigue analysis not normally required (pressure sewer applications). High mechanical strength and toughness. • Ease of jointing. UV resistant/vandal proof/impact resistant. Well established methods of repair. • Suitable for high pressure and above ground pipelines. Restrained joint systems available. • Sufficient ring stiffness to not rely on side support, for structural adequacy for the usual water supply installation depths. • Elevated PH may occur when conveying soft water, or in low flow extremities of reticulation mains. • PE sleeving is required, and must be carefully applied and repaired when damaged. • Standard Portland cement mortar not resistant to H2S attack, at any high points or discharge points in the main. (Wastewater applications. High alumina cement has improved resistance.) • Not suitable for aggressive groundwater, anaerobic conditions, or tidal zones.

Pipe Material	Applicable Standard	Stormwater (Gravity)	Wastewater (Pressure Sewer/ Rising Main)	Wastewater (Gravity)	Water Supply (Pressure)	Notes
ABS	AS/NZS 3518 AS/NZS 3690 AS/NZS 3879	×	✓	×	✓	• Specific design for dynamic stresses (fatigue required for pressure sewer applications).



SECTION 7
WASTEWATER

Section 7 Table of Contents

7.1 Scope

This section sets out requirements for the design and construction of wastewater systems for land development and subdivision. Section 7 primarily addresses reticulated systems, but reference is also made to on-site wastewater systems where applicable.

If the scope of the development is sufficiently large to include its own pumping station, then reference should be made to the Water Services Association WSA 04-2005, Sewage Pumping Station Code of Australia – 2005.

7.2 General

7.2.1 Objectives

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

In principle the wastewater system shall provide:

1. A single gravity connection for each property or where gravity is not feasible then a pumped connection from a service box.
2. A level of service to Council's customers in accordance with the authority's policies.
3. Minimal adverse environmental and community impact.
4. Compliance with environmental requirements.
5. Compliance with statutory occupational, health and safety (OSH) requirements.
6. Adequate hydraulic capacity to service the full catchment.
7. Long service life with minimal maintenance and least life-cycle cost.
8. Zero level of pipeline infiltration on commissioning of pipes.
9. Low level of pipeline infiltration/exfiltration over the life of the system.
10. Resistance to entry of tree roots.
11. Resistance to internal and external corrosion and chemical degradation.
12. Structural strength to resist applied loads.
13. 'Whole of life' costs that are acceptable to Council.

7.2.2 Reference Documents and Relevant Guidelines

Wastewater designs shall incorporate all the special requirements of Council and shall be in accordance with the most appropriate Standards, codes, and guidelines including those set out in Referenced Documents. Related Documents lists additional material that may be useful.

7.3 Design

7.3.1 Design Life

All wastewater systems shall be designed and constructed for an asset life of at least 100 years. Some components such as pumps, valves, and control equipment may require earlier renovation or replacement. Refer to WSA 02-2002 for the classification of life expectancy for various components in conventional gravity systems.

7.3.2 Structure Plan

Council may provide a structure plan setting out certain information to be used in design, such as flows, sizing, upstream controls, recommended pipe layout and requirements of Council. Where a structure plan is not provided, the designer shall determine this information by investigation using this Code of Practice and engineering principles.

7.3.3 Future Development

Where further subdivision, upstream of the one under consideration, is provided for in the district or regional plan, Council may require wastewater infrastructure to be constructed to the upper limits of the subdivision to provide for the needs of this development.

Additionally, Council may require additional capacity to be provided in the wastewater system to cater for existing or future development upstream. Peak flows (PF) and self-cleansing velocities should be taken into account when designing for additional latent capacity.

All infrastructure proposed to service future development will require the approval of Council.

7.3.4 System Design

7.3.4.1 Catchment Design

Pipes within any project area shall be designed to be consistent with the optimum design for the entire catchment area and any future extension of the system shall be accommodated. This may affect the pipe location, diameter, depth, and maintenance structure location and layout. Designers shall adopt best practice to ensure a system with lowest life-cycle cost.

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

A gravity system is required and pressurised systems are considered where gravity is not possible.

7.3.4.2 Gravity vs Pumped Systems

In all instances gravity systems are to be the first choice of system. A Pumped system will only be considered as a last resort or where gravity is not possible.

7.3.4.3 Extent of Infrastructure

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

7.3.4.4 Topographical Considerations

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

7.3.4.5 Geotechnical Investigations

The designer shall take into account any geotechnical requirements determined under Section 4 of this Code of Practice.

7.3.4.6 Contaminated Sites

Contaminated sites should be avoided. Where a contaminated site has been confirmed, written approval to proceed shall be obtained from CDC.

7.3.5 Design Criteria

7.3.5.1 Design Flow

The design flow comprises domestic wastewater, industrial wastewater, infiltration, and direct ingress of stormwater.

The design flow shall be calculated based on 0.7 litre/second/hectare (l/s/ha).] Alternatively, the following design parameters can also be used if approval is granted by Council. Justification for the variables proposed must be provided as part of the approval submissions:

1. Residential flows
    a. Average dry weather flow of 180 to 250 litres per day per person;
    b. Dry weather diurnal peaking factor (PF) of 2.5;
    c. Dilution/infiltration PF of 2 for wet weather;
    d. Number of people per dwelling 2.5 to 3.5.

C7.3.5.1

For small contributing catchments, PF's can be significantly but due to the requirement for a minimum pipe size of DN 150, such flows will not govern the design.

2. Commercial and Industrial flows
3. Where flows from a particular industry or commercial development are known they should be used as the basis of design. Where there is no specific flow information available and Council has no design guide, Table 7-1 is recommended as a design basis. These flows include both sanitary wastewater and trade wastes and include peaking factors.

Table 20: Commercial and Industrial Flows

Industry Type (Water Useage)	Design flow (litre/second/hectare)
Light	0.4
Medium	0.7
Heavy	1.3

Any commercial property that discharges anything other than sanitary waste shall require a trade waste agreement before connecting to the network.

Note – Commercial and industry type definition

Light
A light water usage industry is a relatively dry and clean trade where industrial practices do not include process water usage. Showers provided for personnel's ad-hoc use would still fall into the 'light water usage' category.

Medium
A medium water usage industry in a dirty trade where good industrial practice requires regular water usage and showers are in daily use because of commercial activities that require staff to have washing facilities, but there is no process water usage

Heavy
A heavy water usage industry in a trade that uses water as a part of commercial activities in moderate quantities, but is not a Wet Industry, as defined below. Wherever possible, the design wastewater flow for a heavy water usage industry should be checked against known water consumption and peak discharge rates. The Design Engineer shall submit evidence of these checks as a part of the application.

7.3.5.2 Hydraulic Design of Gravity Pipelines

The hydraulic design of gravity wastewater pipes should be based on either the Colebrook -White formula or the Manning formula. The coefficients to be applied to the various materials are shown in Table 7-2. Gravity pipes should be designed to be between 25% and 75% full for the peak flow.

Table 21: Guide to Roughness Co-efficient for Gravity Pipeline

Material	Colebrook – White Co-efficient k (mm)	Manning Roughness Co- efficient (n)
All pipe material and lining types for gravity systems and low pressure collection systems (PWC), flowing full.	1.5	0.013
All pipe material and lining types for pressure rising mains, flowing full.	0.6	0.011

NOTE:

- These values take into account possible effects of rubber ring joints, slime and debris
- The n and k values apply for pipes up to and including DN 300
- For further guidance refer to WSA 02:1999 Table 2.4 Metrication: Hydraulic data and formulae (Lamont) or the Handbook of PVC Pipe (Uni-Bell)

7.3.5.3 Minimum Pipe Size

Irrespective of other requirements, the minimum sizes of property connection and reticulation pipes shall be not less than those shown in Table 22.

For infill situations, particularly where upgrading an existing DN 100 connections in sound condition and at reasonable grades would be impractical, it is common practice for up to six dwelling units to use the existing connection. However, such connections would not normally be taken over as public pipes by Council. A maintenance shaft will be required at the street boundary when the pipeline enters the public road.

Table 22: Minimum Pipe Sizes for Wastewater Reticulation and Property Connections

Pipe	Minimum Size DN (mm)
Connection servicing 1 Dwelling Unit	100
Connection servicing more than 1 Dwelling Unit	100
Connection servicing Commercial and Industrial Lots	150
Reticulation servicing Residential Lots	150

Note:

In practical terms, in a catchment not exceeding 250 dwelling units, and where no pumping station is involved, DN 150 pipes laid within the limits of Table 7.4 and Table 7.5 will be adequate without specific hydraulic design.

7.3.5.4 Limitation on Pipe Size Reduction

In no circumstances shall the pipe size be reduced on any downstream section.

7.3.5.5 Minimum Grades for Self-Cleaning

Self-cleaning of grit and debris shall be achieved by providing grades that allow a minimum design velocity of 0.6m/s at peak dry weather flow.

Table 23: Minimum Grades for Wastewater Mains

Pipe Size DN	Absolute Minimum Grade (%)
150	0.55
200	0.33
300	0.25

Table 24: Minimum Grades for Property Connections and Permanent Ends

Situation	Minimum Grade (%)
DN 100 property connections	1.65
DN 150 property connections	1.20
Permanent upstream ends of DN 150, 200 and 300 pipes in residential areas with population ≤ 20 people	1.00

7.3.5.6 Maximum Velocity

The preferred maximum velocity for peak wet weather flow is 3.0 m/s. Where a steep grade that will cause a velocity

7.3.5.7 Gravity Wastewater Applications

See Appendix B for appropriate gravity pipe standards for wastewater. The pipe shall be designed to:

1. Have adequate capacity and grade.
2. Have adequate grade and hence velocity for self-cleaning.
3. Be deep enough to provide gravity service to all lots.
4. Comply with minimum depth requirements to ensure mechanical protection and safety from excavation.
5. Avoid all underground services, while maintaining all the necessary clearances.
6. Allow for various drops and losses through MHs

7.3.5.8 Pressure and Vacuum Wastewater Applications

The introduction of pressure or vacuum systems into a network requires approval from Council. See also Section 7.3.12. Design of pressure and vacuum wastewater applications shall consider the following:

1. Selection of pipe material and PN class shall take account of design for dynamic operation stresses (fatigue), and water temperature. Refer to Plastics Industry Pipe Association of Australia Ltd (PIPA) guidelines for PVC and PE pipes (http://www.pipa.com.au), or WSA-07.
2. Sump and pump design.
3. Maintenance requirements.
4. Access for servicing and maintenance
5. Refer CDC Pressure Sewer Requirements 2024 (ID:904902).

7.3.6 Structural Design

7.3.6.1 General

The structural design of piped systems shall be in accordance with AS/NZS 2566.1, or AS/NZS 3725, including the structural design commentary AS/NZS 2566.1 Supplement 1. Details of the final design requirements shall be shown on the drawings..

7.3.6.2 Seismic Design

All pipes and structures shall be designed with adequate flexibility and special provisions to minimise risk of damage during earthquake. Historical experience in New Zealand earthquake events suggests that suitable pipe options, in seismically active areas, may include rubber ring joint PVC or PE pipes. Rocker pipes with two flexible joints shall be provided at all junctions between pipes and manholes and other rigid structures.

7.3.6.3 Structural Consideration

Pipelines shall be designed to withstand all the forces and load combinations to which they may be exposed including internal forces, external forces, temperature effects, settlement, and combined stresses.

7.3.6.4 Internal Forces

Pipelines shall be designed for the range of expected pressures, including transient conditions (surge and fatigue) and maximum static head conditions. For rising mains, surge analysis should be undertaken to assess transient conditions resulting from different pump stop and valve closure scenarios to assess the amplitude and frequency of positive and negative pressures. Rising mains should be designed to accommodate the transient pressure envelope.

7.3.6.5 External Forces

The external forces to be taken into account shall include:

1. Trench fill loadings (vertical and horizontal forces due to earth loadings).
2. Surcharge.
3. Groundwater.
4. Dead weight of the pipe and the contained water.
5. Other forces arising during installation.
6. Traffic loads.

7. Temperature (expansion/contraction).

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

7.3.6.6 Geotechnical Investigations

The designer should take into account any geotechnical requirements determined under Section 4 of this Code of Practice. Where required, standard special foundation conditions shall be referenced on the drawings.

7.3.6.7 Pipe Selection for Special Conditions

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

1. Structural adequacy for the ground conditions and water temperature.
2. Water quality considering the lining material.
3. Compatibility with aggressive or contaminated ground.
4. Suitability for the geotechnical conditions.
5. Compliance with Council's requirements.

7.3.6.8 Trenchless Technology

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

1. Environmentally sensitive areas.
2. Built-up or congested areas to minimise disruption and reinstatement.
3. Railway and major road crossings.
4. Significant vegetation.
5. Vehicle crossings.

Wastewater pipes used for trenchless installation shall have suitable mechanically restrained joints, specifically design for trenchless application, which may include integral restraint, seal systems or heat fusion welded joints.

Trenchless installation methods may include for new Pipes:

1. Horizontal directional drilling (HDD) (PVC with restraint joint/fusion welded PE).
2. Uncased auger boring/pilot bore micro-tunnelling/guided boring (PVC with restraint joint/fusion welded PE).
3. Pipe jacking (GRP/vitrified clay (VC)/ reinforced concrete). For pipe rehabilitation/renovation:
4. Slip lining/grouting (PVC with restraint joint/fusion welded PE).
5. Close fit slip lining (PVC with restraint joint/fusion welded PE).
6. Static pipe bursting (PVC with restraint joint/fusion welded PE).
7. Reaming/pipe bursting/inline removal (PVC with restraint joint/fusion welded PE).
8. Soil displacement/impact mole (fusion welded PE).
9. Cured in place pipe (thermoset resin with fabric tube).

Any trenchless technology and installation methodology shall be chosen to be compatible with achieving the required gravity pipe gradient - refer to manufacturers and installer's recommendations.

The following details including location of access pits and exit points shall be submitted to Council for approval:

1. Clearances from services and obstructions.
2. The depth at which the pipeline is to be laid to ensure minimum cover is maintained.
3. The pipe support and ground compaction.
4. How pipes will be protected from damage during construction.
5. Any assessed risk to abutting surface and underground structures.

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

7.3.7 System Layout

7.3.7.1 Pipe Location

The preferred layout/location of pipes within roads, public reserves and private property may vary and shall be to the requirements of Standard Diagram R2.

Pipes should be positioned as follows with (1) being the most favourable:

1. Within the street/road reserve according to the locally applicable utilities allocation code. In the absence of a code, a location clear of carriageways is preferred.
2. Within public land with the permission of the controlling authority.
3. Within reserves
4. Within reserves but outside of the 1 in 100 year flood overland flow paths. This includes manholes;
5. Within private property parallel to front, rear, or side boundaries.
6. At a lower level than the water supply;
7. Not within the root zones of trees

Locating wastewater infrastructure in a site of cultural significance or significant natural areas is to be avoided.

7.3.7.2 Materials

Section 6.6 sets out various acceptable pipe and fittings materials for wastewater system uses.

7.3.7.3 Pipes in Reserves and Public Open Space

Pipes in reserves and public open space shall be located in accordance with Council's requirements. Consideration for access to maintain, away from trees and other potential intrusions, and outside any areas defined for stormwater storage/flows should be made.

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

7.3.7.4 Pipes in Private Property

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

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

Where pipes are designed to traverse properties containing existing structures such as retaining walls, buildings, and swimming pools, the current and future stability of the structure shall be considered. Pipes adjacent to existing buildings and structures shall be located clear of the 'zone of influence' of the foundations. In addition a minimum clearance of 5.0m is required from any structure.

If this is not possible, protection of the pipe and associated structures shall be specified for evaluation and approval by Council.

Where pipes to be vested to Council are designed to traverse private properties, they should be protected by legal easements when required by Council.

Refer to Clutha District Councils Water Services Bylaw 2019 with regard to asset ownership at point of discharge and connection.

7.3.7.5 Minimum Cover

Minimum cover shall be determined by the property connections which require a minimum depth at the property boundary of at least 1 m. Where there are no property connections to govern the cover over the main the minimum cover shall be 600 mm in private property and 900 mm in the road reserve.

7.3.7.6 Horizontal Curves

Horizontal curves shall only be used where authorised by Council.

The term 'curved pipes' is used to describe either cold bending of flexible pipe during installation or small deflections at joints for rubber ring jointed flexible and rigid pipes. The radius of curvature and pipe deflection shall meet manufacturer's specifications. Curved alignments are used in curved

streets to conform with other services and to negotiate obstructions, particularly in easements.

The use of curves in locations other than curved street alignments shall be justified by significant saving s in life-cycle cost. The straight line pipe is usually preferred as it is easier and cheaper to set out, construct, locate, and maintain in the future.

7.3.7.7 Vertical Curves

Vertical curves may be specified where circumstances provide a significant saving or where maintenance structures would be unsuitable or inconvenient. The curvature limitations for vertical curves are the same as those for horizontal curves in 7.3.7.6.

7.3.7.8 Underground Services

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

7.3.7.9 Clearance from Underground Services

Where a pipe is designed to be located in a road which contains other services, the clearance between the pipe and the other services shall comply with SNZ HB 2002, unless Council has its own specific requirements.

For normal trenching and trenchless technology installation, clearance from other service utility assets shall not be less than the minimum vertical and horizontal clearances shown in Table 7-6. Written agreement on reduced clearances and clearances for shared trenching shall be obtained from Council and the relevant service owner.

Table 25: Clearances between Wastewater Mains and Laterals and other Underground Services

Existing Utility Service	Minimum Horizontal Clearance for new pipe size ≤ DN 300	Minimum Vertical Clearance (mm)
Gas Mains	300(2)	150
Telecommunication Conduits and Cables	300(2)	150
Electricity Conduits and Cables	500	225
Drains	300(2)	150
Water Mains	1,000(3)/600	500

Note:

1. Vertical clearances apply when wastewater pipes and other underground services cross one another, except in the case of water mains when a vertical separation shall always be maintained, even when the wastewater pipe and water main are parallel. The wastewater pipe should always be located below the water main to minimise the possibility of backflow contamination in the event of a main break.
2. Clearances can be further reduced to 150 mm for distances up to 2 m when passing installations such as poles, pits, and small structures, providing the structure is not destabilised in the process.
3. When the wastewater pipe is at the minimum vertical clearance below the water main (500 mm) maintain a minimum horizontal clearance of 1000 mm. This minimum horizontal clearance can be progressively reduced to 600 mm as the vertical clearance increases to 750 mm.
4. Where unable to be achieved, approval from Council must be obtained for alternative designs.

7.3.7.10 Clearance from Structure

Pipes adjacent to existing buildings and structures shall be located clear of the 'zone of influence' of the building foundations. If this is not possible, a specific design shall be undertaken to cover the following:

1. Protection of the pipeline.
2. Long term maintenance access for the pipeline.
3. Protection of the existing structure or building.

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

7.3.7.11 Bulkheads for Pipes on Steep Gradients

For bulkheads, or anti-scour blocks, see 6.3.10.10 and NZS 4404:2010 drawing CM – 003.

7.3.8 Maintenance Structures

7.3.8.1 General

This describes the requirements for structures which permit access to the wastewater system for maintenance.

Maintenance structures include:

1. Manholes (MH's).
2. Maintenance shafts (MS's).
3. Cleaning eyes (CE's)

7.3.8.2 Location of Maintenance Structures

The selection of a suitable location for maintenance structures may influence the pipe alignment. Generally, a minimum clearance of 1.0 m should be provided around maintenance structures clear of the opening to facilitate maintenance and rescue. Council may determine other specific requirements subject to the individual site characteristics.

The design shall include maintenance structures at the following locations:

1. Intersection of pipes except for junctions between mains and property connections.
2. Changes of pipe size.
3. Changes of pipe direction, except where horizontal curves are used.
4. Changes of pipe grade, except where vertical curves are used.
5. Combined changes of pipe direction and grade, except where compound curves are used.
6. Changes of pipe invert level.
7. Changes of pipe material, except for repair/maintenance locations.
8. Permanent or temporary ends of a pipe.
9. Discharge of a pressure main into a gravity pipe.

Table 26: Acceptable Manhole, Maintenance Shaft and Terminal Maintenance Shaft

Application	Acceptable Options (1)		
	Manhole	Maintenance Shaft	Terminal Maintenance Shaft (Cleaning Eye)
Intersection of Pipes (2)	Yes	No	No
Change of Pipe grade at same level	Yes	Yes, for DN 150 pipe only and using vertical bend	No
Change of grade at different level	Yes, Manhole with internal/external drops	No	No
Change in pipe size	Yes, Manhole is the only option	No	No
Change in horizontal direction	Yes, withing permissible deflection at the Manhole	Yes, Maintenance Shaft prefabricated units or	No

		Maintenance Shaft used with horizontal bends of maximum 33^0 deflection	
Change of pipe material	Yes	No	No
Permanent end of a pipe	Yes	No	Yes
Pressure main discharge point	Yes, Manhole is the only only option and shall include a vent	No	No

Note:

1. Where person entry is required down to the level of the pipe, a Manhole is the only options
2. This table refers to reticulation mains. DN 100 connections can be made to any maintenance structure or, using proprietary junction at any point along the main.
3. Clutha District Council may permit the use of a London Junction or Rodding Eye at the end of the pipe, it is recommended that cleaning eyes are used though.

7.3.8.3 Maintenance Structure Spacing

For reticulation pipes, the maximum distance between any two consecutive maintenance structures shall be 120 m.

Where a combination of Manholes and Maintenance Shafts is used along the same pipe, the maximum spacing between any two consecutive Manholes shall not exceed 400 m irrespective of how many Maintenance Shafts are used between the two Manholes (see Figure 11).

7.3.8.4 Manholes

7.3.8.4.1 Manhole Materials

Manholes may be manufactured in concrete, or from suitable plastics materials, including GRP, polyethylene, PVC or polypropylene, or from concrete/plastic lined composites.

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

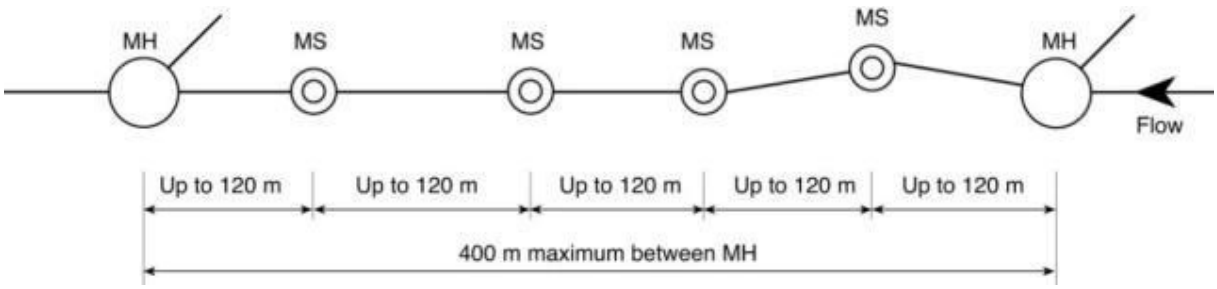
There is to be no rendering/plastering to be done on the inside of manholes. Acceptable alternatives include concrete with a smooth finish, granolithic mortar or using epoxy products.

Where elevated H2S is expected (i.e. at rising main discharges, areas of turbulence), concrete shall not be used. Prefabricated Plastic Manholes (PE/PP) are permitted with approval of Council. These must be capable of withstanding HN-HO-72 traffic loadings.

7.3.8.4.2 Preferred Layout

Each Manhole base shall be formed as shown in the Standard Drawings D12 to D21.

Figure 11: Multiple Maintenance Shafts between consecutive Manholes



7.3.8.4.3 Allowable Deflection through Manholes

A maximum allowable deflection through a MH shall be no more than 90 degrees unless a drop manhole can be used.

7.3.8.4.4 Internal falls through Manholes

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

On pipes where the internal fall across the base of the MH is not achievable due to a large difference between the levels of incoming and outgoing pipes (see Standard Drawing - D13), then internal or external drops shall be provided.

7.3.8.4.5 Effect of Steep Grades on Manholes

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

1. No change of grade is permitted at inlet to a MH.
2. Steep grades are to be continuous through the MH at the same grade.
3. Depth of MH is to exceed 1.5 m to invert for DN 150, DN 200, and DN 225 pipes.
4. Depth of MH is to exceed 2.0 m deep for DN 300 pipes.
5. Change of direction at the MH is not to exceed 45o.
6. No drop junctions or verticals are to be incorporated in the MH.
7. Inside radius of channel inside the MH is to be greater than 6 times the pipe diameter.
8. Benching is to be taken 150 mm above the top of the inlet pipe.

