QUEENSTOWN LAKES DISTRICT COUNCIL

Queenstown Lakes District Council

Land Development and Subdivision Code of Practice

Superseding NZS 4404:2004 and Council Amendments

(Only applies to Queenstown Lakes District Council's subdivision and development design standards)

QLDC Land Development and Subdivision Code of Practice

This document supersedes all previous Queenstown Lakes District Council subdivision and development design standards adopted by Council prior to [date to be entered once adopted]

The Queenstown Lakes District Council under copyright licence has reproduced NZS 4404:2004 and Council amendments with further modifications to produce this document for its use as a land development and subdivision Code of Practice within this geographical area of jurisdiction.

Any update of NZS 4404:2010 does not automatically update this Queenstown Lakes District Council Land Development and Subdivision Code of Practice.

2024 proposed amendments are shown in red in this document. The text in black is based on the original NZS 4404:2010 text, but has been amended in previous Council revisions as per the revision history table below.

Document History

#	Details	Date	Prepared	Approved
1	Content adopted by Council	03/06/15	R Flitton – Principal Resource Management Engineer	Full Council
2	Amendment to water supply requirements	17/08/15	R Flitton – Principal Resource Management Engineer	Ulrich Glasner - Chief Engineer
3	Amendment road safety audit requirements for private networks	24/08/15	Keri Garrett – Senior Resource Management Engineer	R Flitton – Principal Resource Management Engineer
4	Requirement for sumps to be fitted with siphons	24/08/15	Mike Healy – Resource Management Engineer	R Flitton – Principal Resource Management Engineer
5	Vehicle Crossing types added	07/09/15	Lyn Overton – Resource Management Engineer	R Flitton – Principal Resource Management Engineer
6	Amendments as per requirements from Standards NZ	7/10/15	Polly Lambert – Policy, Standards & Assets Planner	K Garrett – Senior Resource Management Engineer
7	Water connection requirements added	30/10/15	K Garrett – Senior Resource Management Engineer	Polly Lambert – Policy, Standards & Assets Planner
8	Amendments as per 2016/17 QLDC review	24/08/17	Polly Lambert – Policy & Performance Programme Manager	David Wallace - Principal Resource Management Engineer
9	Amendments as per 2016/17 October Submissions	28/02/18	Polly Lambert – Policy & Performance Programme Manager	David Wallace - Principal Resource Management Engineer
10	Amendments as per 2017/18 Public Consultation March 2018	17/04/18	Polly Lambert – Policy & Performance Programme Manager	Ulrich Glasner – Chief Engineer David Wallace - Principal Resource Management Engineer
11	Amendments as per 2019 submissions	29/01/20	Asha Schaefer – Civil Engineer	Ulrich Glasner – Chief Engineer David Wallace - Principal Resource Management Engineer
12	Amendments as per 2020 Submissions	23/9/20	Asha Schaefer – Civil Engineer	Ulrich Glasner – Chief Engineer David Wallace - Principal RME
13	Amendments as per 2021/22 Submissions – Draft for public consultation	9/6/2022	Asha Schaefer – Civil Engineer	Richard Powell – Infrastructure Engineer, Chief Engineering

14	Amendments as per 2022 Public Consultation and 2023/24 Submissions – Draft for public consultation	21/08/24	Nisha Dahal –Infrastructure Development Engineer Sam Metcalfe – Infrastructure Development Engineer	Simon Leary – Infrastructure Delivery & Engineering Manager Richard Powell – Team Leader, Infrastructure Development Engineering

CONTENTS

DISCLAIMER

Content from the Standard NZS 4404:2010 Land development and subdivision infrastructure used in the QLDC Land Development Code of Practice has been reproduced with permission from Standards New Zealand under License 001142. The Queenstown Lakes District Council is responsible for the accuracy of this document and its requirements. THIS DOCUMENT IS FOR DOWNLOAD ONLY NO PRINTING IS PERMITTED

REFERENCED DOCUMENTS

Reference is made in this document to the following:

NEW ZEALAND STANDARDS

NZS 1170:- - - -	Structural design actions	
Part 5:2004	Earthquake actions – New Zealand	
Part 5 Supp 1:2004	Earthquake actions – New Zealand - Commentary	
NZS 3109:1997	Concrete construction	
NZS 3114:1987	Specification for concrete surface finishes	
NZS 3116:2009	Concrete segmental and flagstone paving	
NZS 3604:2011	Timber-framed buildings	
NZS 4121:2001	Design for access and mobility: Buildings and associated facilities	
NZS 4241:1999	Public toilets	
NZS 4402:- - - -	Methods of testing soils for civil engineering purposes	
Part 6:1986	Soil strength tests	
NZS 4404:2010	Land development and subdivision infrastructure	
NZS 4407:2015	Methods of sampling and testing road aggregates	
NZS 4431:1989	Code of Practice for earth fill for residential development	
NZS 4442:1988	Welded steel pipes and fittings for water, sewage and medium pressure gas	
NZS 4522:2010	Underground fire hydrants	
NZS 5828:2015	Playground equipment and surfacing	
NZS/AS 1657:1992	Fixed platforms, walkways, stairways and ladders. Design, construction and installation	
SNZ HB 5828.1:2006	General playground equipment and surfacing handbook	
SNZ PAS 4509:2008	New Zealand Fire Service firefighting water supplies Code of Practice	

JOINT AUSTRALIAN/NEW ZEALAND STANDARDS

AS/NZS 1158:- - - -	Road lighting
Part 0:2005	Introduction
Part 1.1:2005	Vehicular traffic (category V) lighting – Performance and design requirements
Part 1.2:2010	Vehicular traffic (Category V) lighting - Guide to design, installation, operation and maintenance
Part 3.1:2005	Pedestrian area (category