To avoid excessively deep channels within MHs, steep grades (>7%) shall be 'graded-out' at the design phase where practicable. Grading the channel of the MH shall be limited to falls through MHs of up to 0.15

m. Where the depth of the channel within the MH would be greater than 2 x pipe diameter, then an internal or external drop structure shall be provided.

C 7.3.8.4.5

For further guidance on handling steep grades, refer to WSA 02.

7.3.8.4.6 Flotation

In areas where liquefaction during an earthquake is likely or the watertable is at a level that may adversely impact the infrastructure all Maintenance Structures shall be designed in accordance with Underground Utilities – Seismic Assessment and Design Guidelines and associated Technical Note 15 – Manhole Flotation (or applicable successor).

7.3.8.4.7 Covers

Watertight MH covers with a minimum clear opening of 600 mm in diameter, complying with AS 3996, shall be used, unless Council has an alternative standard. AS 3996 gives direction for the class of cover for particular locations and applications (see Standard Drawing - D11).

7.3.8.4.8 Bolt-Down Covers

Where required by Council, bolt-down metal access covers (watertight type) shall be specified on Manholes:

1. In systems where the possibility of surcharge exists;
2. Along creeks subject to flooding above the level of the cover, in tidal areas, or in any location where surface waters could penetrate into the top of a Manhole.

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

MHs should, where practicable, be located on ground that is at least 300 mm above the 1 in 100-year flood level. Where this is not practicable, bolt-down access covers may be specified by Council. It will also be necessary to specify the tying together of MH components where bolt -down covers are specified and precast components are used.

7.3.8.5 Maintenance Shafts

Where Maintenance Shafts have been approved by Council, and where it is expected that human access below ground will not be required, MS's can be used on DN 150, DN 200, and DN 225 pipes as an alternative to MHs, providing Sections 7.3.8.5.1 and 7.3.8.5.2 are satisfied. See Standard Drawing - D22.

Typical Maintenance Shafts configurations are:

1. Straight through Maintenance Shafts.
2. Angled Maintenance Shafts (see 7.3.8.5.1a.).

Maintenance Shafts can also be used in conjunction with an inspection chamber.

7.3.8.5.1 Limiting Conditions

The following conditions apply to the use of Maintenance Shafts:

1. Maintenance Shafts shall only be used on DN 150, DN 200, and DN 225 pipes.
2. Maintenance Shafts shall not be used instead of MHs at junctions.
3. Depth of Maintenance Shafts shall:
    a. Be within the allowable depth limit for the particular pipeline system;
    b. Not exceed the Maintenance Shafts manufacturer's stated allowable depth limit;
    c. Be within the depth limit imposed by Council.
4. Maintenance Shafts shall be restricted to pipeline gradients and depths where the deviation from vertical of the Maintenance Shafts riser shaft (that is, projected centre line of base to centre line at surface) is a maximum of 0.3 m measured at the surface.
5. Maintenance Shafts shall not be used at discharge points of pumping mains.

7.3.8.5.2 Design Parameters

MSs shall only be used at the design locations detailed in Figure 11 The following requirements shall apply:

1. Directional and gradient changes at MS's shall be achieved by using either:
    a. close-coupled horizontal or vertical manufactured bends immediately adjacent to the MS
    b. MS units specially manufactured with internal horizontal or vertical angles to suit design requirements (maximum horizontal deviation of 90o).
    c. MS's at changes of grade shall be located on the pipe with the lesser of the two gradients to minimise the deviation from the vertical of the riser shaft.
    d. Straight through type and angled MS's c a n incorporate up to two higher level property connections discharging directly into the riser shaft.

For construction details see Standard Drawing - D22.

7.3.8.6 Cleaning Eyes

Where terminal maintenance shafts and/or cleaning eyes have been authorised by Council and where it is expected that human access below ground will not be required, TMS's/CEs may be used on DN 150, DN 200, and DN 225 pipes as an alternative to MHs, providing the conditions detailed in this Standard are satisfied.

For construction details see Standard Drawing D7.

7.3.8.6.1 Design Parameters

A Terminal Maintenance Shafts may only be used as a terminating structure under the following conditions:

1. At the permanent end of a wastewater pipe.
2. On DN 150, DN 200, and DN 225 pipes.
3. After the last Manhole (with no intermediate Maintenance Shaft) provided it is spaced no further than 120m from that Manhole, as shown in Figure 11
4. Subject to the limiting conditions detailed in 7.3.8

7.3.8.6.2 Property Connections into a Permanent End

Where a property connection is required directly ahead of the permanent end of the pipe (for example, a connection at the end of a no-exit road), a Maintenance Shaft shall be used to accommodate the straight through connection. In such a case, a DN 100 connection will require a reducer immediately adjacent to the Maintenance Shaft.

7.3.8.6.3 Dead Ends

Pipes need not terminate at a MH or MS, if the pipe is to be extended in the future.

7.3.9 Venting

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

1. At pumping stations.
2. At MHs where pumping stations discharge to a gravity pipe.

In such situations vent shafts shall be installed as per the requirements of WSA 02 and WSA 04 and shall incorporate odour filtration.

7.3.9.1 Odour control

Odour control and air relief shall be provided at the receiving structure. Odour control shall be achieved by an appropriate filter or stack to disperse exhaust ventilation air over the rooftops of the surrounding buildings. The ventilation system shall be designed to provide an appropriate ventilation velocity. The capacity design for filter replacement frequency shall be considered site specifically for CDC's acceptance

7.3.10 Connections

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

7.3.10.1 General Considerations

The property connection should be designed to suit the existing situation and any future development. Each connection shall be capable of serving the entire site building area of the property (unless specific approval is obtained from Council).

7.3.10.2 Requirements of Design

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

1. Plan location and lot contours.
2. Invert level at property boundary or junction with the main as applicable.

7.3.10.3 Number of Connections

It is normal practice to provide one connection per lot. Provision of additional connections shall be subject to justification by the developer and approval by Council.

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

Alternatively, if authorised by Council, developers have the option of providing wastewater facilities to the individual titles or tenements in new developments by:

1. Constructing individual connections which shall be owned and maintained by the body corporate, tenants in common or the company.
2. Extending the public line into the lot and providing a separate connection to each unit, (Preferred).
3. For multi-lot developments, service of the rear sites is normally achieved by providing a single point of connection to a Council system via a common drain within private property, with appropriate easements outlining ownership and maintenance responsibilities between the property owners.

7.3.10.4 Location of Connection

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

1. Be clear of obstructions, such as trees, tree roots, paved areas.
2. Be easily accessible for future maintenance.
3. Be clear of any known future developments, such as swimming pools or driveways.
4. Avoid unnecessarily deep excavation >1.5 m where practicable.
5. Be within or on the property boundary.

7.3.10.5 Connection Depth

Connection depths shall be set to drain the buildable area recognizing the following factors:

1. Surface level at plumbing fixtures of buildings (existing or proposed).
2. Depth to invert of pipe at plumbing fixture or intermediate points.
3. Minimum depth of cover over connection for mechanical protection.
4. Invert of public main at junction point.
5. Allowance for crossing other services (for clearances see Table 7-6).
6. Provision for basements.
7. Allowance for head loss in traps and fittings.
8. Minimum depth of the connection at the property boundary shall be at least 1 m.
9. Local sewer main surcharge levels.

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

7.3.11 Pumping Stations

Pump stations to service new subdivision areas will be permitted only where there is prior agreement with Council on need, positioning and requirements. It is noted that with all mechanical and electrical equipment designs requirements are frequently changed and hence the need to refer to Council prior to design and construction to ensure up to date requirements are agreed and covered. Generally, standard reference to WSA 04 shall be used as the basis of design. The following are also matters that should be considered in design of the pumping station.

Pump stations shall meet the following performance standards:

- The pump well shall be underground and have lockable aluminium or stainless-steel lids complete with the supply of standard Council padlocks for all opening lids.
- Valve chambers shall be below ground level, adjacent to but separate to the pump well. provision shall be made to bypass the pumps in case of breakdown with a valved extension. Non-return valves shall be ball-valves full-bore opening. Valve chambers shall have lockable aluminium or stainless-steel lids complete with the supply of standard Council padlocks.
- Residential pump stations shall be designed for the peak flow as calculated in7.3.5.1. Pump stations with non-residential catchments will be subject to specific design and must be approved by the Engineer.
- The capacity of the wet-well between start and stop levels shall be such as to limit pump starts to no more than 10 per hour.
- Pump stations shall have emergency storage in case of mechanical or electrical failure or blockage of the pumps or rising main. The storage must be located at such a level as to prevent overflow from any manholes, gully traps, pump station lids or any other outlet from the system. Emergency storage capacity shall be calculated from Section 7.3.5.1 average flow and the required storage time as required by the Regional Council.
- All pump stations shall have an approved and controlled overflow system which discharges in such a manner to ensure maximum storage is used prior to discharge. A risk assessment shall be provided to identify where the system would surcharge, and identify controls to minimise overflow effects. The design shall comply with Regional Council discharge rules.
- A rigid ventilation pipe shall be provided with breather cap at least 3 m above ground level.
- A 25 mm diameter water supply shall be provided to the immediate vicinity of the station. The supply shall be fitted with an above-ground backflow preventer (RPZ) in accordance with the requirements of the Water Supply Protection Regulations and the Engineer.

- If required (for larger pump stations servicing more than 15 properties) a Mag Flow meter complete with all electrical and data cables shall be fitted to the main outlet of the pump station.
- The actual site of the pumping station shall be on a separate lot with an accessway (if required) to a formed road. Resource consent may be required for the installation, and where necessary must be obtained by the developer prior to the commencement of engineering works. The site shall be developed to prevent entry of surface runoff into the station.
- Permanently surfaced vehicle access and manoeuvring areas shall be provided to the station.
- The area around the pumping station shall be fenced if required to the Engineer's satisfaction,
- and such that Council shall not become a party to fencing costs.
- The power supply to the station shall be underground.
- The main switchboard shall be mounted on a concrete plinth which extends at least 1,200 mm from the front of the switchboard and 300 mm on the other three sides.

Structures and equipment shall allow for the following minimum operational service life:

- Wet wells and storage tanks 100 years
- Pipework (pressure and gravity) 100 years
- Pumps ≤ 15kw 15 years
- Pumps > 15kw 25 years
- Wet well accessories 20 years
- Valves and meters 30 years
- Electrical equipment 25 years
- SCADA and control 15 years

A design drawing of a typical pumping station is available at Council's office and may be used for reference purposes. The proposed pump station and its components shall be approved by Council prior to construction. Pumps shall include the following as a minimum:

- There shall be a minimum of two pumps in all pump stations.
- Pumps shall be of a make approved by the Engineer, three phase submersible type designed for each to take the full flow and be capable of passing a 75 mm diameter solid.
- Pumps shall be controlled so that while one pump is acting as duty pump, the other is on automatic stand-by.
- Each pump shall have power factor correction to 0.95 or better.
- Each pump shall have a multi-pin plug for cable connection/disconnection.
- If available each pump shall also have oil seal monitoring and thermistor or micro -therm protection (oil seal monitors supplied by pump supplier).
- Pump control shall include:
- Multi-trode level stick with 3 x float-less relay switches (Omron or similar approved). Alternatively an ultrasonic level transducer with pump controller unit or a pressure transducer with pump controller unit can be used (prior approval from Council Engineer required). Multi-trode to have "Start", "Stand-by", and "High" switches. That is duty pump starts at "Start" and stand-by pump starts at "Stand-by". Both run together until stop level. "High" switch triggers alarm.
- x back-up float switches for "High-high" (overflow) (to be back-up supplied from back-up 12V DC battery) and "Low" levels. Floats to be hard wired to start both pumps if "High-high" tripped and both stop at stop level or when "Low" float tripped.
- The electrical control cabinet shall be above ground level, constructed from a powder-coated stainless steel, weatherproof, lockable enclosure (to IP 56 rating). The internal main switchboard metalwork arranged into cubicles (layout to be approved by Council Engineer).

The enclosure shall be large enough to house the following items:

- The internal main switchboard metalwork, including supply authority metering.
- 1 x selector switch for Mains/Off/Generator.
- 1x load break main switch isolator appropriately sized, minimum 63A and HRC or circuit breaker type distribution board.

- 1 No. direct online motor starter per pump (may need to be reduced voltage starter based on the supply authorities requirements) complete with overload protection, ammeter, hours run, run and fault light indication and auto/off/manual selector switches.
- Phase failure protection for each pump motor.
- High and low well level indication lights.
- Each pump shall have a multi pin plug and socket for cable connection/ disconnection.
- 1 x 10A single phase RCD protected switch socket.
- 1 x 72 mm voltmeter c/w phase selector switch.
- 1 x portable generator appliance 3 phase plus neutral inlet and plug. Door to be lockable whilst under emergency power.
- 1 x light complete with switch.
- 1 x anti condensation heater and thermostat.
- All electrical work will be carried out by a suitably qualified electrical contractor.
- The control system shall be as agreed:
- Council's standard padlock and latch.
- Council to apply to connect to the power.

7.3.12 Pressure Sewers

Pressure sewers shall be designed and installed in accordance with the standards of Council, with consideration in the design for cyclic dynamic stresses. Refer to Water New Zealand, Pressure Sewer National Guidelines on Ownership Models, Design Requirements, Technical Specifications and Operation & Maintenance, Feb 2020, reference can also be made to the PIPA design guidelines (http://www.pipa.com.au). If Council has no applicable standards, then they shall be designed in accordance with WSA 02 and WSA 07

7.3.13 On-Site Wastewater Treatment and Disposal

On-site wastewater treatment and disposal shall be designed and installed in accordance with the standards of Council. If Council has no applicable standards, then they shall be designed in accordance with AS/NZS 1546.1 and AS/NZS 1547.

7.4 Method of Disposal

On-site disposal of wastewater may be permitted where:

1. No piped system is immediately available or will not be available within 10 years of the subdivision application.
2. No piped system is available immediately adjacent or within a reasonable distance of the site.

For clarification of what constitutes a "reasonable distance" refer to Section 9.8 of this Code of Practice.

3. The site is capable of disposing of treated effluent without harmful effects on the environment or to public health.

In all other cases wastewater is to be collected and disposed of to an existing Council system, via a localised pump station if necessary.

7.5 Private On-Site Disposal System

Septic tanks for on-site domestic wastewater treatment must be designed in accordance with AS/NZS 1546.1:2008, On-Site Domestic Wastewater Treatment Units, Part 1, Septic Tanks.

On-site disposal systems shall be designed and constructed in accordance with AS/NZS 1547:2012, On-Site Domestic Wastewater Management or its applicable successor.

Where on-site disposal is proposed the developer will be required to demonstrate the ability of the ground to accept and dispose of the treated effluent in accordance with the above standard. A Site and Soil analysis in accordance with AS/NZs 1547 Appendix 4.1B is required together with a 4.1B3.9 Final plan report.

The disposal area shall be wholly contained within the allotment serviced.

If ground conditions are considered to be marginal in any way Council will require a specific design, based on-site investigations, to be submitted at the time of subdivision application.

On site treatment/disposal systems must comply with the Regional Effluent Land Application Plan, and the District plan.

Wastewater/effluent must not contaminate drinking water supplies or adversely affect water used for recreational use or the gathering of food.

7.6 Approval of Proposed Infrastructure

7.6.1 Information to be Provided

Applications for design approval shall include the information outlined in Section 3 of this Code of Practice and **Clutha District Councils As-Built Standard for Water Services.** In addition, the following information shall be provided:

1. A plan showing the proposed location of existing and proposed wastewater infrastructure.
2. Detailed long sections showing the levels and grades of proposed wastewater pipelines in terms of datum.
3. Long sections shall include full details of pipe and manhole materials and sizes, existing services and intersecting pipelines.
4. Details and calculations prepared which demonstrate that agreed levels of service will be maintained.
5. Details and calculations prepared which clearly indicate any impact on adjacent area or catchment that the proposed infrastructure may have.
6. Appropriate operating manuals, pump information, and instructions for pump stations and pressure systems if proposed.

7.7 Construction

7.7.1 Pipeline Construction

The construction of pipelines shall be carried out in accordance with the requirements of AS/NZS 2032 (PVC), AS/NZS 2033 (PE), AS/NZS 2566 Part 1 and 2 (all buried flexible pipelines), AS/NZS 3725 (concrete pipes), or AS 1741 or BS EN 295 (VC).

7.7.2 Trenching

See Standard Drawings D23 and D24 for guidance.

Where a pipeline is to be constructed through areas with unsuitable foundations such material shall be removed and replaced with other approved material or alternatively, other methods of construction shall be carried out to the approval of Council to provide an adequate foundation and side support if required for the pipeline.

7.7.2 Reinstatement

Areas where construction has taken place shall be reinstated to the condition required by Council and shall be no less than the original pre-works condition.

7.7.3 Inspection and Acceptance

Pipeline inspection and recording by closed circuit television (CCTV) shall be carried out prior to acceptance by Council.

CCTV inspections and deliverables shall be in accordance with New Zealand pipe inspection manual

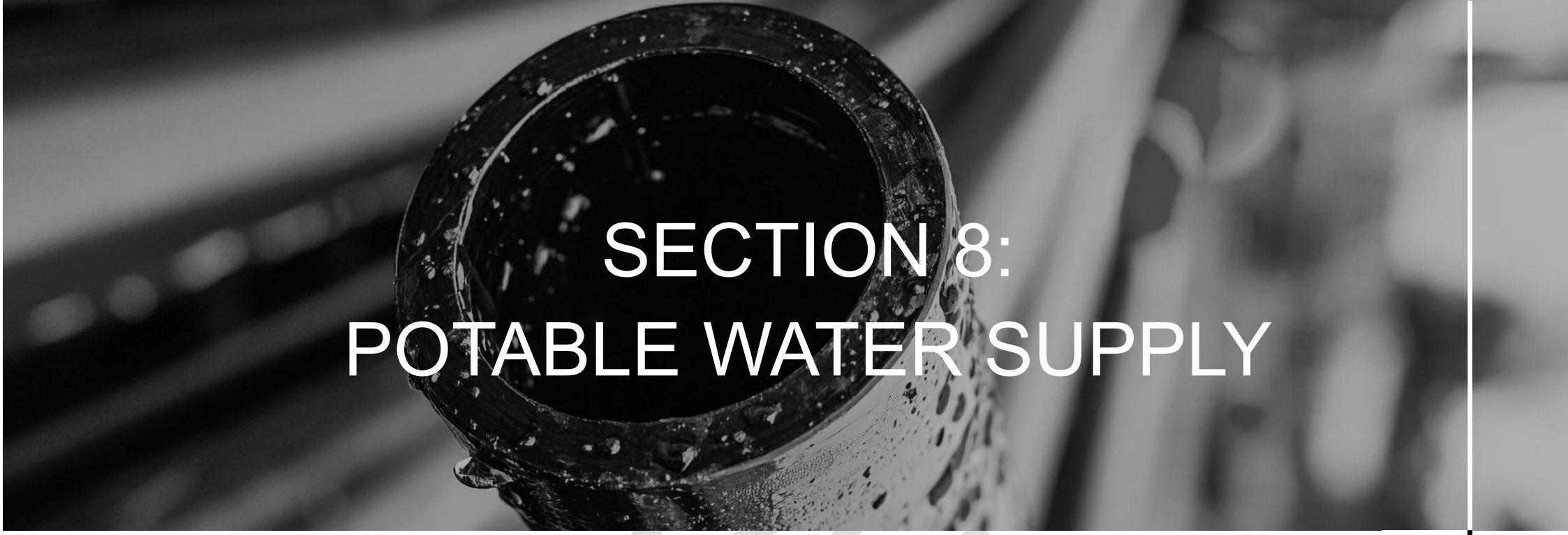
and the requirements of Council.

7.7.4 Leakage Testing of Gravity Pipelines

Before a new pipeline is connected to the existing system, a successful field test shall be completed. The test shall be carried out as specified in Section 8.7.2.

7.7.5 Leakage Testing of Pressurised Sewers

Requirements for field testing of pressurised sewers are given in Section 8.7.3.



SECTION 8:
POTABLE WATER SUPPLY

Clutha District Council

Section 8 Table of Contents

8.1 Scope

This section sets out requirements for the design and construction of drinking water supply systems for land development and subdivision. It covers the design of both the local reticulation system both on demand and restricted supplies and the larger distribution network.

Water reticulation design is generally described in 'performance based' terms combined with 'deemed to comply' solutions. The designer is responsible for all aspects of the water system design, excepting those aspects nominated and provided to the designer by Council.

If the scope of the development is large and includes its own water source, treatment or reservoirs, reference should be made to the Water Services Association - WSA 03.

Detailed plans and design calculations (where appropriate) shall be submitted to Council. In addition the requirements outlined in Section 3 of this Code of Practice shall be met.

8.2 General Requirements

8.2.1 Objectives

The objectives are to ensure that the water reticulation system is functional, the required quality and quantity of water is supplied to all customers within Council's designated water supply area, and Council's requirements are satisfied.

The design shall ensure an acceptable water supply for each property including fire flows, depending on Council policies by providing either:

1. A water main allowing an appropriate point of supply to each property.
2. A service connection from the main for each property,
3. including a meter box and manifold but not a meter.

The designer shall consider:

1. Council's policies, customer charters, and contracts.
2. The hydraulic adequacy of the system.
3. The ability of the water system to maintain acceptable water quality.
4. The structural strength of water system components to resist applied loads.
5. The requirements of SNZ PAS 4509.
6. Environmental requirements.
7. The environmental and community impact of the works.
8. The 'fit-for-purpose' service life for the system.
9. Optimising the 'whole-of-life' cost.
10. Each component's resistance to internal and external corrosion or degradation.

8.2.2 Referenced Documents and Relevant Guides

Relevant legislation is listed in the Referenced Documents Section 2 of this Code of Practice.

Water designs shall incorporate all the special requirements of Council and shall be in accordance with the most appropriate Standards, codes, and guidelines including those set out in Referenced Documents. Some of which include:

1. The Civil Defence Emergency Management Act 2002
2. Drinking-water standards for New Zealand 2005 (Revised 2018)
3. Water Services Act 2021
4. Local Government (Water Services) (Repeals and Amendments) Act 2025
5. Local Government (Water Services) Bill.

8.3 Design

8.3.1 Design Life

All water supply systems shall be designed and constructed for an asset life of at least 100 years. Some components such as pumps, metering, control valves, and control equipment may require earlier renovation or replacement. Refer to WSA 03 for the classification of life expectancy for various components of water supply systems.

8.3.2 System Design

Water mains shall be designed with sufficient capacity to cater for all existing and predicted development within the area to be served and to meet the requirements of SNZ PAS 4509, and NZ Fire Service, Fire Fighting Water Supplies Code of Practice.

The water demand allowance in the subdivision design shall include provision for:

1. Population targets.
2. The area to be serviced.
3. Individual properties proposed by the developer.
4. Adjustment may be required to cater for the known performance (demand-based flows) of the existing parts of the water system.

The water supply system for any development shall also be designed to supply:

1. Any properties that lie between that development and the extent of the existing supply system and
2. Properties beyond that development which form part of the zone council wishes to eventually reticulate.

For capacity beyond that required for the development in question, Council may contribute monies being the actual difference in cost between pipe and fittings required for the ultimate development and that for the development.

8.3.3 Design Criteria

8.3.3.1 Hydraulic Design

The diameter, material type(s), and class of the water main shall be selected to ensure that:

1. The main has sufficient capacity to meet peak demands while maintaining minimum pressure.
2. All consumers connected to the main always receive an adequate water supply and pressure.

The hydraulic design shall meet:

1. A peak hourly demand pressure no less than 250Kpa; and
2. Firefighting demand plus two thirds of peak hourly demand no less than 100Kpa.

8.3.3.2 Network Analysis

Where required by Council, a network analysis of the system shall be undertaken. The system shall be analysed using a mathematical model of the network to ensure adequate water supply is available to all consumers connected to the system for all defined modes of operation. The analysis shall include all elements within the system and shall address all demand periods including peak demand, low demand flows, and fire flows. Council will commission a network analysis where appropriate on behalf of the developer.

8.3.3.3 Peak Flows

Water demands vary on a regional basis depending on a variety of climatic conditions and consumer use patterns. Council should be able to provide historically-based demand information appropriate for design. Where peak demands are required for the design of a distribution system, the value shall be calculated from the following formulae:

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

Unless specified otherwise by Council:

1. PF = 1.5 for populations over 10,000.
2. PF = 2 for populations below 2,000.

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

Unless specified otherwise by Council:

1. PF = 2 for populations over 10,000.
2. PF = 5 for populations below 2,000.

8.3.3.4 Head Losses

The head loss through pipe and fittings at the design flow rate shall be less than:

1. m/km for DN ≤150.
2. 3 m/km for DN ≥200.

Head loss can be calculated using one of a number of standard hydraulic formulae. The final calculation method and formulae used to calculate head loss shall be determined by Council.

8.3.3.5 Hydraulic Roughness Values

The hydraulic roughness values considered in the analysis shall take account of the pipe material proposed, all fittings and other secondary head losses, and the expected increase in roughness over the life of the pipe. The designer should check with Council to ascertain if it has any requirements to use a specific formula and or roughness coefficients. If there are no specific requirements then it is recommended that the Colebrook-White formula is used (see Table 27).

Table 27: Hydraulic Roughness Values

Material	Colebrook – White Co- efficient k (mm)	Manning Roughness Co-efficient (n)
PVC	0.003 - 0.015	0.008 - 0.009
PE	0.003 - 0.015	0.008 - 0.009
Ductile iron cement mortar lined	0.01 - 0.06	0.006 - 0.011
Mild steel cement mortar lined	0.01 - 0.06	0.006 - 0.011
GRP	0.003 – 0.015	0.008 - 0.009

NOTE:

The values show a range of roughness coefficients. The lower the value in the range represents the expected value for clean, new pipes laid straight. The higher value in the range represents the typical maximum expected for the product. It cannot be an absolute maximum, as the factors detailed in AS 2200 can lead to even higher roughness values in some circumstances. Recommendations on the appropriate roughness coefficient for a particular fluid may be obtained from the pipe supplier. Refer also to AS 2200 Table 2 and notes.

8.3.3.6 Minimum Flows

The minimum flow shall be the greater of:

1. 25 L/min for normal residential sites.
2. Fire flows as specified in SNZ PAS 4509.

8.3.3.7 Minimum Water Demand

The minimum peak domestic demand shall be specified by Council, or:

1. Daily consumption of 250 L/p/day, applied to an occupancy rate of at least 2.5 persons / dwelling.
2. Peaking factor of up to 5.
3. Firefighting demands as specified in SNZ PAS 4509.

4. The network should be designed to maintain appropriate nominated pressures for both peak demand (average daily demand in L/s x peaking factor) and firefighting demand scenarios. These figures should be applied to mains of 100 mm diameter or greater. Mains less than 100 mm in diameter can be sized using the multiple dwellings provisions of AS/NZS 3500.1 Table 29.

The network is to be designed to suit both scenarios of:

1. Peak hourly demand no less than 250Kpa; and
2. Firefighting (as specified in SNZ PAS 4509) plus two thirds of peak hourly demand no less than 100Kpa.
3. Where these criteria are unable to be met or where no reticulation is available then fire water must be supplied for a dwelling in accordance with SNZ PAS 4509.

8.3.3.8 Sizing of Mains

Table 28 and Table 29 may be used as a guide for Sizing Mains.

Table 28: Empirical Guide for Principal Main Sizing

Nominal Diameter of Main (DN)	Capacity of Main (Single Direction Feed Only)			
Fixed	**Residential (Lots)**	**Rural Residential (Lots)**	**General/Light Industrial (Lots)**	**High Usage Industrial (Hectare)**
100	40	10	0	0
150	160	125	23	0
200	400	290	52	10
250	650	470	84	24
300	1,000	670	120	35
375	1,600	1070	195	55

Table 29: Empirical Guide for Sizing Rider Mains

DN 63 Rider Mains		
Pressure	**Maximum Number of Dwellings Unit**	
	One End Supply	**Two End Supply**
High > 600 kPa	20	40
Medium 400 – 600 kPa	15	30
Low < kPa	7	15

8.3.3.9 Pressure Zones

In some cases, a 'PRV zone' may be used to control the pressure delivered to an area. In these cases the designer shall consult with Council to confirm pressure requirements.

8.3.3.10 Maximum Pressure Requirements

An output of the hydraulic design of a pipeline is the specification of the maximum pressure that may be imposed on the pipeline during operation.

Inputs to the design process include:

1. Static head of supply.
2. The range of pressure and flows required to provide an acceptable level of service to the end- user (minimum pressure) and to avoid water leakage (maximum pressure).

The outputs of water main hydraulic design shall include:

1. Size of mains.
2. Maximum and minimum design pressure.
3. The pressure class/rating of pipeline system components.
4. Surge analysis results.
5. Hydraulic loss functions.
6. Specification of the maximum allowable operating pressure.
7. Flow and pressure compliance with peak demand and firefighting demand scenarios.

8.3.3.11 Design Pressure

The design pressures are the limiting pressures for operation of a pipeline system including any allowance for variation of usage in the future.

The minimum design pressure is either the minimum pressure defined by Council or some higher pressure selected to control (or minimise) the range of pressures experienced over the normal diurnal variation in the system.

Unless otherwise specified by Council, the design pressure shall be between 250 kPa and 800 kPa (25 m to 80 m).

A minimum pressure rating of each pipeline component is to be provided to Council with the as-built details.

C8.3.3.11

A design pressure of 250 kPa to 800 kPa is set as this provides for approximately 200 kPa for two-storey dwellings at the upper floor and less than excessive pressures for dwellings constructed on lots below the position of the main. Specific additional consideration to these pressures may be needed in areas of significant contour.

8.3.3.12 Operating Pressure/ Working Pressure

The operating pressure shall not exceed the rated pressure class/rating or the operating pressure limit of the pipeline components at that location.

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

Design pressure, (m) = Maximum Supply Pressure, (m above the level datum used for the ground level) + Surge Allowance, (m) - Lowest Ground Level (GL) of the proposed main, (m above datum).

The design pressure (m head) shall be used for:

1. Selection of pipe materials and classes.
2. Selection of pipe fitting types and classes.

The minimum pressure for design scenarios shall be in accordance with Section 8.3.3.7.

8.3.3.13 Pipe PN Class (Pressure Rating)

Pipe PN class is selected on the basis of the design pressure (head) calculated for the various sections of the reticulation network. This may be varied by specific operational requirements specified by Council but is normally defaulted to a minimum PN12 (12 bar).

8.3.3.14 Water Quality

A number of factors in a network can adversely affect the quality of the water in the system. The network design shall ensure that the water quality at each property complies with Taumata Arowhai standards, Water Services Act 2021. Also

applicable are the Drinking-water standards for New Zealand 2005 (Revised 2008). The requirement to protect water supplies from the risk of backflow is stated in the Health (Drinking Water) Amendment Act Section 69ZZZ and this shall be adhered to.

8.3.3.15 Material

All parts of the water supply system in contact with drinking water shall be designed using components and materials that comply with AS/NZS 4020.

8.3.3.16 Prevention of Backflow

Drinking water supply systems shall be designed and equipped to prevent backflow. The location and operation of hydrants, air valves, and scours shall ensure no external water enters the system through negative pressure from normal operation. All connections shall be fitted with backflow prevention devices.

8.3.3.17 Water Age

Drinking water supply systems shall be designed to minimise water age to ensure no unacceptable deterioration of water quality. This shall include:

1. Mains with dead ends should be avoided by the provision of linked mains or looped mains. Particular care shall be taken at the boundaries between supply zones where dead ends shall be minimised.
2. Mains for short runs shall be reduced in size or looped, for example no -exit roads
3. Provision of large diameter mains capacity shall be staged by the initial provision of a smaller main, followed by additional mains as the demand increases. Discussions should be held with Council on staging, as multiple mains may not be desirable and larger mains with a scouring programme may be preferred instead.

8.3.4 Flow Velocities

In practice it is desirable to avoid unduly high or low flow velocities. Pipelines shall be designed for flow velocities within the range of 0.5 to 2.0 m/s. In special circumstances, velocities of up to 3.0 m/s may be acceptable.

For pumping mains an economic appraisal may be required to determine the most economical diameter of pumping main to minimise the combined capital and discounted pumping cost. The resulting velocity will normally lie in the range 0.8 m/s to 3.0 m/s.

The following factors shall be considered in determining flow velocity:

1. Stagnation.
2. Turbidity (large fluctuations in flow rates can dislodge the biological slime or stir up settled solids in pipelines).
3. Pressure.
4. Surge.
5. Pumping facilities.
6. Pressure reducing devices.
7. Pipelining materials.

8.3.4.1 Surge Analysis

During the design stage a surge analysis shall be undertaken for any pipeline within a pumped system or system containing automated valves. The source of any significant pressure surges or high-pressure areas shall be identified and remedial measures to minimise pressure surges designed and specified.

For water mains in pumped systems, a detailed surge analysis shall be conducted unless otherwise directed by Council to ensure:

1. The appropriate surge pressure is included in the calculated design head.
2. Surge control devices are included in the system design, where identified by the detailed analysis, to protect the network or control pressure fluctuations in the supply to customers, or both.

Note: Surge can also be managed by soft starts on pump motors, variable speed drives, and speed controls on valve closures, for example.

8.3.5 System Layout

8.3.5.1 General

Water mains are usually located in the road. The location shall be in accordance with Standard Drawing R2. Where approved by Council water mains may be located in private property or public reserve, where in this case easements shall be required.

Water mains should:

1. Be aligned parallel to property boundaries.
2. Should not traverse steep gradients.
3. Should be located to maintain adequate clearance from structures and other infrastructure.

8.3.5.2 Reticulation Layout

A principal water main of not less than nominal internal diameter (DN) 100, fitted with fire hydrants, shall be laid on one side of all public roads and no-exit roads in every residential development. A DN 50 rider main may be laid to lots not fronted by the principle main but still within fire protection of a hydrant subject to approval by Council. The principal mains serving commercial and industrial areas shall be at least DN 150. This requirement may be relaxed in short no-exit roads as long as adequate firefighting coverage is available.

8.3.5.3 Mains Layout

In determining the general layout of mains, the following factors shall be considered:

1. Main location to allow easy access for repairs and maintenance.
2. Whether system security, maintenance of water quality, and ability to clean mains meet operational requirements.
3. Location of valves for shut-off areas and zone boundaries (see 8.3.3.14).
4. Avoidance of dead ends by use of looped mains or rider mains.
5. Provision of dual or alternate feeds to minimise service risk.

8.3.5.4 Water Mains in Private Property

Water mains are not normally permitted within private property. In extraordinary circumstances when their presence has been agreed by the Council, then they will require a registered easement. Water mains located within private property will require an appropriately sized and registered easement in accordance with Council's requirements.

Refer to Clutha District Councils Water Services Bylaw 2019 in reference to responsibilities, asset ownership and points of supply.

C8.3.5.4

For some TAs, an easement over private property is not the preferred option and may only be used as a temporary solution for landlocked subdivisions pending future permanent supply within a road. A typical situation where Council may approve water mains in easements is a fire main in a right of way.

8.3.5.5 Types of System Configuration

Network layouts shall be established in accordance with Council practice. Interconnected ring systems should be provided when feasible. Refer to WSA 03 for further information.

8.3.5.6 Water Mains Near Trees

Locating water mains within the root zone of trees should be avoided if possible. Where this is not practicable, careful attention to pipe material selection is necessary to minimise risk of pipe failure due to root intrusion.

8.3.5.7 Shared Trenching

Where shared trenching is approved by Council and utility service owners, a detailed design shall be submitted for approval by those parties and shall include:

1. Relative location of services (horizontal and vertical) in the trench.
2. Clearances from other services.
3. Pipe support and trench backfill material specifications.
4. Embedment and trench backfill compactions.
5. Trench and / or individual service] markings.
6. Services' location from property boundaries.
7. Any limitations on future maintenance.
8. Special anchoring requirements, such as for bends and tees.
9. Compliance with Table 30

Where approved by Council and utility service owners, shared trenching may also be used for property service connections.

8.3.5.8 Rider Mains and Duplicate Mains

A rider main may be laid to lots not fronted by the principle main but still within fire protection of a hydrant subject to approval by Council. Duplicate mains are required to provide adequate fire protection in the following cases:

1. Arterial roads or roads with a central dividing island.
2. Roads with split elevation.
3. Roads with rail lines.
4. Urban centres.
5. Parallel to large distribution mains that are not available for service connections.
6. Commercial and industrial areas nominated by Council.
7. Where required by SNZ PAS 4509.

8.3.5.9 Crossings

Water main crossings of roads, railway lines, and underground services shall, as far as practicable, be at right angles. Mains should be located and designed to minimise maintenance and Replacement work. Council may require extra mechanical protection for the pipes or different pipe materials to minimise the need for future maintenance.

8.3.5.10 Crossings of Waterways or Reserves

All crossings of waterways or reserves shall be specific designs to suit Council's requirement.

Crossings shall, as far as practicable, be at right angles to the waterway or reserve. Reference should be made to Council to establish whether it prefers elevated crossings or below waterway invert crossings. When the pipeline is placed under the invert level of a waterway it may require mechanical protection by concrete encasement or steel or other acceptable pipe duct. Different pipeline materials may need to be used for the crossing.

8.3.5.11 Location Marking of Valves and Hydrants

Hydrant location markings shall be according to SNZ PAS 4509. Additionally reinforced concrete marker posts shall be set in the ground opposite the hydrant or valve and close to property boundaries. Marker posts shall have inscribed letters as below.

- "V" to indicate sluice valves, painted white
- "AV" to indicate air valves, painted red
- "SV" to indicate scour valves, painted blue
- The location marking of stop valves, service valves, and fire hydrants shall be to SNZ PAS 4509 and Code of Practice Standard Drawings and Clutha District Councils Three Waters Asbuilt Specification for Water Services

8.3.5.12 Connection to the Council's Reticulated Water Supply

Subject to engineering constraints, connection to the Council's reticulated water supply will be required unless:

1. No piped system is immediately available or will not be available within 10 years of the subdivision application.
2. No piped system is available immediately adjacent or within a reasonable distance of the site.

For clarification of what constitutes a "reasonable distance" refer to Section 9.8 of this Code of Practice.

8.3.6 Clearances

8.3.6.1 Clearance from Underground Services

Where a pipe is designed in a road the location of the pipe from other services shall comply with the Code as defined in Section 9.2.2, unless Council has its own requirements.

For normal trenching and trenchless technology installation, clearance from other service utility assets shall not be less than the minimum vertical and horizontal clearances shown in Table 30. Written agreement on reduced clearances and clearances for shared trenching shall be obtained from Council and the relevant service owner prior to the commencement of construction.

Table 30: Clearances between Mains and Underground Services

Utility (Existing Service)	New Main Size		
	Minimum Horizontal Clearance (mm)		Minimum Vertical Clearance (mm) (1)
	DN ≤200	DN>200	
Water Mains DN>375	600	600	500
Water Mains DN≤375	300(2)	600	150
Gas Mains	300(2)	600	150
Telecommunications Conduits and Cables	300(2)	600	150
Electricity Conduits and Cables	500	1,000	225
Public Mains	300(2)	600	150(3)
Wastewater Pipes	1,000/600(4)	1,000/600(4)	500(3)
Kerbs	150	600(5)	150 (where possible)

NOTE:

- Vertical clearances apply when water mains cross another utility service, except in the case of wastewater when a vertical separation shall always be maintained, even when the main and wastewater pipe are parallel. The main should always be located above the wastewater pipe to minimise the possibility of backflow contamination in the event of a main break. Where unable to be achieved, approval from Council must be obtained for alternative designs.
- Clearances can be further reduced to 150 mm for distances up to 2 m when passing installations such as poles, pits, and small structures, providing the structure is not destabilised in the process.
- Water mains should always cross over wastewater and stormwater drains.
- When the wastewater pipe is at the minimum vertical clearance below the water main (500 mm), maintain a minimum horizontal clearance of 1000 mm. This minimum horizontal clearance can be progressively reduced to 600 mm as the vertical clearance is increased to 750 mm.
- Clearance from kerb and channel shall be measured from the nearest edge of the concrete. For water mains ≤375 clearances can be progressively reduced until the minimum of 150 mm is reached for mains DN ≤200.
- Where a main crosses other services, it shall cross at an angle as near as possible to 90°.

8.3.6.2 Clearance from Structures

Pipes adjacent to existing buildings and structures shall be located clear of the 'zone of influence' of the building foundations. If this is not possible, a specific design shall be undertaken to cover the following:

1. Protection of the pipeline.
2. Long term maintenance access for the pipeline.
3. Protection of the existing structure or building.

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

Sufficient clearance for laying and access for maintenance is also required. Table 31 may be used as a guide for minimum clearances for mains laid in public streets.

Table 31: Minimum Clearances from Structures

Pipe Diameter (DN)	Clearance to Wall or Building (mm)
<100	600
100-150	1,000
200-300	1,500
375	2,000

NOTE:

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

8.3.6.3 Clearance from High Voltage Transmission Facilities

Water mains constructed from metallic materials shall generally not be located close to high voltage transmission lines and other facilities. Special design shall be undertaken if it is necessary to locate such mains close to such facilities.

8.3.6.4 Deviation of Mains Around Structures

Deviation of a pipeline around an obstruction can be achieved by deflection of the pipeline at joints, to the angular deflection limits stated by the pipe joint manufacturer and with suitably restrained fitting bends. Permitted angular deflection varies with pipe material, pipe wall thickness, pipe PN class, joint type, design and geometry. Some joint types are specifically designed to accommodate angular deflection. Butt welded or electrofusion collared PVC and PE pipes may also be curved along the pipe barrel, between joints, to a minimum radius of curvature not less than that stated by the pipe manufacturer.

8.3.7 Pipe Selection

The selection of the appropriate pipe material, sizes, and classes shall be based on the designed system demands.

8.3.7.1 Standard Pipe Sizes

The principal main shall be standardised as DN 100, 150, 200, 250, 300, 375, 450, 525, 575, or 600 mm diameter only. Pipe sizes shall be in accordance with Table 32:

Table 32: Standard Pipe Size according to Material Type

Standard Pipe Size according to Material Type			
Nominal Internal Diameter (mm)	Polyethylene (PE)	Polyvinylchloride (PVC)	
		uPVC	PVC-O
50	DN63	DN50	DN50
100	DN125	DN100	DN100
150	DN180	DN150	DN150
200	DN250	DN200	DN200
250	DN315	DN250	DN250
300	DN355	DN300	DN300

NOTE:

1. For PE pipe: Comply with AS/NZS 4130, pressure rating PN12.5Mpa
2. For uPVC pipe: Comply with AS/NZS 1477 series 1 or 2, pressure rating PN12Mpa

8.3.7.2 Minimum Pipe Sizes

Minimum pipe diameters shall be as follows, where DN is the pipe diameter:

1. DN 50 for rider mains in residential zones.
2. DN 100 for residential zones.
3. DN 150 for industrial or commercial zones.

Council may also specify minimum pipe diameters for other identified areas such as Central Business District areas.

8.3.7.3 Pipe Materials

For acceptable pipe materials and Standards see Pipeline Construction.

8.3.8 Fire Flow

The water reticulation system shall be designed to comply with SNZ PAS 4509.

8.3.9 Fire Protection Services

Some developments require specific firefighting water supply provisions where connection to a reticulated high-pressure water supply is not available or does not meet required fire flow standards.

Where a development cannot be connected to a reticulated supply capable of meeting the required firefighting flows, on-site water storage shall be provided in accordance with the requirements of Fire and Emergency New Zealand (FENZ) and this Code.

Individual Dwellings – Non-Reticulated Areas

For each dwelling in a non-reticulated area, the following shall be provided:

- A minimum firefighting water supply of 45,000 litres available at all times.
- This may be achieved through:
    - A single tank of not less than 45,000 litres capacity; or
    - Multiple tanks providing a combined available firefighting volume of not less than 45,000 litres.

Where a domestic sprinkler system is installed and certified, any reduction in required storage must be consistent with current FENZ guidance and approved by Council.

There is no minimum dwelling size threshold for the application of these requirements.

Tank and Connection Requirements

Water supply tanks shall:

- Maintain the required firefighting reserve at all times;
- Be accessible to Fire and Emergency New Zealand appliances;
- Be located so that the connection point is not compromised in the event of a fire.

A firefighting connection shall:

- Comply with SNZ PAS 4509 (current edition);
- Be located within 75 metres of any building on the allotment;
- Be clearly identified and unobstructed at all times;
- Be positioned within 6 metres of a hardstand suitable for fire appliance parking.

Acceptable couplings shall be compatible with FENZ operational equipment and comply with SNZ PAS 4509, including:

- 70 mm instantaneous (female) couplings; or
- 100 mm or 140 mm suction couplings (female) with matching hose tail diameter.

Access Requirements

Heavy-duty vehicle access shall:

- Be a minimum of 4 metres wide;
- Provide all-weather access to a hardstand area suitable for fire appliance parking;
- Be maintained at all times;
- Provide access within 6 metres of the water supply connection point.

Communal Tanks

Where communal water supply tanks are proposed to service multiple properties:

- At least two tanks shall be provided where required to ensure redundancy;
- Each tank shall have a minimum capacity of 45 m^3 unless otherwise approved;
- Tanks shall be located within strictly 135 metres of each building they are intended to service;
- Permanent firefighting couplings complying with SNZ PAS 4509 shall be installed at each tank.

Council approval is required for any communal firefighting water supply arrangement.

8.3.9.1 General

For installation conditions beyond those shown on the drawings, the pipeline installation shall be specifically designed to resist structural failure. The design shall be in accordance with AS/NZS 2566.1 including the structural design commentary AS/NZS 2566.1 Supplement 1. Details of the final design requirements shall be shown on the drawings.

8.3.9.2 Seismic Design

All pipes and structures shall be designed with adequate flexibility and special provisions to minimise risk of damage during earthquake. Historical experience in New Zealand earthquake events suggests that suitable pipe options, in seismically active areas, may include rubber ring joint PVC pipes, or PE pipes. Specially designed flexible joints shall be provided at all junctions between pipes and rigid structures (such as reservoirs, pump stations, bridges, and buildings) in natural or made ground.

8.3.9.3 Structural Consideration

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

8.3.9.4 Internal Forces

Pipelines shall be designed for the range of expected pressures, including transient conditions (surge and fatigue) and maximum static head conditions. In the case of transient conditions the amplitude and frequency shall be estimated. The allowance for surge included in the maximum design pressure shall not be less than 200 kPa. Transfer and distribution mains subject to negative pressure shall be designed to withstand a transient pressure of at least 80 kPa below atmospheric pressure. A surge safety factor of 2 may be applied to the normal operating pressure to estimate the surge pressure in lieu of a detailed surge analysis.

8.3.9.5 External Forces

The external forces to be taken into account shall include:

1. Trench fill loadings (vertical and horizontal forces due to earth loadings).
2. Surcharge.
3. Groundwater.

4. Dead weight of the pipe and the contained water.
5. Other forces arising during installation including flotation.
6. Traffic loads.
7. Temperature (expansion/contraction).

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

8.3.9.6 Geotechnical Investigations

The designer should take into account any geotechnical requirements determined under Section 4 of this Code of Practice.

Where required, standard special foundation conditions shall be referenced on the drawings.

8.3.9.7 Pipe Selection for Special Condition

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

1. Structural adequacy considering ground conditions and water temperature.
2. Water quality considering lining material.
3. Compatibility with aggressive or contaminated ground.
4. Suitability for the geotechnical conditions.
5. Compliance with Council's requirements.

8.3.9.8 Above Ground Water Mains

The design of above-ground water mains shall include:

- The design of pipeline supports
- Maintenance and access requirements
- control of unbalanced thrusts

and shall address exposure conditions, such as:

- Corrosion protection
- UV protection
- Frost protections
- freezing of water mains
- temperature derating.

In such situations the pipe materials, support, and restraint for the pipes and fittings shall be detailed on the drawings.

8.3.9.9 Trenchless Technology

Trenchless technology may be required for alignments passing through or under:

1. Environmentally sensitive areas.
2. Built-up or congested areas to minimise disruption and reinstatement.
3. Railway, water course and major road crossings.
4. Significant vegetation.
5. Vehicle crossings.

Pressure pipes used for trenchless installation shall have suitable mechanically restrained joints, specifically designed for trenchless application, which may include integral restraint seal systems, or heat fusion welded joints.

For information on trenchless installation methods see 7.3.6.8.

C8.3.10.9

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

8.3.9.10 Embedment

8.3.9.10.1 Minimum Pipe Cover

Pipelines shall have minimum cover in accordance with Council or utility owner's requirements. Where Council does not have specific requirements, the minimum covers as described in AS/NZS 2566.2 may be used.

8.3.9.10.2 Minimum Trench Width

Pipe trench width design considerations shall be based on the minimum side clearances detailed in Standard Drawing – W10.

8.3.9.10.3 Pipeline Restraint

Anchorage shall be provided at bends, tees, reducers, valves, and dead ends where necessary.

C8.3.10.11

In-line valves, especially those DN 100 or larger, should be anchored to ensure stability under operational conditions. See NZS 4404 WS-005.

8.3.9.10.4 Thrust Blocks

The design of thrust blocks shall be based on the maximum test pressure.

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 maximum design pressure, or as otherwise specified by Council.

Restraint joint systems, specifically designed to resist the total unbalanced thrust, and support all thrust load, may be used, instead of thrust blocks. These may include mechanical restraint coupling joints, or integral restraint seal systems.

Typical contact areas for selected soil conditions and pipe sizes are shown in Standard Drawings W9- W9B.

Thrust blocks for temporary infrastructure shall be designed to the requirements for permanent thrust blocks..

8.3.9.10.5 Anchor Blocks

Anchor blocks are designed to prevent movement of pipe bends in a vertical direction. They shall consist of sufficient mass concrete to prevent pipe movement as shown in Standard Drawings W9-W9B.

8.3.9.10.6 Restrained Joint Water Mains

Commercially available mechanically restrained jointing systems may be used to avoid the need for thrust and anchor blocks subject to the approval of Council.

8.3.10 Reservoirs and Pumping Stations

Where reservoirs or pumping stations are required, reference shall be made to Council for its specific requirements.

WSA 03 contains design criteria for pumping stations and reservoirs.

8.3.11 Valves

8.3.11.1 General

Valves are used to:

1. Isolate reticulation mains from distribution mains.
2. Isolate smaller reticulation mains from larger reticulation mains.
3. Isolate planning zone boundaries, for example, industrial, residential, or commercial.

Valves shall be provided:

1. Each side of state highways, arterial roads, and railway crossings.

2. Adjacent to street intersections (for ease of location).
3. In the footway, clear of roadway, where possible.
4. Valves shall generally be placed on two of the three legs at a tee intersection or on three of the four legs of a four-way intersection so as to limit the number of properties without water during shutdown.

Subject to these considerations, valve numbers shall be minimised.

Council should be consulted to establish the local requirement for connection type (flange or socket), as well as any other issues such as valve anchoring requirements.

8.3.11.2 Siting of Valves

For standardization, valves shall be placed as safe a location as possible, and in line with transverse street boundaries. The siting of valves shall take a holistic view of the existing infrastructure and proposed additions, and safety in design for future maintenance. General principles to be considered shall include:

1. Valves shall be sited to provide the control (such as flow, pressure, isolation, and diversion) required by Council.
2. Ready access to valves to enable their safe operation. Account shall be taken of traffic and other site peculiarities.
3. Minimisation of inconvenience to the public by avoiding clustering of surface fittings in the footpath at intersections.
4. Optimisation of the number and location of valves to meet Council's operation and maintenance requirements, safe working, and to minimise the effect of a shutdown on Council's customers.

8.3.11.3 Gate Valves

Valves shall have anticlockwise rotation of the input spindle for closure, unless otherwise specified by Council. Gate valves DN ≤50 (commonly called peet valves) shall be clockwise closing unless otherwise specified by Council.

Buried gate valves shall be operated from above ground and shall be designed to facilitate the use of a standard key and bar. An extension spindle shall be incorporated as necessary to ensure the top of the spindle is 350 mm below the FSL.

Valves DN ≥80 shall be gate valves. In-line valves shall be the same diameter as the reticulation main.

8.3.11.3.1 Gate Valve Spacing Criteria

For Diameters than 80mm, the number of property service connections in a shut -off area shall be in accordance with Table 33. When assessing property service numbers, unit title and strata title properties such as apartment buildings and multi-unit developments shall be counted as multiple connections. All connections having an alternative supply may be excluded when assessing property service numbers. The overriding maximum spacing between in-line valves shall be in accordance with Table 33.

Table 33: Valve Spacing Criteria

Water Main Size (DN)	Number of Property Service Connections (Nominal)	Maximum Spacing (m)
≤150	40	300*
200-300	100	750
375	150	1,000
In rural areas the maximum spacing is 500 mm		

8.3.11.3.2 Pressure Zone Dividing Valves

Pressure zone dividing valves and hydrants shall be installed in one of the following arrangements (see Figure 13):

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

8.3.11.3.3 Secure Service Connections for Maintaining Supply to Critical Users

Additional stop valves may be provided at a service connection to a customer requiring a greater security of supply such as hospitals and large industrial or commercial developments. Figure 14 illustrates typical arrangements to facilitate partial isolation of the main while maintaining supply to the customer.

Figure 12: Branch Valve adjacent to Main

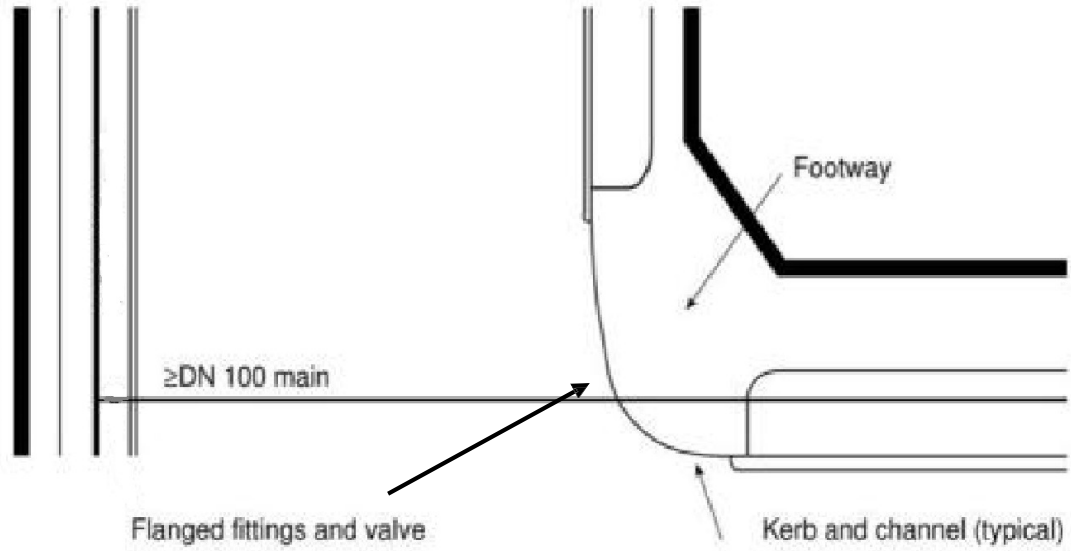


Figure 13: Valve and Hydrant Combinations for Pressure Zone Dividing Valves

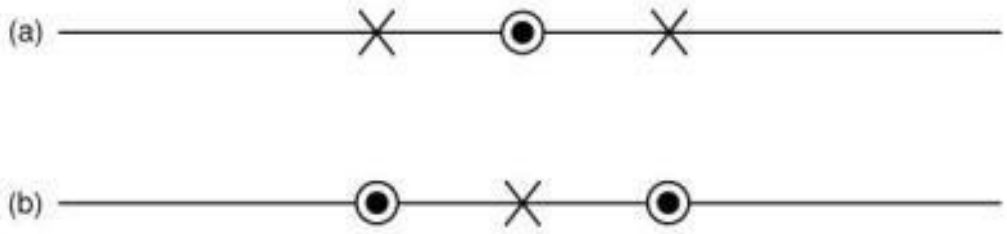
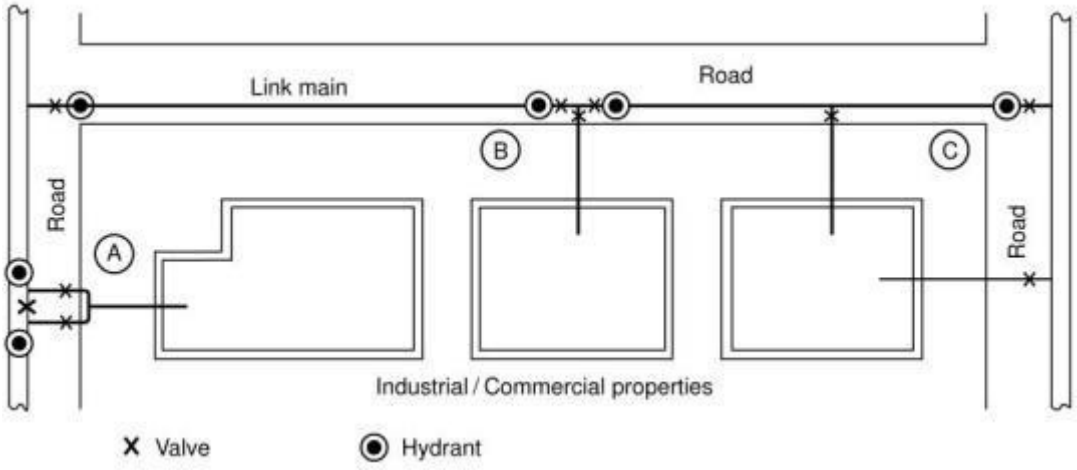


Figure 14: Secure Connection for Critical Users



NOTE:

1. Example A - feed from two directions off a large diameter water main. The arrangement is more complicated than Example B, but is justified by the cost of an additional large diameter stop valve which would be required if using Example B.
2. Example B - feed from two directions off a smaller diameter main. This is a simpler arrangement than Example A - but requires two valves on the main.
3. Example C - feed from two separate mains.

8.3.11.4 Butterfly Valves

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

C8.3.12.4

Butterfly valves are not normally used in reticulation mains as they hinder swabbing operations, and the quick closing action can induce high surge pressures.

8.3.11.5 Pressure Reducing Valves

Pressure reducing valves (PRV) are outside the scope of this Standard. Refer to WSA 03.

C8.3.12.5

A PRV is used to reduce the pressure upstream of the PRV to a desired lower downstream pressure. The PRV works automatically to maintain the desired downstream pressure. Refer to WSA 03 for design criteria

8.3.11.6 Air Valves

8.3.11.6.1 Installation Design Criteria

Investigation into the need for air valves (AVs) shall be made for all high points on mains, particularly at points more than 2 m higher than the lower end of the section of water main and particularly if the main has a steep downward slope on the downstream side.

Where the hydraulic head is less than 10 m, special consideration shall be given to the type of AV to prevent water leakage from the valve. AVs shall be installed with an isolating valve to permit servicing or replacement without having to shut down the main.

Combination AVs, that is (dual) AVs incorporating an AV (large orifice) and an air release valve (small orifice) in a single unit, are generally the preferred type for distribution and transfer mains, and where required on reticulation mains.

The nominal size of the large orifice of air valves shall be DN 80 for installation on mains. This size has an exhaust capacity of approximately 0.3 m 3/s.

C8.3.12.6.1

Water mains with only a few service connections or a configuration that leads to air accumulation may require combination air valves to automatically remove accumulated air that may otherwise cause operational problems in the water system.

The configuration of the distribution network for both the change in elevation and the slope of the water main governs the number and location of air valves required.

8.3.11.6.2 Air Valves Location

Air valves shall not be located in major roadways or in areas subject to flooding. When required, air valves shall be located:

1. At summits (high points).
2. At intervals of not more than 800 m on long horizontal, ascending, and descending sectors.
3. At every increase in downward slope.
4. At every reduction in upward slope.
5. On the downstream side of PRVs.
6. On the downhill side of major isolating valves.
7. At blank ends.

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

8.3.11.7 Scours and Pump-Out Branches

Scours and pump-out branches are provided in the distribution network for maintenance purposes. They are designed to allow draining of water from the mains by gravity or use of a mobile pump.

Hydrants may be used for flushing and draining on water mains DN <300.

On mains DN ≥300, scours are more effective in draining and provide greater flushing velocities than hydrants.

Scours and pump-out branches shall incorporate appropriate measures to prevent back siphonage into the water supply system.

There shall be adequate drainage facilities to receive the flow resulting from flushing and draining operations. Scours shall:

1. Drain the water main by gravity or have provision for pump-out within a period of one hour, or both.
2. Have a diffuser fitted at the discharge point if there is a likelihood of environmental or asset damage.
3. Not be subject to inundation.

8.3.11.7.1 Scour Size

Scours shall be in accordance with Table 34.

Table 34: Minimum Scour Size

Main Size (DN)	Scour Size (DN)
DN ≤ 200	80
DN > 200 – DN ≤ 300	100
DN > 300 – DN ≤ 375	150

8.3.11.7.2 Scour Locations

Scours shall be located at:

1. Low points at the ends of water mains.
2. Low points between in-line stop valves.

Scours shall drain to a point where the discharge is readily visible to prevent the scour valve inadvertently being left open.

Typical discharge locations include:

1. An approved pit that is to be pumped out each time the scour is operated (called a pump scour).
2. A kerb and channel.
3. An open-grated street drainage sump.
4. A natural water course (with energy dissipater).
5. Scours shall not:
6. Cause damage when operated.
7. Discharge to closed stormwater structures.
8. Discharge directly to waterways, unless in compliance with the appropriate consent requirements.

8.3.11.8 Flushing Points

Flushing points, in the form of a hydrant, shall be installed at the end of reticulation mains (see Standard Drawing W1).

8.3.12 Hydrants

8.3.12.1 General

Hydrants are installed on reticulation mains for firefighting or operational purposes. Operational purposes include mains flushing, chlorination, to allow the escape of air during charging, and the release of water during dewatering of the water main, where air valves and scours are not installed..

8.3.12.2 Hydrant Installation

Fire hydrants shall not be fitted to reticulation mains DN <100 or to distribution or transfer mains without the prior written approval of Council.

8.3.12.3 Hydrants for Reticulation System Operational Requirements

Additional to firefighting requirements, hydrants shall be provided at:

1. High points on reticulation mains to release air during charging, to allow air to enter the main when dewatering, and for manual release of any build-up of air, as required, where automatic combination AVs are not installed.
2. Localised low points on water mains to drain the water main where scours are not installed.

Adequate drainage facilities shall be provided to receive the hydrant flows from dewatering and flushing operations.

C8.3.13.4

AVs are not normally required on reticulation mains in residential areas where the configuration of mains and service connections will usually eliminate small amounts of air accumulated during operation; hydrants should be placed as close as possible to stop valves to facilitate maintenance activities such as cleaning of water mains.

8.3.12.4 Hydrant Ends of Mains

If a scour is not provided, a hydrant shall be installed as close as possible to the end of every main DN ≥100.

C8.3.13.5

Apart from the firefighting function, a hydrant also allows the section of dead end main to be flushed regularly to ensure acceptable on-going water quality. This is particularly important in new subdivisions where only a small number of properties may be connected initially and where the main has been laid in a larger than required size with the expectation that it will be extended at a future date.

8.3.13 Connections

8.3.13.1 Connection of New Mains to Existing Mains

In specifying connection detail, the designer shall consider:

1. Pipe materials, especially potential for corrosion.
2. Relative depth of mains.
3. Standard fittings.
4. Pipe restraint and anchorage.
5. Limitations on shutting down major mains to enable connections.
6. Existing cathodic protection systems.

Connections from the end of an existing main shall be designed to address any differing requirements for the pipes being connected, particularly restraint, spigot/socket joint limitations, and corrosion protection. The designer shall consider the potential for insufficiently restrained/ anchored stop valves near the connection.

All connections to the existing reticulation shall be made by a contractor approved by Council.

8.3.13.2 Property Service Connections

Property service connections shall be DN25mm PE pipe installed perpendicular to the main, terminating 1.0 m inside the property boundary (refer Standard Drawings W20-W21). Each property connection shall be fitted with an Accuflow manifold system complete with stopcock, backflow protection in a meter box and located adjacent to the property road boundary in the road reserve. Pipe shall be PE80B of pressure rating 12.5 bar. Tapping bands shall be the full encirclement type to AS/NZS 4793 for all pipes except PE. For PE pipes, approved thermoplastic tapping saddles shall be used.

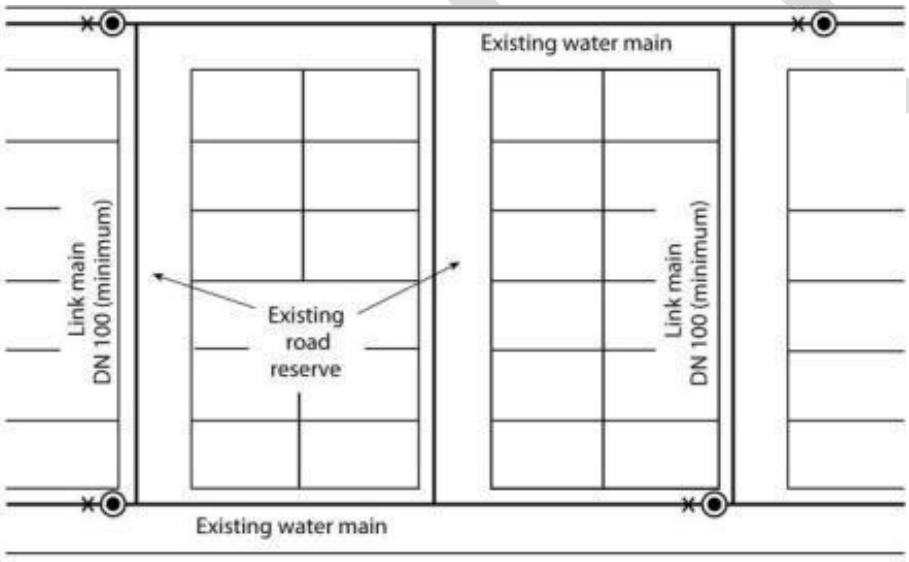
8.3.13.3 Termination Points

Termination points or dead ends should be avoided to prevent poor water quality. Alternative configurations such as a continuous network, link mains, looped mains, and the use of reticulation mains smaller than DN 100, particularly in no-exit roads, should be considered (see

Figure 15 and

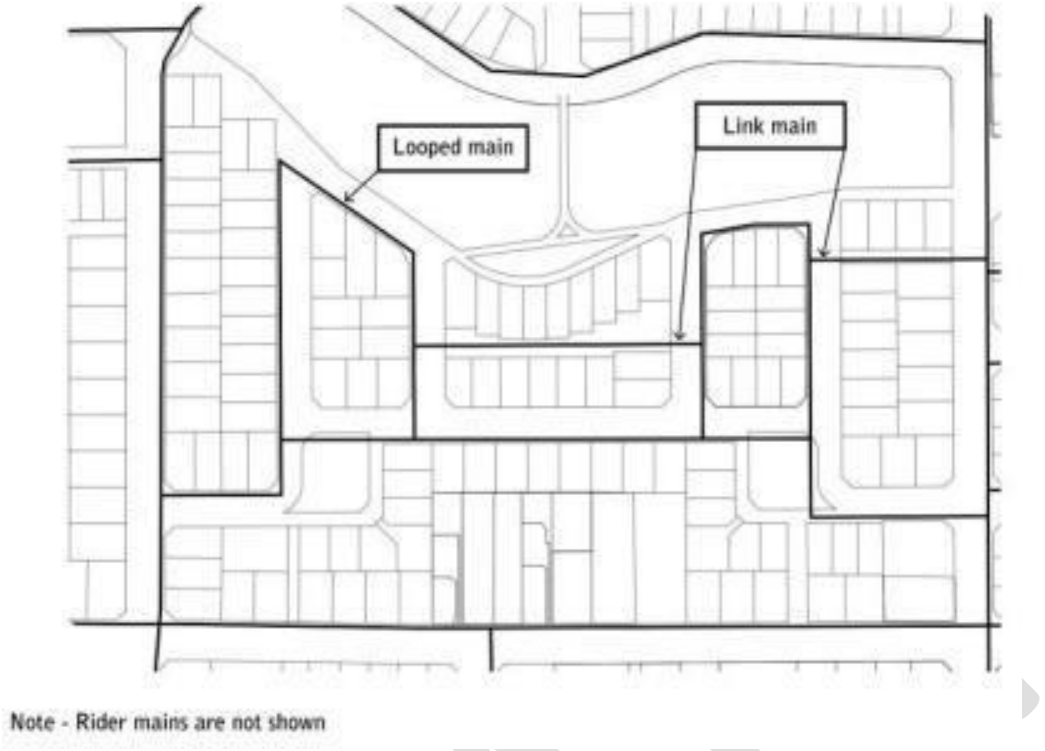
Figure 16).

Figure 15: Elimination of Termination Points



NOTE – Rider mains are not shown.

Figure 16: Looped and Link Principal Mains



8.3.13.4 Permanent Ends to Water Mains

The DN 100 main shall be laid to a point where all properties are provided with the fire protection required by SNZ PAS 4509.

A method of flushing shall be provided at the end of the water main, which shall be suitably anchored.

8.3.13.5 Temporary Ends of Water Mains

Water mains shall be laid to within 1 m of the boundary of a subdivision where the main is to be extended in the future.

Temporary dead-end mains shall terminate with a hydrant followed by a gate valve. The valve and hydrant shall be suitably anchored so that the future extension can be carried out without the need to disrupt services to existing customers

Where a development is staged, mains shall be constructed to terminate approximately 2 m beyond the finished road construction to ensure that future construction does not cause disruption to finished installations.

8.4 Approval of Proposed Infrastructure

8.4.1 Information to be Provided

Design drawings compatible with Council's concept plan and the design parameters included in this Code of Practice shall be provided to Council for approval. Applications for design approval shall include the information outlined in Section 3 of this Code of Practice. Designers shall ensure the following aspects have been considered and where appropriate included in the design:

1. The size (or sizes) of pipework throughout the proposed reticulation system.
2. Selection of appropriate pipeline material type/s and class.
3. Mains layouts and alignments including:
    a. Route selection;
    b. Topographical and environmental aspects;
    c. Easements;
    d. Foundation and geotechnical aspects;

e. Clearances, shared trenching requirements;
f. Provision for future extensions.

4. Hydraulic adequacy including:
    a. Compliance with the required maximum and minimum operating (working) pressure; Acceptable flow velocities;
    b. Compliance with the estimated water demand, including firefighting.
5. Property service connection locations and sizes.
6. Types and locations of appurtenances, including
    a. Stop valves;
    b. Pressure reducing valves (PRVs);
    c. Hydrants and fire services;
    d. Scours and pump-out branches;
    e. Termination details.
    f. Locations and details of thrust blocks and anchors, see NZS 4404 WS-004 and WS-005.
    g. Preparation of final design drawings, plans (and specifications if applicable).

8.5 Construction

8.5.1 Excavation

Excavation of existing carriageways shall conform to Council's road opening procedures (CAR, Carriageway access request). Excavation in existing carriageways shall be carried out in a safe manner with the minimum disruption to traffic and pedestrians.

8.5.2 Embedment

Pipes and fittings shall be surrounded with a suitable bedding material in accordance with NZS 4404 CM- 001 and NZS 2566.

8.5.3 Backfilling and Reinstatement

8.5.3.1 Carriageways

Backfilling shall be in accordance with the requirements of Council.

Pipe trenches within a carriageway shall be backfilled using an approved hardfill (maximum size AP65) placed immediately above the pipe embedment and compacted in layers not exceeding 200 mm in loose depth.

In existing sealed roads, the top section of the trench shall be backfilled as specified in 5.4.2.3. The depth of base course and type of finishing coat seal shall conform a s a m i ni m um to the standard of the existing road construction.

8.5.3.2 Berms

Pipe trenches under grass berms and footpaths shall be backfilled in accordance with the requirements of NZS 4404 CM-001.

8.5.3.3 Detector Tape

Open trenching - backfill shall be placed up to the bottom of the existing road basecourse. At this point, where required by Council, the contractor shall provide and lay metallic 'detector' tape coloured blue, stipulating 'Danger - Water Main Below' (or similar).

8.5.4 Pressure Testing of Water Mains

Before a new water main is connected to the existing reticulation, a successful pressure test shall be completed. The system test pressure is applied to test the integrity of construction of the pipeline system. The system test pressure will be the pressure rating of the pipe used, generally exceeds the actual design pressure of the system (maximum 1.25 times the maximum rated operating pressure of the lowest rated component in the system). See Section 7.7 for the appropriate testing procedure.

8.5.5 Disinfection of Water Mains

Disinfection of the water mains shall be carried out following successful pressure testing and backfilling as specified in Section 5. The disinfection solution shall be collected and disposed of in an appropriate manner to an approved disposal site.

8.5.6 Discharge of Testing Waer

Discharge of testing or chlorinated water from pipelines may require a resource consent from the regional council.

8.5.7 Water Sampling

Council may require water samples to be taken for water quality compliance purposes.

8.6 Rural Water Supplies

Sufficient information shall accompany subdivision applications to ascertain:

1. If the property is connected to any rural water supply scheme.
2. If the new allotments will be connected to any scheme.

The application process to connect to any scheme is independent of the subdivision process: a connection is not compulsory and if a connection cannot be made this does not negate the subdivision application.

Prior to making application for the issue of the Section 224(c) certification by the Council, the consent holder shall:

1. Apply to Council for installation of separate water connections to each allotment requiring a supply. A scheme plan for any alterations to the rural water scheme shall be included with the application, and all applications shall be subject to Council's usual terms, conditions and fees, and any special conditions that may apply.

   NOTE: Only applies when the water allocated to the property is to be redistributed.

2. Arrange for all existing internal water supply lines that cross the new subdivisional boundaries to be disconnected. The disconnections shall be left uncovered until they have been inspected by Council or its representative, to verify that disconnection has been completed. The consent holder shall notify Council. At least two working days prior notice is required.
3. Arrange for a surveyor to prepare as-built drawings showing the revised water reticulation layout, detailed within an accuracy of +/- 0.5 m. Certification of the scheme plan will not be completed until this verification has been made.

   NOTE: Only applies when the water allocated to the property is to be redistributed.

4. Pay Council's fees to cover processing, inspection costs and updating of records by Water and Waste Services.
5. Arrange for Council's maintenance contractor to install any new connection to an existing main and any new tank and fittings.
6. Provide information required in Clutha District Councils As-Built Specification for Water Services.

Conditions (b) and (c) will be imposed on all consents where the existing property is connected to a rural water scheme. This condition protects the owner of an allotment connected to a scheme from having other properties connect via their property, as well as ensuring continuation of supply for all consumers.

Where water allocations are assigned to new parties through a subdivision process, Council will continue to bill the previously designated parties until a change of ownership is formally advised.

Where a property is within a rural water supply scheme area but is not connected no condition will be imposed requiring the property to be connected. However, applicants are encouraged to consider the benefits of connecting to a scheme. Applications for connection to any rural water supply scheme shall be made by a separate application through Council's Water and Waste Department.

8.7 Field Testing of Pipelines

8.7.1 Scope

This Section is based on some of the test methods in AS/NZS 2566.2, Section 6, and associated appendices. It specifies suggested methods of test and their application to field testing of pipelines for the purpose of determining pipeline acceptability. Field testing includes leak or hydrostatic pressure testing, as appropriate, for pressure and non-pressure pipelines. Testing may also be carried out in accordance with the material-specific and application-specific test methods of AS/NZS 2032, AS/NZS 2033, and AS/NZS 2566.2..

8.7.1.1 Purpose of Field Testing

The purpose of field testing is to:

1. Reveal the occurrence of faults in the laying procedure, for example, joints incorrectly installed, or pipes damaged.
2. Reveal the occurrence of faults in the assembly procedure of pipeline components, for example, tapping bands, maintenance structures, frames, and covers.
3. In the case of pressure pipelines, determine that the pipeline will sustain a pressure greater than its design pressure without leakage.
4. In the case of non-pressure pipelines, determine that the pipeline satisfies the requirements for infiltration and exfiltration.
5. Test the installed structural integrity of the pipeline.

Field testing is not intended to supplement or replace the test requirements of product standards.

8.7.2 Non-Pressure Pipelines – Field Leakage Testing

Leakage testing is used to reveal locations of potential infiltration and exfiltration due to the inclusion of damaged pipes, seals, or incorrectly made joints in the pipeline at the completion of installation.

Leakage testing for acceptance of non-pressure pipelines shall be carried out by at least one of the following methods:

1. Low pressure air testing.
2. Hydrostatic testing.

NOTE: Air tests provide qualitative data only, as air pressure losses cannot be related directly to water leakage rates.

For pipeline test sections installed below the water table, and for submarine pipelines, the test pressure used for the hydrostatic test, and for the air test, shall be increased to maintain the required differential between internal and external pressure..

A pipeline failing to meet the requirements of the air tests may be retested using the hydrostatic test method.

NOTE: A air and/or water test pass does not guarantee acceptance.

8.7.2.1 Low Pressure Air Test

The test length shall be acceptable where the gauged pressure exceeds 18 kPa (or not more than 7 kPa less than the pressure at the start of the test) for the time interval shown in Table 34 after the shut- off of the air supply.

Table 35 is based on an air test pressure of 25 kPa (in excess of any external hydrostatic pressure due to groundwater) and, on this basis, air volume losses shall not exceed the greater of:

1. A rate of 0.0009 m3/(min x m2) of pipe wall area.
2. A rate of 0.056 m3/min, which is regarded as the lowest detectable individual air leak. Column 2 and column 3 of Table 6.8 give the times and lengths up to which (b) prevails over (a). **Note**: For safety reasons air test pressures in excess of 50 kPa should not be applied.

Table 35: Low Pressure Air and Vacuum Tests – Minimum Time Intervals for 7kPa Pressure Change in Pipeline

DN	Minimum Time (minutes)	Maximum Length for Minimum Time to Apply (metres)	Test Length (metres)				
			Minimum Test Duration (minutes)				
			50	100	150	200	250
80	1.5	231	1.5	1.5	1.5	1.5	1.6
100	2	185	2	2	2	2	3
150	3	123	3	3	3	5	6
225	4	82	4	5	8	10	13
300	6	62	6	9	14	18	23
375	7	49	7	14	22	29	36
450	9	41	10	21	31	41	52
525	10	35	14	28	42	56	70
600	11	31	18	27	55	73	92
675	13	27	23	46	70	93	116
750	14	25	29	57	86	115	143
900	17	21	41	83	124	165	207
1,000	19	19	51	102	153	204	255
1,050	20	18.8	56	112	169	225	281
1,200	23	15	73	147	220	294	367
1,50	28	12	115	230	334	459	574

NOTE -
The time interval may be reduced for a proportionate reduction in the allowable pressure drop. Where there is no detectable change in pressure after 1 hour of testing, the section under test shall be deemed acceptable.
This table is based on the following equation:

T = 1.02DikLq
where
T = time for a 7 kPa pressure drop, in seconds
Di = pipeline internal diameter, in metres
q = allowable volume loss in cubic metre/minute/square metre taken as 0.0009 m 3/min.m2
k = 0.054DL but not less than 1
L = length of test section, in metres.
Columns 2 and 3 have been calculated with k = 1.0.

The appropriate air or vacuum test/pressure method for pipes larger than DN 750 should be established by reference to the specifier.

8.7.2.1.1 Low Pressure Air Test Procedure

The procedure shall be as follows:

1. Pump in air slowly until a pressure of 25 +5 −0 kPa is reached. Where the pipeline is below the watertable this pressure shall be increased to achieve a differential pressure of 25 kPa. In no circumstances should the actual pressure exceed 50 kPa.

NOTE: Rapid pressurisation may cause significant air temperature changes, which will affect the testing accuracy.

2. Maintain the pressure for at least 3.0 minutes.
3. Where no leaks are detected, shut off the air supply.
4. Where the pipeline fails the test, repressurise to 25 +5 −0 kPa and check for leaks by pouring a concentrated solution of soft soap and water over accessible joints and fittings.
5. Repair any defects, then repeat steps (1) to (3).
6. With the air supply shut off, monitor the pressure for the time intervals given in Table 35

   The test length shall be acceptable where the pressure drops by 7 kPa, or less, over the required (tabulated) test period.

NOTE:

1. The test length of pipeline should be restricted to pipeline sections between maintenance holes (the most convenient places for inserting test plugs or fixing temporary bulkheads). The method should not be used for test lengths in excess of 250 m and for pipe diameters larger than 600 mm.
2. The procedure for low pressure air testing of large diameter pipelines is potentially hazardous because of the very large forces to be resisted by temporary plugs or bulkheads and the serious consequences of accidental bulkhead blow -out. A relief valve, with a 50 kPa maximum setting, should be installed on all pressurising equipment.

8.7.2.2 Hydrostatic Test

The test length shall be acceptable where the specified allowable make up water is not exceeded. Where not specified, the allowable make up water shall be 0.5 L/hour per meter length per meter diameter.

8.7.2.2.1 Hydrostatic Test Procedure

The procedure shall be as follows:

1. The test pressure shall be not less than 20 kPa, or 20 kPa above the groundwater pressure at the pipe soffit at its highest point, whichever is the greater, and not exceed 60 kPa at the lowest point of the section.
2. Steeply graded pipelines shall be tested in stages where the maximum pressure, as stated above, will be exceeded if the whole section is tested in one length.
3. The pressure shall be maintained for at least two hours by adding measured volumes of water where necessary.
4. Any visible leaks detected shall be repaired and the pipeline shall be retested.

8.7.3 Pressure Pipelines Field Hydrostatic Pressure Testing

The hydrostatic pressure test method shall be as specified.

Hydrostatic pressure testing requires selecting an appropriate configuration of method, pressure, and length of test section.

Test parameters and details shall be determined with due consideration to the following:

1. Pipe material.
2. Pipe diameter.
3. Length of test section.
4. Duration of the test.
5. Magnitude of test pressure and rate of pressurisation.
6. Presence of air in the pipeline.
7. Time required for saturation of porous liners.
8. Potential movement of pipeline thrust restraints.
9. Design pressure for thrust and anchor supports.
10. Accuracy of test equipment.
11. Ambient temperature changes during testing.
12. Presence of leaks in equipment used for testing or equipment attachment points (such as sealing plugs).
13. Potential for leaks in the pipeline.

NOTE: It is advisable to begin testing early in the pipeline installation to confirm adequacy of laying procedures and, where appropriate, to increase the length tested progressively as experience is gained.

8.7.3.1 Selection of Test Pressure

The hydrostatic test pressure at any point in the pipeline shall be:

1. Not less than the design pressure.
2. Not more than 25% above the rated pressure of any pipeline component.

NOTE: The design pressure is the maximum system pressure at a point in the pipeline, considering future developments, static pressure, dynamic pressure, and an allowance for short -term surge pressure (water hammer), as determined by analysis. Compressed air testing shall not be permitted for pressure pipe.

8.7.3.2 Selecting Test Lengths

The pipeline length tested shall be either the whole, or a section (capable of being isolated), of the pipeline depending on the length and diameter, the availability of water, and the spacing between sectioning valves or blank ends.

The pipeline shall be divided into test sections such that:

1. The hydrostatic test pressure at any point in the pipeline is: Not less than the design pressure; and
2. Not more than 25% above the rated pressure of any pipeline component; and
3. Water is available for the test together with facilities for its disposal, in accordance with regulatory requirements, after the test.

NOTE:

1. Pipelines longer than 1000 m may need to be tested in several sections. Where long lengths are to be tested, radio or other electronic means of communication between test operatives, to coordinate test procedures and thus minimise the test duration, is desirable.
2. Long test sections may incorporate a large number of mechanical (that is, flanged) joints, which should be checked for leakage. The longer the test section the harder it is to locate a leak, or discriminate between a leak and the other effects, such as the absorption of air into solution under pressure.

8.7.3.3 Pre-Test Procedures

The pre-test procedures are as follows:

1. All required temporary and permanent thrust blocks, or other pipeline thrust -resisting methods, including integral joint-restraint systems, shall be in place, and all concrete shall be adequately cured (normally a minimum of seven days).
2. Blank flanges or caps shall be installed at the beginning and end of the test section. Testing shall not take place against closed valves unless they are fully restrained and it is possible to check for leakage past the valve seat. Mechanical ends that are not end load resistant shall be temporarily strutted or anchored, to withstand the test pressures without movement.

NOTE: Temporary supports should not be removed until the pipeline has been depressurised. All test personnel should be informed of the loading limits on temporary fittings and supports.

3. Where practicable, all bolted joints shall be left exposed to allow for re-tensioning during or after testing.
4. Compacted embedment and fill material shall be placed to leave all joints, service connections and ball valves exposed wherever possible.
5. For PE pipelines, the pressurising time shall not exceed 45 minutes: **Note:** The pressurising time affects the duration of the PE pipeline test.
6. The test equipment shall be placed in position and checked for satisfactory operation. (g The pump shall be of adequate size to raise and maintain the test pressure:

NOTE: A pump that is too small may increase the test duration or where too large it may be difficult to control the pressure.

7. Two calibrated test gauges shall be used to cross check gauge accuracy.
8. Slowly fill the test length of pipeline with water, preferably from the lowest point, ensuring air is vented at the high point valves. Allow a period, in the range of three hours to 24 hours, for the temperature of the test length and the test water to stabilise and for dissolved air to exit the system. The recommended rate of filling shall be based on a flow velocity of 0.05 m/s, calculated from the following equation:

Qf ≤ 12.5 π D2, where:

Qf = Filling Rate – in litres per second

D = Pipe Diameter – in metres

NOTE: The slow rate of 0.05 m/s avoids air entrainment when the filling water is cascading through downward gradients along the pipeline. The period of stabilisation will depend on pipe dimensions, length, material, longitudinal profile, and air exit points. For cement-mortar lined pipe, the pipeline shall be filled at least 24 hours before the commencement of the test, to allow the lining to become saturated.

NOTE: A firm foam swab may be used ahead of the fill water to assist air removal especially where the pipeline undulates. Extract the swab at a high-point wash-out.

Typical pressure test equipment and location are shown in Figure 17 and Figure 18.

8.7.3.4 Post Test Procedures

After testing, pipelines shall be depressurised slowly. All air venting facilities shall be open when emptying pipelines. The test water shall be drained to an approved waterway and all connection points shall be reinstated.

Figure 17: Typical Pressure Pipeline under Field Hydrostatic Test

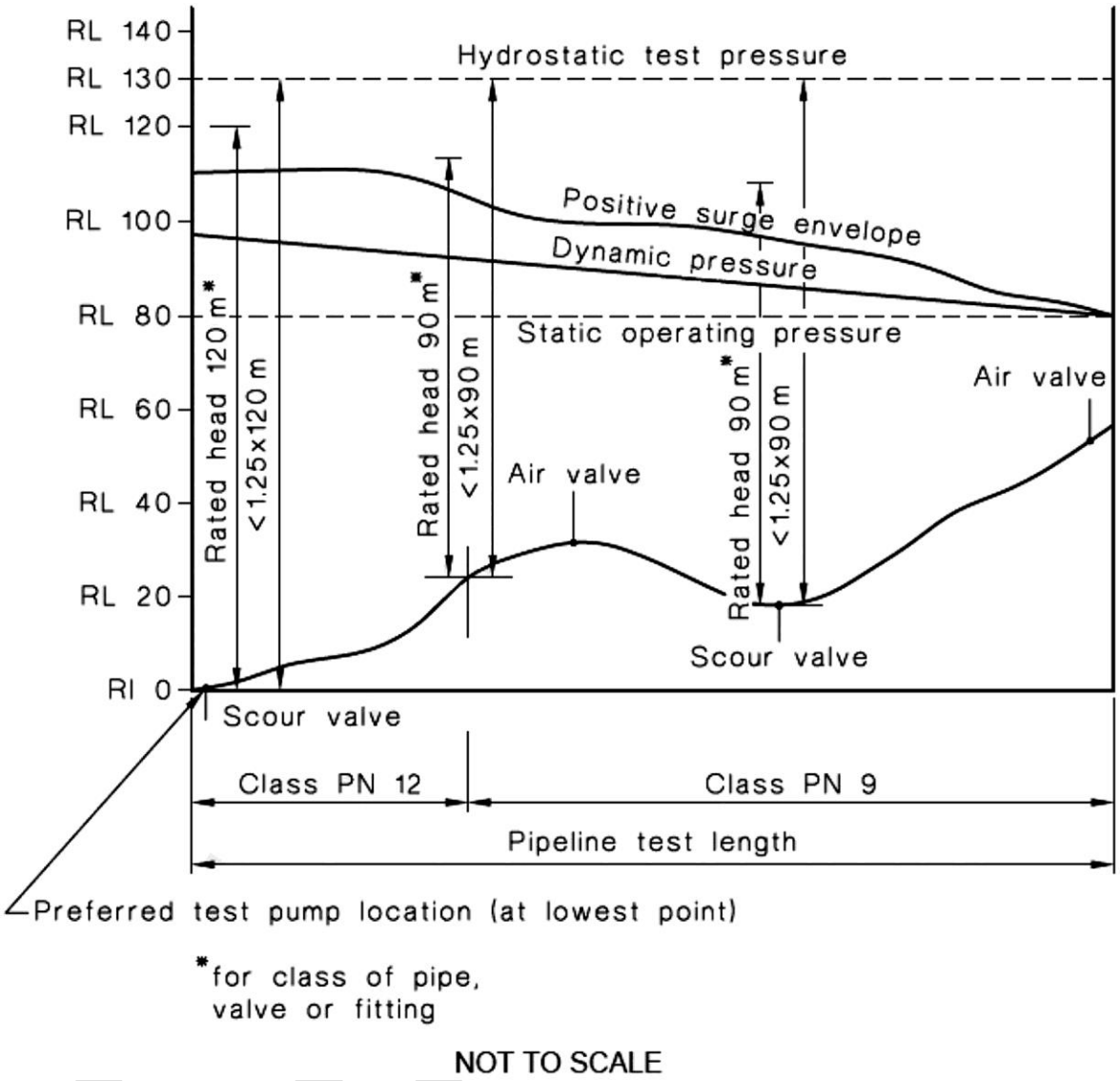
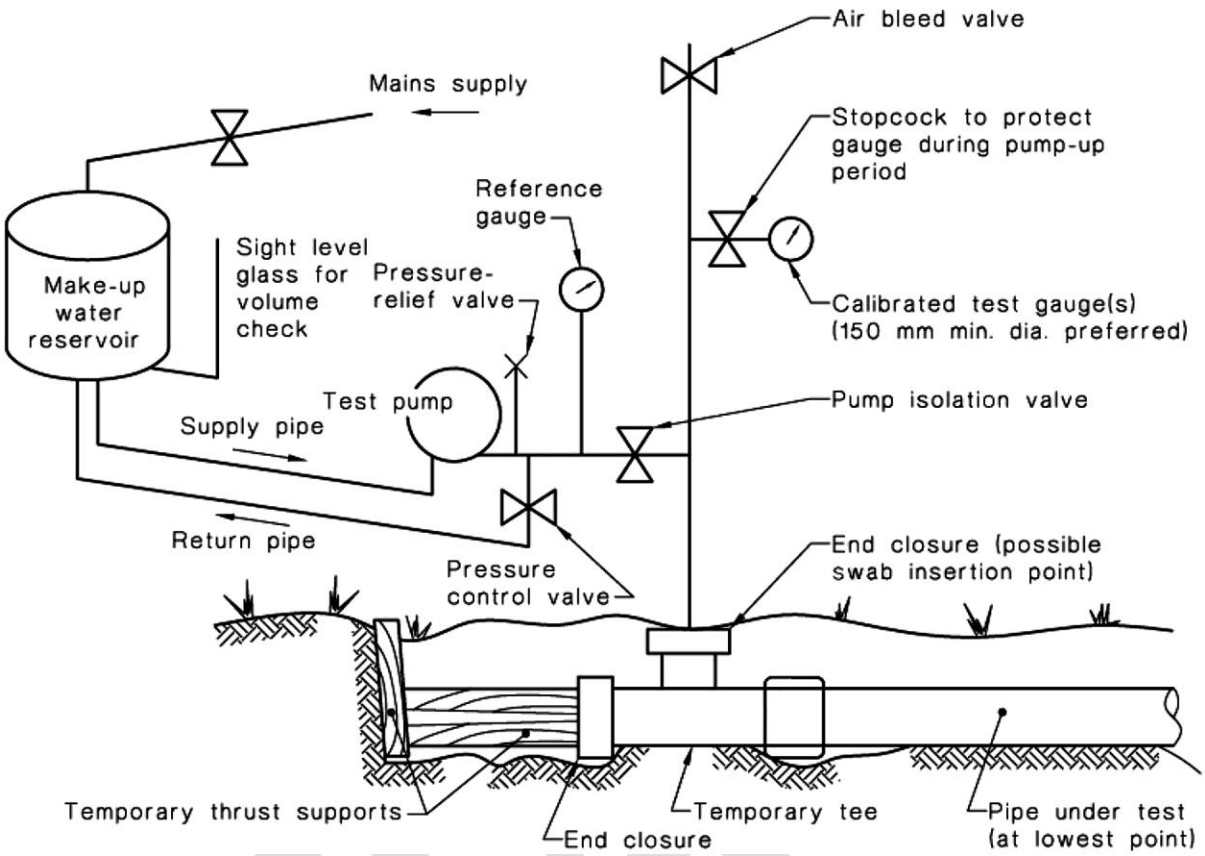


Figure 18:Typical Field Pressure Test Equipment Layout



8.7.3.5 Constant Pressure Test (Water Loss Method) – PVC, DI, GRP and Steel Pipelines

This test is applicable for PVC, DI, GRP, and steel pipelines. The test length may be several kilometres in length.

8.7.3.5.1 Details of Procedure

The procedure shall be as follows:

1. Close all valves apart from the test pump input and pressurise the test length to the specified test pressure (STP) - see Section 8.7.3.1
2. Apply and then maintain the test pressure by the addition of measured and recorded quantities of make-up water at regular intervals over a period, in the range of 1 hour to 12 hours.
3. Where pressure measurements are not made at the lowest part of the test length, make an allowance for the static head, between the lowest point of the pipeline and the point of measurement, to ensure that the test pressure is not exceeded at the lowest point.

The quantity of make-up water necessary to maintain the test pressure shall comply with the following equation:

$Q \leq 0.14\ LDH$ where:

Q = Allowable Make-Up Water – in litres per hour L = Length of the Test Length – in kilometres

D = Nominal Diameter of the Test Length – in metres

H = Average Test Head over Length of Pipeline under Test – in metres

NOTE: The make-up water is not a leakage allowance but is an allowance to cover the effects of the test head forcing small quantities of entrapped air into solution. Normally the test should last for a minimum of two hours and be concluded within

five to eight hours. The make-up water requirement should reduce with time as air goes into solution. Where, after 12 hours the make- up water still exceeds the allowable limit, testing should cease, and the cause of loss investigated.

8.7.3.5.2 Acceptance

1. test length shall be acceptable where there is no failure of any thrust block, pipe, fitting, joint, or any other pipeline component.
2. There is no physical leakage.
3. The quantity of make-up water necessary to maintain the test pressure complies with Section 8.7.3.5.1.

8.7.3.6 Constant Pressure Test (Water Loss Method) for Viscoelastic Pressure Pipelines

This test is applicable to PE, PP, and ABS pressure pipelines. The test lengths may be several kilometres in length.

NOTE: This method is based on VAV P78, as outlined in AS/NZS 2566.2, Appendix A The procedure shall be as follows:

1. Purge the air from pipeline.
2. Apply the specified test pressure (STP) (see Section 8.7.3.1) to the test length.
3. Shut off main and allow pressure to settle for 12 hours (pressure will drop significantly).
4. Re-apply and maintain test pressure for 5 hours by successively pumping a sufficient amount of water.
5. Measure and record water volume (V 1 in litres) required to maintain this pressure between Hour 2 and Hour 3.
6. Measure and record water volume (V 2 in litres) required to maintain this pressure between Hour 4 and Hour 5.
7. Calculate:

0.55 V 1 + Q

Where Q is the allowable make-up Volume obtained from Section 8.7.3.5.1.

ACCEPTANCE: - The test length shall be acceptable where:

1. The test length shall be acceptable where there is no failure of any thrust block, pipe, fitting, joint, or any other pipeline component.
2. There is no physical leakage; and
3. V 2 ≤ 0.55 V 1 + Q.

8.7.3.7 Pressure Rebound Method for Viscoelastic Pressure Pipelines

This test is applicable to PE, PP, and ABS pressure pipelines up to and including DN 315, where a short test time is required.

NOTE: This test is based on BS EN 805:2000, Appendix A (refer to AS/NZS 2566.2).

8.7.3.7.1 Pressure Measurement Rig

The test rig shall be a recently calibrated pressure transducer, data logger, and check pressure gauge that has a dial of at least 100 mm diameter and a pressure range that places the specified test pressure (STP) (see Section 8.7.3.1) in the range 35% to 70% of the gauge's full scale. The transducer and the check gauge shall read within ±5% of each other. If they do not agree within this tolerance, the equipment shall be recalibrated or replaced.

8.7.3.7.2 Procedure

The test procedure has the following three phases:

1. A preliminary phase in which the pipeline is:
    a. Depressurised and allowed to relax after the pre-test procedure in Section 8.7.3.3;
    b. Pressurised quickly to the test pressure and maintained at this pressure for a period of time without further water being added;
    c. The pressure is allowed to decay by viscoelastic creep;
    d. Provided the pressure drop does not exceed a specified maximum, the pressure test can proceed to the second phase.
2. A phase in which the volume of air remaining in the pipeline is assessed against an allowable maximum.

3. The main test phase in which the pipeline is maintained at the test pressure for a period of time and decay due to viscoelastic creep commenced. The creep is interrupted by a rapid reduction of the pressure in the pipeline to a specified level. This rapid reduction in pressure results in contraction of the pipeline with an increase (rebound) in pressure. If during the rebound period, the pressure versus time record shows a fall in pressure, the pipeline fails the test.

8.7.3.7.3 Preliminary Phase

The procedure shall be as follows:

1. Reduce pressure to just above atmospheric at the highest point of the test length and let stand for 60-minutes. Ensure no air enters the line.
2. Raise the pressure smoothly to STP in less than 10 minutes. Hold the pressure at STP for 30- minutes by pumping continuously, or at short intervals as needed. Do not exceed STP.
3. Inspect for leaks during the 30- minute period, then shut off pressure.
4. Allow the pressure to decay for 60-minutes.
5. Measure the pressure remaining at 60-minutes (P60).
6. If P60 ≤ 70% of STP the test is failed. The cause shall be located and rectified. Steps (a) to (e) shall be repeated. If P60 > 70% of STP, proceed to the air volume assessment.

8.7.3.7.4 Air Volume Assessment

The procedure will be as follows:

1. Quickly (<5 min) reduce pressure by ΔP (10%-15% of STP).
2. Measure water volume bled out (ΔV).
3. Calculate ΔVmax allow able as follows:

   ΔVmax allow able = 1.2 × V × ΔP(1/EW + D/ER) where

   1.2 = Air Allowance

   V = Pipe Volume – in litres

   ΔP = Measured Pressure Drop – in kilopascals

   D = Pipe Internal Diameter – in metres

   ER = Pipe Material Modulus – in kilopascals (see Table 36)

   EW = Bulk Modulus of Water – in kilopascals (see Table 37);

4. If ΔV > ΔV max allow able the test has failed. The cause shall be located and rectified. The preliminary phase shall be repeated. If ΔV ≤ ΔV max allow able, proceed to the main test phase.

NOTE: ΔV and ΔP should be measured as accurately as possible, especially where the test length volume is small.]

8.7.3.8 Main Test Phase

Observe and record the pressure rise for 30-minutes.

In the event of failure, locate and repair leaks. If failure is marginal or doubtful, or if it is necessary to determine leakage rate, use a reference test (see Section 8.7.3.4).

NOTE: Figure 18 gives an example of a full pressure test with the main test phase extended to 90-minutes.

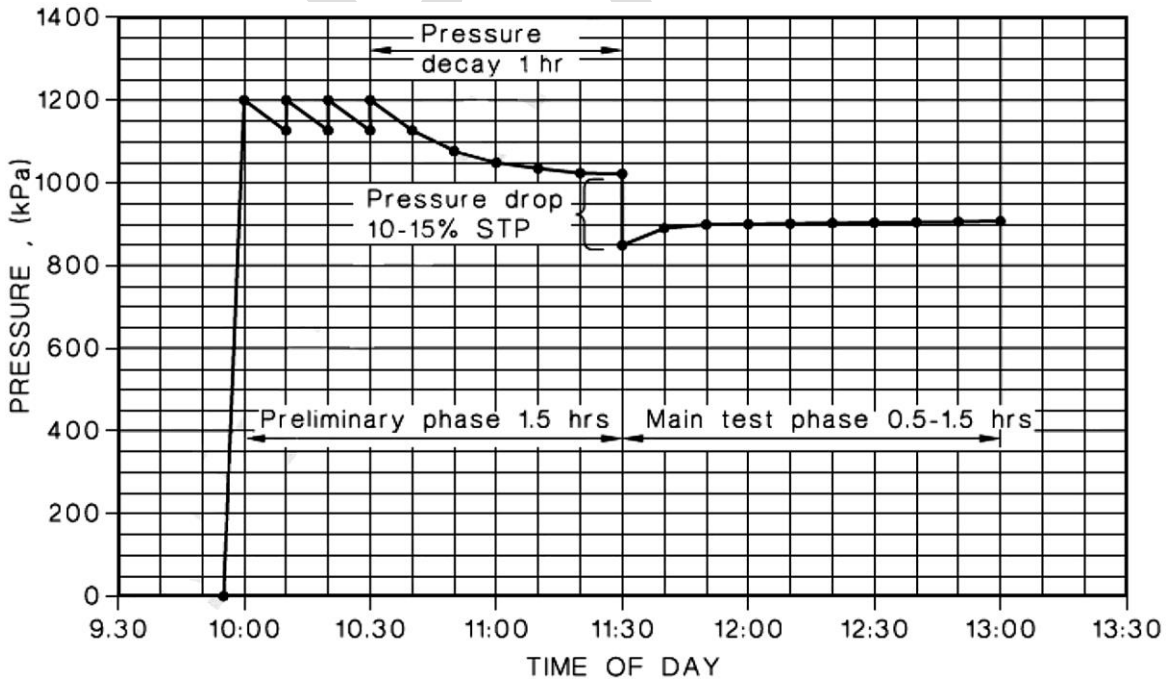
Table 36Pipe E Material Modulus for PE 808 and PE 100:

Temperature (°C)	PE 808 - E Modulus (kPa x 10^3)			PE 100 – E Modulus (kPa x 10^3)		
	1 hour	2 hour	3 hour	1 hour	2 hour	3 hour
5	740	700	680	990	930	900
10	670	630	610	900	850	820
15	500	570	550	820	780	750
20	550	520	610	750	710	680
25	510	490	470	690	650	630
30	470	450	430	640	610	600

Table 37: Bulk Modulus Ew – Water

Temperature (^{0}C)	Bulk Modulus (kPa x 10^3)
5	2080
10	2110
15	2140
20	2170
25	2210
30	2230

Figure 19: Typical successful Modified Rebound Test for a PE Pipeline



8.7.3.8.1 Acceptance

The test shall be acceptable if:

1. There is no failure of any thrust block, pipe, fitting, joint, or any other pipeline component.
2. There is no physical leakage.
3. The pressure rises or remains static in the 30-minute period.

If doubt exists about the pressure recovery, the monitoring period may be increased to 90 minutes, and any pressure drop that does occur shall not exceed 20 kPa over the 90-minute period.

If the pressure drops by more than 20 kPa during the 90-minute extended period, the test fails.

Repetition of the main test phase shall only be done by carrying out the whole test procedure, including the relaxation period of 60 minutes.

8.7.3.9 Visual Test for Small Pressure Pipelines

This test is applicable for small pipelines of all materials (less than 200 m in length), and pipelines where pipeline joints have been left exposed for the test operation (such as coiled pipe).

8.7.3.9.1 Procedure

The procedure shall be as follows:

1. The test pressure shall be applied and the test section isolated by closing the high point air release valves and the pump feed valve.
2. The test section shall be visually inspected for leakage at all joints, especially bolted joints, all fittings, service connections, and ball valves.
3. Pressure gauges shall be checked to ensure that pressure has not fallen significantly indicating an undetected leak.
4. Any detected leak shall be repaired and the section shall be retested.
5. Where no leak is detected, high point air release valves shall be opened, the pipeline shall be depressurised to slowly drain the line into an approved waterway and all connection points shall be reinstated.

8.7.3.9.2 Acceptance

The test length shall be acceptable where:

1. There is no failure of any thrust block, pipe, fitting, joint, or any other pipeline component.
2. There is no physical leakage.
3. There is no pressure loss indicative of a leak.

8.8 Water Supply Disinfection Specification

8.8.1 Disinfection of Pipelines and Fittings

After flushing the main to remove all debris and air, the main shall be filled with water containing a free available chlorine concentration of 15 g/m 3 ± 5 g/m3 and allowed to stand for a minimum of 12 hours for all new mains. At the end of the disinfection period, the free available chlorine (FAC) concentration shall be at least 5 g/m 3. If the FAC is less than 5 g/m 3 at the completion of the period, the disinfection shall be repeated until a satisfactory result is obtained. Note that the main should not be drained after flushing unless all high points are 'vented' to allow for complete removal of air.

Under no circumstances will the use of handfuls of hypochlorite powder or chlorine tablets dumped into the pipe and hydrant tees be an acceptable practice.

The sterilising solution should be fed by gravity or pumped into one end of the main and the 'flushing' water in the pipe displaced out of the opposite end of the main until tests carried out show that the water being displaced contains the full FAC concentration. The authorised officer will arrange for testing of the FAC concentration, and to this end, the contractor shall give 24-hour's notice of intention to sterilise.

The contractor shall provide all temporary fittings necessary to allow for the introduction of the sterilising solution to and its removal from the main.

The above is a general guide and Councils Three Waters disinfection standards and process must explicitly be followed.

See also Section 8.8.3

8.8.2 Methods of Introducing the Sterilisation Solution

Methods of introducing sterilising solution will depend on the volume of solution required for the particular main and the availability of appropriate equipment.

In general, wherever the pipe volume is less than 10 m 3, the most practical method is to add sufficient calcium or sodium hypochlorite (powder or solution) to a potable water tanker suitable for carrying potable water to achieve the desired 15 g/m 3 FAC concentration. (This may require two tankers full).

For greater quantities, the sterilising solution may be injected into the main using a portable gas chlorinator or a hypo-chlorinator. An approved backflow preventer shall be installed if either of these options is used.

8.8.3 Disposal of Sterilising Solution

After the satisfactory completion of the sterilising process, the chlorine solution shall be flushed into the sanitary wastewater pipe or, alternatively, retained in a temporary surface storage pond until Council's authorised officer is satisfied that the FAC has reduced to a satisfactory concentration before being allowed to flow down the stormwater drainage system or into a natural watercourse.

8.8.4 Acceptable Method for Sterilising Mains

1. Use sodium hypochlorite solution. This solution usually has 10% or 15% FAC.
2. Obtain a clean water tanker, as used for potable drinking water. The tanker should have a known water capacity.
3. Measure the required amount of sodium hypochlorite solution into a beak er and pour it into the empty tanker.

NOTE: The final strength of the chlorine to water is to be 15 g/m 3 ±5 g/m3.

4. Fill the tanker to the appropriate volume and ensure the solution is well mixed.
5. Charge the new main with the chlorinated water from the tanker at one end of the main or into a new hydrant through a standpipe. All service pipes and hydrants shall be left open and allowed to run for a couple of minutes. The services and hydrants shall then be closed to allow the highest end of the main to fill completely.

NOTE: The main should ideally be charged from the highest point. This will allow the water to be gravity fed into the main. If this is not possible the water tanker shall have a truck mounted pump to pump the chlorinated water in.

6. Seal off the main and leave it charged with the chlorinated water for 24 hours.
7. Take samples and test for residual chlorine.
8. After 24 hours flush the main well until the chlorine smell is gone. Once the main is connected into the reticulation system it should be flushed thoroughly before the services are connected up.

NOTE: For large Mains, a Water Tanker may not have the required capacity so a Dose Pump System shall be used and approved by the Authorised Officer.

Example:

Calculate the volume of the Mains to be chlorinated – that is 85 metres of 100 mm diameter Main

$$Vol = \frac{85 \times \pi \times 0.1^2}{4} = 0.67^2 = 667.6\ litres$$

Plus 100 metres of 150 mm diameter Main

$$Vol = \frac{110 \times \pi \times 0.15^2}{4} = 1.944^2 = 1{,}944\ litres$$

Total Volume = 1,944 = 667.6 = 2,611.6 litres

The total volume of 2,611.6 litres is less than the volume of the Water Tanker (say 5,000 litres) so calculate how many millilitres of sodium hypo-chlorate is required for the 5,000 litre Tanker to give a final solution 15 g/m^3

$$v = \frac{\mathrm{v} \times \mathrm{c}}{\mathrm{s} \times 10}$$

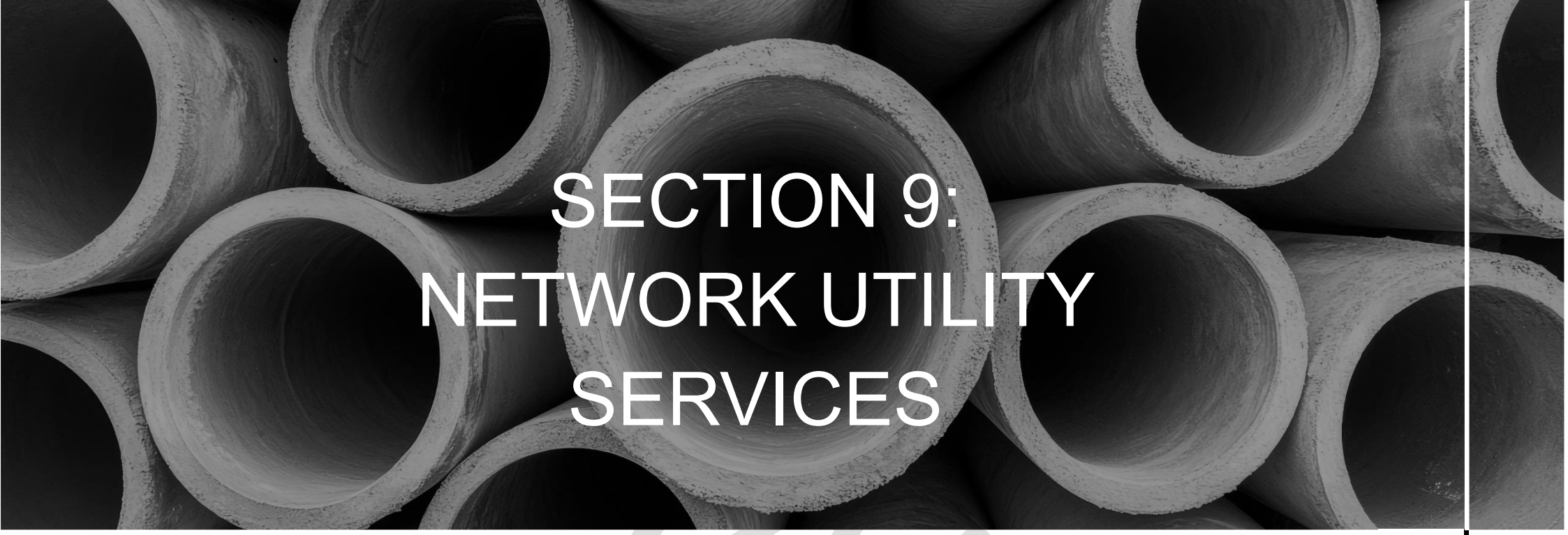
v = volume of sodium hypo-chlorate in ml V = volume of Water Tanker

c = concentration of final solution in g/m3

s = strength of concentrated hypo-chlorate in % FAC (free available chlorine)

$$v = \frac{5000 \times 15}{15 \times 10} = 500\ ml$$

The above is a general guide and Councils Three Waters disinfection standards and process must explicitly be followed.



SECTION 9: NETWORK UTILITY SERVICES

Section 9 Table of Contents

9.1 Scope

This section sets out requirements for the provision of stormwater, wastewater, and water supply systems, power, telecommunications and gas, and their locations in the road. The scope of these provisions applies to both future and existing roads and applies equally to all network utility services.

The developer shall provide satisfactory evidence to Council's Network Control Officer that the network utility operators are prepared to reticulate the subdivision and that agreement on the financial arrangements for the installation of each supply has been reached.

Note: Network utility services in roads are subject to the Utilities Access Act 2010 and the Infrastructure (Amendments Relating to Utilities Access) Act 2010. The national code of Practice for Utility Operators Access to Transportation corridors July 2019.

9.2 General

9.2.1 Legislation

Referenced legislation and documents are listed in the Referenced Documents Section 2 of this Code of Practice.

9.2.2 Definitions

For the purpose of Section 9 the following definitions shall apply:

Code means the national code of practice approved in accordance with the Utilities Access Act 2010.

Network Control Officer has the same meaning given to it by the Utilities Access Act 2010.

9.2.3 Context

The developer is required to make all arrangements with the appropriate network utility operators for the supply and installation of stormwater, wastewater, water supply, and electric power and to the extent applicable for the provision of telecommunication reticulation.

The developer shall provide satisfactory evidence to Council's Network Control Officer that the network utility operators are prepared to reticulate the subdivision and that agreement on the financial arrangements for the installation of each supply has been reached. The following applies to each utility:

1. Stormwater, wastewater, and water supply. Where water supply and wastewater pipes and stormwater systems are in the road reserve, they shall be installed at the time of road construction to the requirements of Council's Network Control Officer and Council's Three Waters Asset Management Department.
2. Electricity. The supply of electricity will generally be by means of an underground system. Ducts shall be installed at the time of road construction to the requirements of the electrical supply authority and Network Control Officer. Where the developer is intending to provide electricity other than by underground connections, the developer shall provide alternative supply arrangements for approval by Council.
3. Telecommunications. Arrangements shall be made with the telecommunication supplier for the reticulation of telecommunication facilities. Where only part of this reticulation is being supplied initially, the arrangements shall include the requisite space being maintained for the installation of the remainder of the reticulation at a later date. Ducts will be installed by the developer at the time of carriageway formation to the requirements specified by the telecommunications supplier and be approved by Council's Network Control Officer.

The developer shall follow the requirements of the Code to the extent that they apply to the utility installation for the development.

9.3 Design

9.3.1 Plans

Copies of the plans of the development/subdivision shall be forwarded by the developer to all of the affected network utility operators at an early date to facilitate the design of the reticulation.

NOTE: It is important that all of the affected network utility operators are advised by the developer of any amendments to the development plan. Information when available on the type of dwellings and likelihood of more than one dwelling on any lot, will be valuable for design purposes.

9.3.1.1 Plan Preparation

In preparing the engineering plans consideration shall be given to the requirements of the network utility operators and Council's Network Control Officer for:

1. The minimum depth of cables and pipes.
2. The network utility operator's desired position for the cable and piping within the road berm as agreed with Council's Corridor Manager.
3. The minimum separation distances between power or telecommunication cables, and water mains.
4. The width of berm which shall be clear of other services and obstructions to enable efficient cable-laying operations.

Common trenching for power and telecommunication cables is commonly adopted at a distance of between

0.6 m and 1.2 m from the boundary. The possibility of common trenching should be discussed with each of the network utility operators during the design phase.

NOTE: Reference should be made to each network utility operator and Council's Network Control Officer for their specific requirements. Refer to the Code for further information.

9.3.2 Utilities above ground

Utilities should preferably be sited within the road berm or on land which will legally become part of the road (land vested as road). Separate lots (public utility reserves) or easements over private property may be used. The safety of above ground structures together with risk should be assessed in accordance with the requirements of the Code and any significant risks mitigated.

Similarly the locations of mail boxes and refuse collections and refuse storage must be carefully considered during the design development to ensure that safe access for the provider and normal road user is maintained. These shall be within the road but set back from the road line or carriageway.

9.4 Construction

9.4.1 Underground Cabling

Underground cable laying shall be achieved by the most appropriate method considering the nature of subsoil and potential damage to infrastructure and shall be to the approval of Council's Corridor Manager.

9.4.2 Materials

Materials and sizes of ducts and pipes shall comply with the requirements of the network utility operators and the colours should be in accordance with the Department of Labour's Guide for safety with underground services.

9.4.3 Conversion to Underground on Existing Roads

Where a proposed subdivision fronts on to an existing road, the conversion of overhead reticulation to underground will in some instances be desirable. Agreement on the feasibility and benefit shall first be agreed between the network utility operator and Council.

9.4.4 Commercial and Industrial Subdivisions

The servicing requirements for commercial and industrial areas will depend on the ultimate use. Close liaison between the developer and the network utility operator is advisable, particularly immediately before cabling is installed so that changes can be incorporated to accommodate extra sites or the requirements of a particular industry.

9.4.5 Location of Services

9.4.5.1 Position in the Road

Position and depth shall be agreed with the appropriate network utility operator and Council's Network Control Officer in accordance with the provisions of the Code.

9.4.5.2 Recording of Underground Services

Council shall maintain a procedure for recording the location of their underground services on plans which are readily available to the public at Council's main office. It is unlikely that Council will be able to provide a service for utility services other than those for which it is immediately responsible.

These will usually be stormwater, wastewater, and rural and urban water supply. Other authorities or network utility operators are required to maintain similar records of the existence and detailed location of their services for ready reference.

9.4.5.3 Accuracy and Tolerance

It is essential that all services be laid to predictable lines if there is to be a reasonable opportunity of laying new services in existing systems. In addition to specifying the location of any service in the road berm, there should also be a tolerance which shall on no account be exceeded without proper measurement and recording on the detailed record plan. Tolerance of ±300 mm in the horizontal and ±100 mm in the vertical is a practicable requirement.

9.4.6 Trenches

When new subdivision construction is undertaken the backfilling and compaction of trenches to a state of stability consistent with the future of the surface shall be carried out in accordance with the Code and to the satisfaction of Council's Corridor Manager. NDM relative compaction testing shall be required depending on the trench width and extent. Refer section 5 compaction to be accordance with the Waka Kotahi (NZTA) B/5 specification.

Where underground services are laid after the initial construction of the subdivision or where they are extended from an existing area into a new one, special attention shall be given to the opening and reinstatement of trenches in accordance with the Code and to the satisfaction of Council's Corridor Manager.

9.5 Connections to Electricity and Telecommunications Services

Unless otherwise approved by Council through a resource consent decision, all new allotments shall have physical connections to power utilities.

9.6 Positioning of Lateral Connections

Wherever possible connections shall be made at the following positions on the road frontage of each property as identified below, unless otherwise approved by Council:

Power and Telephone Plinth	-	Immediately adjacent to the boundary
Stormwater Lateral	-	1 metre from lower elevation side boundary
Sewer Lateral	-	1 metre from lower elevation side boundary
Water Metre Box	-	Centre of Road Frontage

All pipe connections shall extend 0.5 metres inside the property boundary.

The depth of connection at the property frontage shall be:

Power and Telephone	-	minimum 600 mm cover, if installed
Stormwater and Sewer	-	minimum 750 mm cover, preferred depth 900 mm cover, but sufficient to service all future building connections at grades set out in the Building Code
Water	-	450 mm cover

The position of stormwater and sewer laterals shall be shown by incorporating a vertical riser on the service line and extending to 200 mm above ground level. The top of the riser shall be securely capped.

Sewer laterals are to be painted red to clearly distinguish them from storm laterals.

Water connections shall include a toby valve clearly marked with a cover. See Standard Drawing W06.

9.7 Status of Laterals

All services within the boundaries of the road reserve shall be property of Council or other utility company once formally taken over by that organisation.

Unless specifically arranged otherwise and protected by an easement in gross assigned to Council, services through privately owned allotments shall be the responsibility of the landowner.

Accordingly, in the construction of new services to rear allotments, Council's policy is as follows:

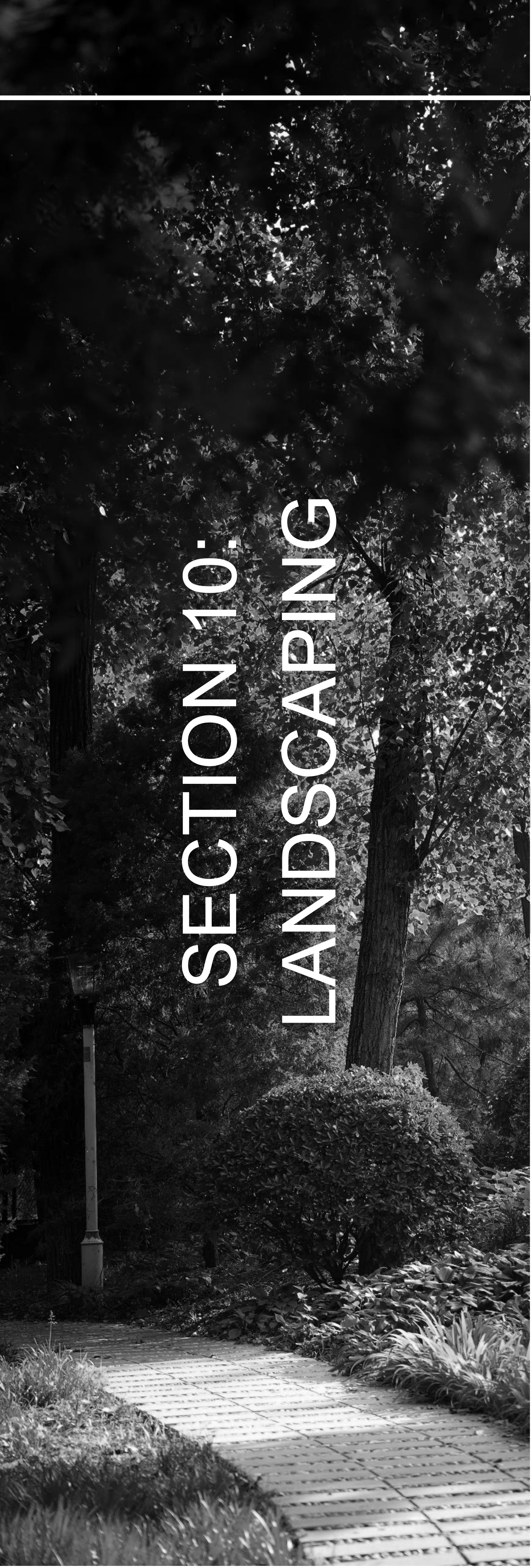
1. A separate connection to be provided to each allotment wherever possible.
2. Where various allotments are serviced by a common right of way or access lot, a public drain is to be constructed along the right of way. The public drain is to be constructed to Council's standards with manholes at each end (or manhole and cleaning eye where permitted by the Engineer) and maintenance access for Council is to be provided via a registered easement in gross.
3. Where a separate connection is not possible or not easily achievable, then a drain in common may be constructed provided that:
4. All of the affected landowners are in agreement with this option;
5. The common drain is to be registered against the affected titles;
6. No more than six lots are to be serviced by any one common private drain.
7. The costs of registering easements and agreements against titles shall be borne by the developer.

In the case of common sewers or storm drains, Council will require manholes at each end of the service, or one manhole and one cleaning eye depending on the length, in order to maintain the line and remedy any blockage. In the case of common water supplies Council will require the installation of appropriate valving in order to isolate the supply.

9.8 Definition of "Reasonable Distance"

The definition of a "reasonable distance" shall be assessed on a case-by-case basis and take into consideration such factors as the relative cost of the in-property reticulation and the extensions to connect to the existing services, the lengths of connections and any difficulties in making a connection at grade. However, in general terms, an application is expected to include connection to existing services where any of the following apply:

1. The subdivision is wholly or partially within the Urban Zone as defined by the Clutha District Plan, or wholly or partially within any transition zone.
2. The centre of the subdivision is within 500 m of the boundary of the Urban Zone.
3. The centre of the subdivision is within 500 m of an existing service.



SECTION 10: LANDSCAPING

Section 10 Table of Contents

10.1 Scope

This section sets out requirements for the design and construction of landscape and planting for land development and subdivision. This section applies to all landscape areas requiring planting and revegetation whether in road reserves, swales, rain gardens, ponds/wetlands, recreation reserves, or other public reserves, and private land when required by a resource consent.

10.2 General

10.2.1 Approval

Consultation with Council on landscape design and construction at an early stage of the design development is required. If landscape infrastructure proposed is over and above the minimal level of service, Council must agree to the increase in cost.

Stormwater systems including secondary flow paths shall be considered when landscape designs are determined, so as to avoid conflict or failure of these systems.

10.2.2 Environmentally Responsible Design

Landscape design has application throughout the subdivision and development process. Landscape design should be considered in the early stages of a development and at this initial concept stage it is important to establish objectives for overall landscape design involving the appropriate professionals to assess the natural systems, vegetation, and landscape features. This includes consideration of protecting, maintaining, and restoring existing natural ecosystems, vegetation, and landscape features; responding to the surrounding landscape character and context; and cultural and heritage elements; and contributing to ecological and habitat biodiversity. Provision of amenity open space and access is required to make open space connections, access to and location of watercourses, and provision of reserves and streetscape to provide a framework of coherence and amenity.

10.2.3 Reserves and Land Protection Covenants

Layout plans and location of reserves and land protection covenants must be discussed with Council prior to the lodgement of finalised plans. Development plans for all future reserves shall be submitted with the application for engineering approval, no work is to be carried out on site before Council approval is issued.

All reserve development works shall be completed in accordance with the plans approved by Council. Development may include earthworks, drainage, planting, paths, structures (such as seating, tables, litter bins, fencing, barriers, signs, and play equipment) and facilities (such as toilets, changing sheds and footpath lighting) as specified by Council.

10.2.4 Ecological, Functional and Aesthetic Opportunities

Planting provides a range of ecological, functional, and aesthetic opportunities for environmental enhancement:

1. Ecological:
    a. Provides, protects, and maintains terrestrial biodiversity and habitat;
    b. reduces the amount of sediment and pollutants entering waterways;
    c. Maintains and enhances water quality and habitat;
    d. Reduces surface water flooding;
    e. Increases stability and contributes to erosion control;
    f. Supports carbon sequestration;
    g. Supports ecosystem functioning including nutrient recycling, water retention, purification, and sediment control;
    h. Provides wildlife habitat value.
2. Functional:
    a. Defines space;
    b. Provides shade, shelter, and privacy;
    c. Screens unsightly outlooks and provides visual barriers;
    d. Ameliorates sound and reduces pollution;

e. Assists driver recognition of road link and place context;
f. Reduces glare and reflection and provides urban cooling;
g. Assists in the control of erosion;
h. Creates physical barriers;
i. Provides recreation and amenity value;
j. Provides edible species;
k. Provides opportunities for enhancing health and should not be detrimental to it.

3. Aesthetic:
   a. Frames views;
   b. Emphasises landform and landscape features;
   c. Provides visual unity in the environment;
   d. Reduces the visual impact of the roadway;
   e. Softens hard surfaces and bare areas;
   f. Provides colour, form, and texture;
   g. Provides visual lineage within and between regions;
   h. Provides identity and environment.

10.2.5 Landscape and Planting Opportunities

Opportunities for landscaping are diverse, ranging from specimen tree planting to planting associated with existing indigenous vegetation, traffic management devices, riparian margins, wetlands, swales, rain gardens, ponds, reserves, and specific landscape features in the development.

10.3 Design

10.3.1 Location

The design shall be submitted to Council for approval prior to installation.

Landscaping and planting should be designed to respond to the overall environmental context such as vegetation and water bodies, cultural and heritage elements, local road geometry, stormwater and reserve design, and utilities placement. Planting may include specimen trees, edible gardens, rain gardens, swales, and other amenity garden features.

Infrastructural services should be planned at the same time as the landscape design so that tree and garden planting location does not compromise the integrity and efficient operation of services. If particular landscape conditions or objectives are required for a subdivision or development then these will need to be taken into account prior to undertaking detailed engineering design. Root barriers to protect infrastructure should be considered by the designer as appropriate.

Consideration shall be given to the location of trees that will grow into large specimens and paved surfaces, as root migration/growth can adversely impact on the sub-base and levelness of the paving. In addition consideration must be given to the potential long term impacts to the neighbouring properties, including Aspects such as shade, maintenance access, falling leaves and the like.

10.3.2 Reserve Location and Layout

Reserve location and layout design shall take into account adjoining land uses and areas to ensure there is an appropriate provision of recreation assets and landscaping in accordance with Council's plans and policies. The design of access routes into and through a reserve should ensure linkages with existing networks, consider future developments both of the reserve and adjoining areas, take into account topography, and shall follow Crime Prevention through Environmental Design (CPTED) principles.

10.3.3 Existing Vegetation and Trees

All existing vegetation and trees to be retained shall be cordoned off to protect the root zone and vegetation, prior to the commencement of construction and the cordon shall remain in place until completion of construction.

Existing trees to be retained are to be protected by temporary fencing in a circle with a radius equal to the maximum crown extension (drip line). A qualified person shall be used to determine the protected area and supervise construction.

At no time shall anything be deposited in the root zones of protected vegetation and trees. If installation is required under existing vegetation trenchless technology should be considered if this is not practicable advice from a suitably qualified person should be sought to minimise damage to the vegetation.

A tree or vegetation plan and construction methodology shall be supplied to Council including:

1. Position and design of temporary protective fencing or other methods of protection.
2. Arboriculture maintenance required.
3. Methods of protection of the tree and root zone where construction is to occur near the root zone and tree canopy.
4. Maintenance required for long term health and stability of the tree or vegetation.

10.3.4 New Trees and Road Geometry

Materials and sizes of ducts and pipes shall comply with the requirements of the network utility operators and the colours should be in accordance with the Department of Labour's Guide for safety with

10.3.5 Planted Grass Areas, Berms, Swales or Rain Gardens

Berms, swales, or rain gardens shall be of sufficient width to allow for adequate growth of the plants and ease of maintenance. Narrow grass strips should be avoided. It is important to provide adequate means for tree growth and ongoing tree health at the same time as allowing for infiltration of water.

10.3.6 Quality Control

All plants shall be sound, healthy, vigorous, and free of any defects which may be detrimental to plant growth and development. In addition, plants should have vigorous root and branch systems and plants supplied in pots should not be root bound. To ensure that plants adapt and thrive once planted they should be 'hardened off' prior to planting. Only species adapted to the site conditions shall be planted.

10.3.7 Landscaping Structures

Landscaping structures include (but are not limited to) sculptures, walls, fences, screens, bollards, entranceways, and posts. The materials should be robust to suit their purpose and ideally reflect the local character. The design of the landscape structure shall be considered as an integral part of the development and surroundings to fulfil both functional and aesthetic requirements. Durability and maintenance requirements shall be considered. Structures shall not:

1. Inappropriately limit safe sight lines.
2. Be a hazard to pedestrians, people with disabilities, cyclists, or vehicle traffic.

Entranceway wall structures shall be located fully on private land unless Council approval is obtained. Any other immovable landscape structure (for example boulders) shall be located away from underground services to allow maintenance.

Structures shall be designed to safely withstand appropriate loadings. Structures shall be required to be approved by way of an application for Building Consent under the Building Act if they are not an exempt structure.

All Playground Equipment shall comply with NZS 5828 and Standards NZ Handbook 5828.1.

All retaining walls including those not requiring a building consent shall be constructed to resist lateral earth pressures and those from any surcharge loading that may be present.

10.3.8 Walkways and Cycleways

Any paving though reserves shall be constructed to the same standard and composition as set out for street footpaths in the locality, unless otherwise authorised by Council as per Standards NZ Handbook 8630:2004.

10.3.9 Fencing of Reserves

The permanent fencing of common boundaries of any reserve including esplanade, reserve accessways, and road boundaries, may be required.

Standards and requirements shall be in accordance with the Fencing Act 1978 and/or any subsequent versions.

Under normal circumstances Council do not require fencing between a reserve and the public Road. However, Council will require a fencing covenant to be registered on all titles of properties with a common boundary to reserve land, absolving the Council against all costs of erection and maintenance of fences on common boundaries.

10.3.10 Planting Period and Irrigation

Planting programmes where possible shall occur in the season that optimises growing conditions for plants and trees and maximises plant establishment.

Council may require provision for permanent or temporary irrigation of specimen trees, gardens, or plantings. Irrigation of trees shall be required by the developer during the first two summer seasons following planting. Provision for watering during the establishment of plants may be required for gardens that are not otherwise irrigated.

10.4 Construction and Maintenance

10.4.1 Introduction

It is the developer's responsibility to ensure that the landscaping meets the required standards at the termination of the two-year maintenance period, unless otherwise agreed with Council. The developer is responsible (and may be bonded) for the routine maintenance and replacement of the planting including dead wooding, weed control, mulching, replacing dead trees, shrubs, and plants, and watering for a defined period from the date Council issues the Section 224 completion certificate under the RMA.

10.4.2 Soil and Fertility

The developer shall be responsible for the supply and spreading of soil. Topsoil should be correctly stored and handled when stripped and respread.

All soil used for landscaping shall be free from any contaminants that may affect human health. Any soil which is to be utilised for landscaping purposes, that has been on a site used for Hazardous Activities or Industries, shall be tested for levels of contamination, which shall prove that it is suitable prior to use.

A soil test shall be undertaken to determine the composition and type of fertiliser to be applied to the area being developed. A proprietary fertiliser or soil ameliorant suited to the species shall be applied where the existing soil is deficient in minerals and nutrients, plants are showing signs of lack of fertility, or to ensure maximum health and vigour.

Application rates and type of fertiliser or soil ameliorant should be selected according to species and soil fertility.

10.4.3 Weeds and Litter Control

At the end of the maintenance period there shall generally be no weeds within 2 m of any tree planting or in garden beds. Weeds should be controlled in an appropriate manner. When hoeing/pulling weeds care shall be taken to avoid damage to plants and their roots. The soil shall not be mixed with mulch when removing weeds. Any spraying should be kept to a minimum near swales, rain gardens, ponds, riparian margins, and adjacent properties.

All areas once established shall be kept free of litter and debris, including paper, plastic, stones, bricks, bottles, glass, cans, and other forms of inorganic matter.

10.4.4 Planting Grass Areas

Grass areas and berms shall be formed after all other construction has been completed. The grass areas and berms shall incorporate not less than 100 mm compacted thickness of friable weed and stone free topsoil (generally made up of a composition of approximately 1 - 5% sand, 7 - 16% humus or organic material, and no more that 30% weight in clay) placed over a base material capable of allowing root penetration and sustaining growth. The maximum slope for grass areas intended to be mown is 1:5.

Heavily compacted soils shall be ripped to a depth of 300 mm with rip lines 1 m apart, and rolled, before any laying of topsoil. The ground profile shall be smooth and free of ruts and depressions prior to grassing. Ripping to de-compact soils should not be undertaken within the dripline of trees to be retained.

Grass areas and berms shall be graded to edges (for example, pavement or footpath) allowing for approximately 15 mm of settlement.

Rural berms shall be topsoiled to the same standards as urban berms unless they make use of already grassed undisturbed ground.

The area for grass seeding shall be free of all weed species. Grass seed mixes shall be either an approved

dwarf cultivar rye grass or an approved turf species blend. Other special purpose grass seed and plant species may be used in special areas such as swales and rain gardens.

A sward coverage of not less than 90% shall be achieved within one month of sowing, and before completion documentation shall be provided for processing by Council. All established grass shall be mown to a range specified by Council. A common mowing height range is a minimum height of 50 mm and maximum height of 100 mm. All grass edges shall be maintained in a neat and tidy manner.

10.4.5 Mulch

Mulch shall be applied to tree and garden areas to conserve moisture and reduce weed growth, except in riparian margins. Typically, mulch will be cambium grade bark mulch, clean, free of sawdust and dirt, and with individual pieces no larger than 100 mm; mulched trees/branches that have no viable seeds; or stone mulches. Mulch must not be older than 3 months. Mulch for planting beds shall be a uniform 100 mm in final depth. Edges shall be formed to hold the mulch without spillage on to adjacent surfaces.

Before mulching soil should be damp to a depth of 300 mm. Mulching should be carried out on an ongoing basis to all garden beds and juvenile trees to maintain specified depth at end of maintenance period.

Mulch shall only be spread after the soil surface is levelled off to remove bumps and hollows. Weeds and grass are to be removed prior to mulching. Plants shall not be damaged or buried during the mulching process. Where it is known that bark mulch affects certain species or will be lost due to wind, slope of the land, or for some other reason, alternative mulches shall be considered and used.

10.4.6 Specimen Tree Planting

Specimen trees are defined as trees with a trunk diameter of 25 mm to 100 mm when measured at 1400 mm above ground level. Larger trees can be used with the approval of Council.

Those contractors involved in specimen tree planting and maintenance should be competent horticultural/arboriculture practitioners and follows accepted industry standard procedures for tree planting. Establishment and initial maintenance are critical to the long-term viability of the specimen tree.

Specimen trees shall be sound, healthy, vigorous, and free of any defects (relative to the species). Specimen trees are to be a minimum of PB 95 (planter bag of 95-pint capacity approximately 54 L) grade when planted. A recommended minimum height for specimen trees is 2.5 m at the time of planting to aid early establishment unless the local conditions of a site require consideration of alternatives, for example, an exposed site may require small, well-hardened trees. Specimen trees between 1.5 - 2.5 m may be allowed with the approval of Council.

Given the generally modified nature of soil in subdivisions it is essential that a suitable tree planting pit be prepared. The approach shall endeavour to have:

1. Ground free from debris and rubbish.
2. Ground cultivated to a depth of 1 m and a width of 1 m to break up any compaction, fracture subsoil, and afford drainage to hard rock areas.
3. Sides of planting holes crumbled and not smooth.
4. Topsoil incorporated into the upper level of planting holes.
5. Each tree fertilised with an appropriate amount of slow release fertiliser, as per the manufacturer's recommendations.
6. Final planted depth consistent with finished ground level.
7. Each tree adequately staked to withstand movement in natural wind conditions and to meet Council standards.
8. Trees secured with expandable ties at approximately 1/3 of their height or as high as required

9. to support the tree (to be checked every six months) or anchored below ground with a root ball anchor.
10. Soil firmed sufficiently to force any air pockets from planting holes.
11. Trees watered immediately following planting.
12. Trees radially mulched to a distance of 500 mm or to drip line, whichever is the greater area and a depth of 100 mm.
13. Staking uniformly low and visually consistent throughout the subdivision stage.
14. Ground Treated timber stakes should only be used if the stakes are to be removed once the trees are stable that is at the end of a maintenance period.

The onus is on the developer to ensure that trees are protected during the further development of the subdivision (that is, the construction of dwellings/buildings) and during the defined maintenance period.

10.4.7 Revegetation Planting and Existing Vegetation

Revegetation planting shall be a minimum grade of PB3 (planter bag) or root trainers and shall be planted at a density and size of plant that achieves a coverage ratio specified by Council's Tree Plan Plants shall be spaced unevenly in the planting layout to encourage a natural appearance and setting.

Assisted natural revegetation is a technique using native seedling establishment complemented with weeding, thinning, and mulching and is an option that may be considered.

Edges of existing vegetation, to be retained where appropriate, shall be planted to mitigate the effects of wind funnelling. Mulches can be used in these areas to minimise the establishment of weed species.

10.4.8 Ponds, Wetlands and Riparian Margin Planting

Ponds, wetlands, and riparian margins should have site specific planting plans prepared by a suitably qualified person and submitted to Council for approval of designs. Access shall be provided for future removal and/or maintenance by heavy equipment.

Any water body (not including natural lakes) shall take into consideration the likelihood of people falling into the pond. Furthermore, the design shall provide appropriate access that a person who has fallen into the pond can climb out.

10.4.9 Pruning

Trees should be selected and located to minimise ongoing pruning costs and requirements. All pruning of street trees shall be undertaken by a suitably qualified arborist. All pruning shall be undertaken by a recognised arboricultural practice.

Pruning should be carried out on shrubs to maintain a high standard of presentation, display, and plant vigour. Paths, roads, and all other accessways should be kept clear of excess growth. Pruning may also be necessary to ensure signs are not obscured. Where appropriate, pruning should allow for adequate sight visibility to ensure the safety of road and footpath users. However, there are situations where planting should be used to restrict visibility and slow traffic or frame views.

Vegetation shall not be allowed to grow in a position which will prevent the driver of a vehicle from having a clear and unobstructed view of official traffic signs or signals, rapid number, approaching or merging traffic or any corner, bend, intersection or vehicle crossing.

Vegetation shall not be allowed to grow in a position that will reduce the effectiveness of road management.

In areas where ice can form on roads, vegetation shall not be allowed to grow, in a position that will shade a road between the hours of 10.00 am and 2.00 pm on the shortest day of the year. See also District Plan RULE TRAN.7 Vegetation. The exception to this standard is where topography is already preventing the direct access of sunlight on to the road or where the vegetation existed at the time of notification of the plan.

Vegetation shall be maintained in a condition which prevents damage to the road surface, road structures or drainage devices.

All weak, dead, diseased, and damaged growth should be removed, and pruning carried out to maintain the desired shape and size. Pruning should not be carried out during leaf burst or leaf fall. The following pruning techniques (for shrubs) should be employed where appropriate:

1. Tips to be pinched or purged as appropriate for species to give desired shape and size.
2. Form pruning of young plants to ensure compact form and shape.
3. Undercutting of groundcovers at edges generally.
4. Plants are to be pruned so that they do not smother neighbouring plants.

10.4.10 Maintenance

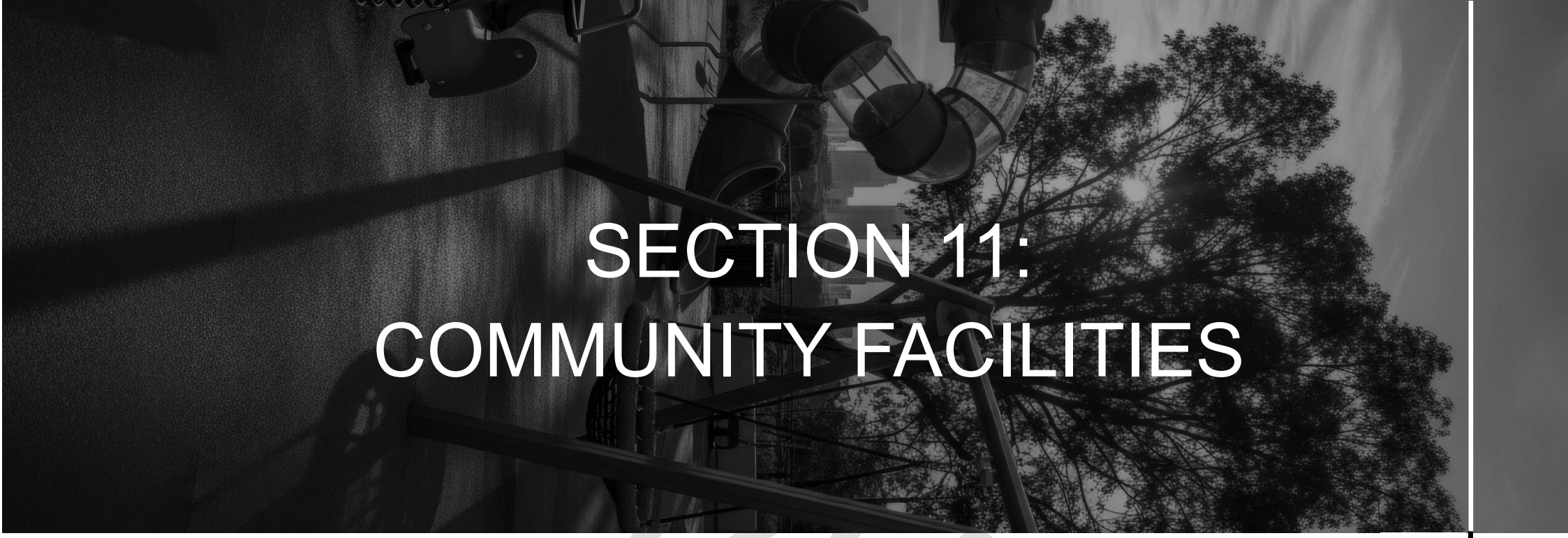
Landscape plans shall ensure that future maintenance requirements have been considered so that ongoing costs are minimised. The maintenance period will vary depending on the nature and type of planting and should be covered in specifications and as required by Council.

The developer shall:

1. Remove from the area all temporary services, machinery, and surplus materials that have been used for the construction, and leave the site in a tidy condition.
2. Clean all paths and surrounding areas.
3. Clear and weed all channels.
4. Ensure that all damaged, vandalised, stolen, or dead plants are replaced to maintain numbers and unity of display.
5. Ensure that amenity planting beds are cleaned to remove prunings, dead or damaged leaves, and any other object or material, including retail attachments such as plant labels. The edges of the beds shall be left evenly shaped and sloped.

Land to be vested for reserves purposes shall as a minimum meet the following general requirements:

a. The land is to be free of noxious weeds, tree stumps (above ground) and other specified vegetation.
b. All previous fences, farm utilities, building remains, and rubbish are to be removed or disposed of to the satisfaction of Council.
c. Land to be mown shall be accessible to suitable mowing equipment and is to have an established turf type seed grass cover.
d. Drainage reserves, ponds, lakes, channels, and streams requiring maintenance shall have suitable access for heavy machinery and trucks.
e. All boundaries are to be surveyed and clearly pegged.
f. Any proposed landscape planting or furniture/structures shall be completed.
g. The land is to be free of easements/services unless previously agreed in writing by Council.
h. Any rights of way or easements are to be formalised at no cost to Council.



SECTION 11:
COMMUNITY FACILITIES

Section 11 Table of Contents

11.1 Purpose

The purpose of this chapter is to outline the standards for the design and creation of community facilities that are to be vested in the Council. The aim is to achieve a high standard of accessibility, public health and safety, variety, multifunctional use, and environmental value, whilst maintaining whole-of-life affordability.

The community facilities covered in this Code of Practice include parks, reserves, council -owned buildings (e.g., library, hall), playground, public toilets, sport fields, cemetery, and water facilities. These assets provide the community and visitors with access to Council services and activities.

11.2 Performance Outcomes

Community facilities play an important role in serving communities by provides them with the opportunity to access services, activities and interact socially with other members of the community. The facilities enable the communities to be more socially connected and active and makes Clutha a desirable place to live. The way a subdivision relates to community facilities is very important for their usability, amenity and public safety.

The performance outcomes for the design and creation of community facilities and associated assets sought by this Code of Practice are as follows:

- Providing a local hub where residents and visitors can access services or engage in social activities, catering for the changing demand
- Providing accessible facilities and safe public places for communities, clubs, organisations and individuals to enjoy sporting, social, cultural, educational and recreational pursuits
- Providing safe, clean and accessible public toilets and dump stations across Clutha District for both residents and visitors by reducing the likelihood of human waste impacts and raising community appreciation and use of Council's facilities.
- Providing facilities that are affordable and accessible to operate and maintain
- Providing facilities and assets that are completed to a high standard of presentation prior to vesting in the Council; and
- Providing plantings that meet amenity, natural character, beautification (including colour), ease of maintenance whilst avoiding off-site effects.

11.3 Reference Documents

11.3.1 District Plan Requirements

This section addresses matters that are specific to the Council asset creation or activities that may have an impact on an asset. They are subject to Activity Management Plans. Key provisions of the Activity Management Plans that preside over the design and creation of community facilities are urban design, subdivision and reserves and open space sections.

11.3.2 Internal Standards

Additional documents that may be useful references for Designers:

- Reserve Management Plan
- Activity Management Plans
- Tree Plan
- Donations Guidelines (does CDC have anything like this?)

11.3.3 External Standards

Community Facilities and associated assets will be designed and created in a manner consistent with this document.

Additional requirements may be specified from the documents set out in Section 1 of this Code of Practice. Where an Act or National Standards document is referenced, this will be the current version including any associated amendments.

Documents that should be considered or referenced as:

- Recreation Aotearoa Open Spaces Maintenance Specification
- NZS 5828 Playground Standards
- Standards NZ Handbook 5828.1 Playground Standards
- Standards NZ Handbook 8630:2004 Track and Structure Handbook

11.3.4 General

Gaps in neighbourhood park/reserve provision identified in Activity Management Plans or an indicative reserve is identified in a structure plan or outline development plan (including the need to protect natural or archaeological features, linkages, viewpoints or rest areas) must be used to assist in determining appropriate sites for community resource.

11.3.5 Financial Contributions

Refer to the District Plan Section on Financial Contributions (or its subsequent amendment).

11.3.6 Process of determining Design Purpose

Prior to lodging for larger subdivision applications, developers must undertake pre-application workshop with the relevant team members within the Council. The teams could include planners, Transport team, Three Waters team and community facilities team and any other teams that may be relevant. The purpose of these discussions is to form the agreement on the matters relevant to the subdivision or adjacent areas and ensure that urban design goals are met in the design of both private and public spaces, and any areas for utility or transportation purposes.

Following pre-application workshops with the Council's teams, the location and size of community resource (e.g., a reserve) will be included in the scheme plan submitted with the subdivision application. The vesting of the community resource, its classification and any development requested by or agreed to by

the Council will be a condition of the consent. There is a requirement for a concept plan to be submitted for the development of community resource. The community resource is required

to be presented for vesting in accordance with these standards. Development of the community resource will generally be undertaken following vesting and in consultation with the community.

11.4 Community Facilities

All built assets (e.g. signs, fences, artworks, lighting, structures and furniture) must be approved by Council prior to installation. They must be robust, low -maintenance, and safe for use by the public. Consider the life-cycle of built assets, to reduce the frequency of renewing or replacing such assets in the future. Consider colours and construction materials in aesthetic terms, for built assets that form part of a reserve.

Note that the developer is responsible for gaining all necessary building consents required under the Building Act.

11.4.1 Sports Fields

The Council objectives are to provide and develop sports fields that meet the needs of the local community and, in the case of district facilities, the needs and aspirations of the greater community. Provide fully accessible sports fields with surfacing that allows easy access where specified. Not all sites will be suitable and some that are may not require such facilities.

Obtain approval from the Council for the design proposal for the sports field within a reserve, including the types of recreation opportunity. This prevents oversupply of facilities in other reserves nearby. It should also simplify the numbers and options and hence simplify operations and maintenance costs.

All play facilities must comply with:

- Sports Field Development Guide 2020 (Recreation Aotearoa)
- Open Spaces Maintenance Specification 3.2-3.7 (Recreation Aotearoa)

11.4.2 Playgrounds and Play Structures

The Council's objective is to provide and develop interesting and exciting playgrounds that meet the needs of the local community and, in the case of district facilities, the needs and aspirations of the greater community. Provide fully accessible playgrounds with surfacing that allows easy access where specified. Not all sites will be suitable and some that are may not require formal play facilities.

Approval shall be obtained from the Council for the design proposal for the play space including the types and style of equipment.

All play facilities must comply with:

NZS 5828:2015 Playground equipment and surfacing; Parks and Waterways Access Policy. Use the following resources for the design of playgrounds:

- Barrier Free NZ
- Sport and Recreation Victoria The Good Play Space Guide: "I can play too"

11.4.3 Seats and Picnic Tables

The design of proposed seating and tables must be consistent with the character of the reserve and its locality, in accordance with Recreation Aotearoa Open Spaces Maintenance Specifications .

11.4.4 Boundary Fencing

The Council promotes the concept of open frontages onto reserves. Funding of boundary fencing must comply with the Fencing Act 1978. The Act does not apply to fences alongside legal roads or esplanade reserves. Funding of boundary fences will also be in accordance with any registered fencing covenants.

11.4.5 Public Toilets

The provision of toilet facilities is essential to allow people with disabilities to use parks. Consider the needs of that locality and the numbers of expected visitors at any one time when determining the requirement for toilet facilities. Locate toilets to be easily s een and in close proximity to playgrounds.

Design the toilet and its access to conform to NZBC / G1, Public Toilets and Design for Access and Mobility.

11.5 Open Space

11.5.1 Parks and Reserves

Parks and reserves shall be located and designed so that they are connected with the existing roading network and, where possible, existing reserves, access ways and open spaces to provide routes and return loops for recreational use, encourage sustainable transport choices by allowing for continuous off-road journeys and contribute to creating larger open space areas. Consideration should be given to how the development will link to the surrounding landscape, including existing areas of open space, and to other public areas, such as schools, town centres, community facilities or public transport. They must not be made of "left over" land, the location and design must be informed by the neighbourhood context and the particular aspects of the sites. Parks and reserves must be designed and presented in accordance with these standards prior to the application for section 224(c) certificate approval.

The level of service for the location of community parks and reserves in relation to residential properties shall be in accordance with relevant Council activity management plans. Parks and reserves shall be of an even and regular shape that allows for maximum usable space and ease of maintenance. They shall be highly visible in order to maximise amenity, safety and open space benefits for the surrounding community and to allow the parks and reserves to be easily found by users, and meet the following standards:

Have a minimum 30 metre road frontage on at least one side;

- Have additional access points provided to connect to the road network within the subdivision and adjoining areas;

- Have access crossings provided for maintenance vehicles and equipment;
- Be located and orientated to maximise daylight and sunlight hours;
- Located to ensure that potential hazards to public safety (such as site stability or contamination) do not exist or it is possible to remedy or mitigate any hazard.

Natural features or features of local and/or cultural interest or significance such as streams, remnant native forest or specimen trees will be identified and included within the reserve where appropriate and agreed to by the Council.

11.5.2 Esplanade Reserves

The circumstances, where esplanade reserves and or esplanade strips under this chapter must be provided or considered adjoining lakes, rivers or the coast, are prescribed within the District Plans. The Council may seek to purchase additional areas to add to the environmental, amenity and recreational value of the reserve network. Paths on esplanade reserves must be provided where they are an integral part of a walking/cycling connection within the subdivision or wider area. Given the generally long and linear nature of these reserves, visibility and accessibility must be maximised to enhance the amenity, safety and open space benefits for the surrounding community and to allow them to be easily located. Where possible conservation and landscape reserves/special interest site reserves must have a minimum of 20 meters road frontage, with good access for pedestrians and maintenance vehicles.

11.5.3 Public Gardens/ Formal Gardens

Public gardens and formal gardens must have a minimum 30- meter road frontage, with good pedestrian and maintenance vehicle access. Prior to any construction a detailed landscaping plan highlighting the proposed species of plants shall be submitted to Council for approval. Areas to be considered include not only the visual appearance but the type and scale of long-term maintenance required in accordance with Recreation Aotearoa Open Spaces Maintenance Specifications.

11.5.4 Other Facilities

The Council requires the following standards to be met in the design and location of other community resource facilities.

If lighting is required for community parks, the design shall be consistent with AS/NZS1158 Lighting for Roads and Public Spaces and must be approved by the Council prior to construction. Where reserve signage is required, it will be approved by Council.

11.6 Water Facilities

11.6.1 Structures

Structures are installed at the discretion of the Council. These include jetties, wharves, boat ramps and swimming pontoons. The design of structures must fulfil both functional and aesthetic requirements. They must be durable and not require a high level of maintenance.

Note that the developer is responsible for gaining all necessary building consents required under the Building Act.

11.7 Community Services

11.7.1 Cemeteries

The Council may seek to purchase additional land for the purpose of Cemeteries, particularly land adjacent to existing cemeteries to meet identified levels of service.

11.8 Construction – Access and Boundary Treatment

This section outlines the standards and design for access to and within reserves and boundary treatments. The following standards are required in the design of access to and within reserves.

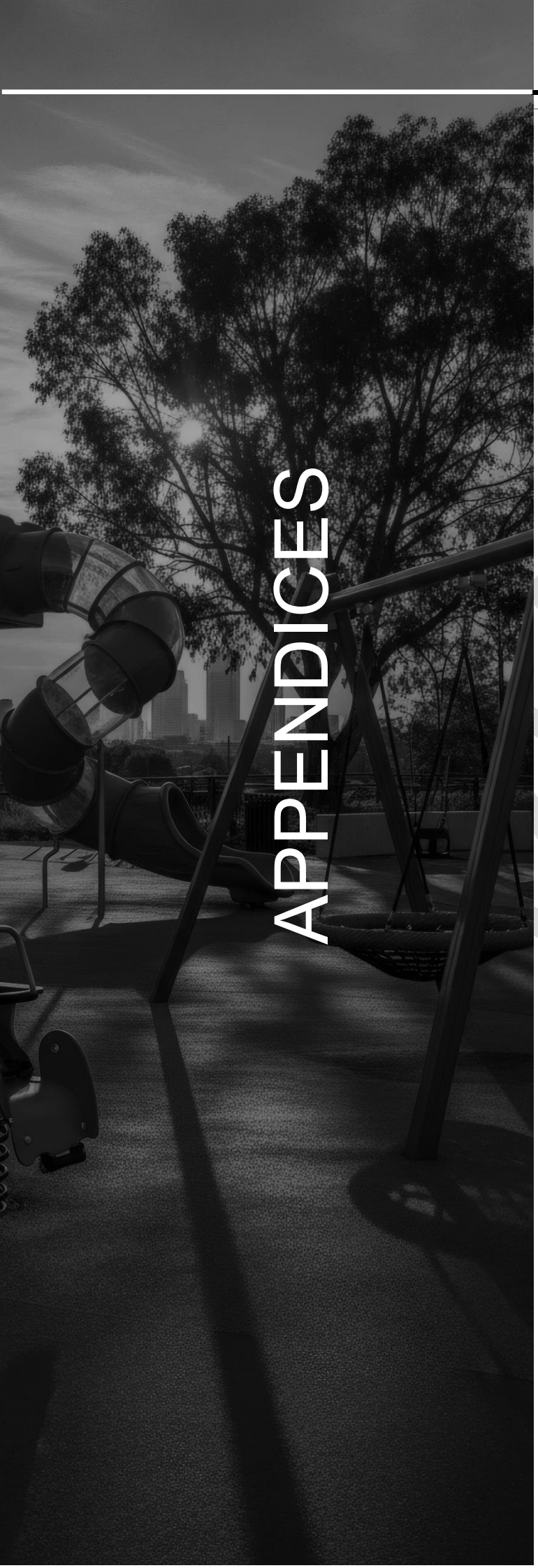
11.8.1 Access

The design and standards of formation for paths and tracks within reserves are outlined in Table 11-1.

The location of paths and plantings on reserve access ways and walkways must be designed to ensure the path receives maximum sunlight hours in winter and minimises frosting. A vehicle crossing access permit is required or the crossing needs to be approved through the submission of Engineering Plans as part of the subdivision process. Consultation with the Council must be undertaken to determine if parking areas and access roadways are required.

Table 38: Path, Track and Road Category Standards in Reserves

Track Types	Markers	Gradient
Path/Accessway • These are to be Multi-Use Accessible Paths	• Requires Signage stating they are Multi-Use Accessible Paths • Signage required at Entrances and Junctions	• Maximum 5° (1 in 11.4)
Steps	**Width**	**Surface**
• No Steps	• Minimum 2 metres	• Event and well-formed of durable material • Maximum Discontinuity Height – 5 mm
Structure	**Furniture**	**Vegetation Clearance**
• Minimum 2 metres • No Stiles, Turnstiles or Kissing Gates	• Seats and Tables may be provided	• Minimum width equal to the Path width • Minimum Height 2.5 metres • Windfall and hangers cleared with 48 hours notice



APPENDICES

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Appendix A – Designer Check List

The designer checklist for subdivision application and construction:

Note: This list is produced to clarify the design requirements and holding points in the subdivision application process. The aim of this list is to guide the developer/developer's advisor to follow the correct and effective steps to be efficient in the subdivision application and construction. The implementation of the steps listed in this document will ensure that delays are kept to a minimum. Please inquire with the Council when in question.

Activities Developer to follow:

REFERENCE FROM COP	ACTIVITY REQUIRED	Y/N/NA
Section 1 – General requirements and Procedures		
3.2.1	Appoint a designer of the work.	
3.2.2	Preliminary Discussions to define Council requirements prior to design	
3.2.4.3	Consultation with Regional Council (Otago Regional Council) on Stormwater impacts to the natural environment aspects	
3.2.4.8	Design Approval docs to include: • Earthworks and geotechnical requirements; • Roading and site access including a design and access statement and a road safety audit • Stormwater infrastructure shall include details such as proposed design parameters, primary systems capacities, storage, secondary systems including overland flow paths, and structural details of components • Wastewater infrastructure design drawings compatible with Council's requirements and the design parameters included in the CoP shall be provided. • Water supply infrastructure design drawings compatible with Council's requirements and the design parameters included in the CoP shall be provided. Landscape; • All proposed planting to be located within the publicly vested areas shall be agreed with Council prior to installation. • Proposed network utility service designs. • Safety in Design register	
3.2.4.8	A geo-professional's report on the suitability of the land for subdivision or development.	
3.2.4.8	Other reports as considered necessary by Council in the circumstances of the proposed infrastructure in order to meet the requirements of the CoP.	
3.2.4.8	A design certificate in the form of the certificate in Schedule 2A.	
3.2.6	Design drawings complying with requirements spelled out in the CoP	
3.2.8	Climate change – confirmation of impacts to design such as sea level change and increased stormwater events	
3.2.10	Construction Pre- construction Permits are in place Notification of the Construction Programme in writing Suitable qualification/experience of Construction Personnel Documentation to be held on site Variations to the approved design Inspections and Hold Points – Notification to Council Completion Certification Services Connections Testing Pre-vesting maintenance Reinstatements	

REFERENCE FROM COP	ACTIVITY REQUIRED	Y/N/NA
Section 2 - Geotechnics		
4.1	The designer shall take account of all relevant standards and Council requirements in terms of construction requirements, or development limitations.	
2.2.3	A geo-professional shall be appointed by the developer to carry out the defined functions.	
4.4.1	Preparation of a Geotechnical Completion Report	
4.4.2	As built drawings for Earthworks and subsoil drains	
4.5	Schedule 4A	
Section 3 - Roads		
0	Design Philosophy/design report including design drawings and detailing proposed materials.	
5.2.4 5.3.1	The Waka Kotahi NZTA One Network Framework should be used as the basis for the definition of the road design.	
5.2.6	Prepare and submit a design Access Statement	
0	Proposals that provide for new roads to vest in Council shall be subject to the Waka Kotahi (NZTA) Road safety audit procedures for projects unless Council decides that audits are not required at any or all of the stages.	
5.3.1	Design Requirements	
5.3.3	Geometric design	
5.3.4	Pavement Structural Design	
5.3.12.1	Footpath design – Council confirmation of requirements	
0	Road construction shall be carried out to the alignments and standards detailed in the approved drawings and with the specified materials so as to provide the intended design life.	
5.4.17	Progress Inspections at key construction stages.	
5.4.19	As built handover documentation	
Section 4 – Stormwater		
6.2.1	Compliance with design objectives	
6.2.6	All stormwater systems shall provide for the management of stormwater run-off from within the land being developed together with any run-off from upstream catchments.	
6.2.8	Rainfall design charts shall be adjusted to take into account the predicted increase in rainfall intensities from the effects of climate change.	
0	Design – Council shall be consulted for the design requirements for a particular site	
0	The designer shall undertake the necessary design and prepare design drawings compatible with Council's design and performance parameters.	
0	The developer shall implement low impact design principles for the treatment of stormwater. Where the developer does not believe that low impact design methods will be suitable the developer shall provide reasons for this for approval by the Council.	
6.4	Approval of proposed Stormwater infrastructure	
6.5.4	Inspection and Acceptance	

REFERENCE FROM COP	ACTIVITY REQUIRED	Y/N/NA
Section 5 - Wastewater		
7.2.1	Objectives	
7.2.2	Wastewater designs shall incorporate all the special requirements of Council and shall be in accordance with the most appropriate Standards, codes, and guidelines including those set out in Referenced Documents.	
0	Applications for design approval shall include the information outlined in Section 2 of this CoP. In addition the following information shall be provided: • A plan showing the proposed location of existing and proposed wastewater infrastructure. • Detailed long sections showing the levels and grades of proposed wastewater pipelines in terms of datum. • Long sections shall include full details of pipe and manhole materials and sizes. • Details and calculations prepared which demonstrate that agreed levels of service will be maintained. • Details and calculations prepared which clearly indicate any impact on adjacent area or catchment that the proposed infrastructure may have. • Appropriate operating manuals, pump information, and instructions for pump stations and pressure systems if proposed. • All details as per Clutha District Councils As-Built Specification for Water Services	
Section 6 – Water Supply		
0	Detailed plans and design calculations (where appropriate) shall be submitted to Council.	
0	Objectives	
8.4	Approval of Proposed Infrastructure	
8.5.4	Pressure Testing of Mains	
8.5.5	Disinfection of Mains	
8.5.6	Discharge of Test water	
8.5.7	Water Sampling	
8.7	Field Testing of Pipelines	
Section 7 – Network Utility Services		
1	The developer shall provide satisfactory evidence to Council's Corridor Manager that the network utility operators are prepared to reticulate the subdivision and that agreement on the financial arrangements for the installation of each supply has been reached.	
9.2.3	The developer is required to make all arrangements with the appropriate network utility operators for the supply and installation of stormwater, wastewater, water supply, and electric power and to the extent applicable for the provision of telecommunication and gas reticulation.	
9.3.1	Copies of the plans of the development/subdivision shall be forwarded by the developer to all of the affected network utility operators at an early date to facilitate the design of the reticulation.	
0	In preparing the engineering plans consideration shall be given to the requirements of the network utility operators and Council's Corridor Manager for: • The minimum depth of cables and pipes. • The network utility operator's desired position for the cable and piping within the road berm as agreed with Council's Corridor Manager. • The minimum separation distances between power or telecommunication cables, and gas or water mains. • The width of berm which shall be clear of other services and obstructions to enable efficient cable-laying operations. Common trenching for power and telecommunication cables is commonly adopted at a distance of between 0.6 m and 1.2 m from the boundary. The possibility of common	

	trenching should be discussed with each of the network utility operators during the design phase.	
9.4.1	Underground cable laying shall be achieved by the most appropriate method considering the nature of subsoil and potential damage to infrastructures and shall be to the approval of Council's Corridor Manager.	
9.5	Unless otherwise approved by Council through a resource consent decision, all new allotments shall have physical connections to power and telecommunications utilities.	
Section 8 – Landscaping		
10.2.1	Consultation with Council on landscape design and construction at an early stage of the design development is required. The Council may seek input from the relevant Community Board or Community Development Area Subcommittee in relation to landscape issues, prior to its approval of any proposed landscaping.	
10.2.3	Layout plans and location of reserves and land protection covenants must be discussed with Council prior to the lodgement of finalised plans. Development plans for all future reserves shall be submitted with the application for engineering approval, no work is to be carried out on site before Council approval is issued.	
10.2.3	All reserve development works shall be completed in accordance with the plans approved by Council.	
10.3	The design shall be submitted to Council for approval prior to installation	
10.3.2	Reserve location and layout design shall take into account adjoining land uses and areas to ensure there is an appropriate provision of recreation assets and landscaping in accordance with Council's plans and policies.	
10.3.3	All existing vegetation and trees to be retained shall be cordoned off to protect the root zone and vegetation, prior to the commencement of construction and the cordon shall remain in place until completion of construction	
10.3.4	In selecting species for planting, take into account the overall composition, low maintenance, and longevity, as well as the need to comply with Council's planting policies. The relevant Community Board, Community Development Area Subcommittee or Council shall approve the species to be planted before the planting is undertaken.	
10.3.8	Any paving though reserves shall be constructed to the same standard and composition as set out for street footpaths in the locality, unless otherwise authorised by the relevant Community Board or Community Development Area Subcommittee.	
0	Landscape plans shall ensure that future maintenance requirements have been considered so that ongoing costs are minimised.	
Section 9 – Community Facilities		
11.3.6	Process of determining design purpose Prior to lodging subdivision applications, developers must undertake pre-application workshop with the relevant team members within the Council. The teams could include planners, Transport team, 3 waters team and community facilities team and any other teams that may be relevant. The purpose of these discussions is to form the agreement on the matters relevant to the subdivision or adjacent areas and ensure that urban design goals are met in the design of both private and public spaces, and any areas for utility or transportation purposes. Following pre-application workshops with the Council's teams, the location and size of community resource (e.g., a reserve) will be included in the scheme plan submitted with the subdivision application. The vesting of the community resource, its classification and any development requested by or agreed to be the Council will be a condition of the consent. There is a requirement for a concept plan to be submitted for the development of community resource. The community resource is required to be presented for vesting in accordance with these standards. Development of the community resource will generally be undertaken following vesting and in consultation with the community	
11.4	All built assets (e.g. signs, fences, artworks, lighting, structures and furniture) must be approved by Council prior to installation.	
11.4	Maintenance required during establishment	
11.4	Presentation of community facilities for vesting	

Appendix B – Standard Drawings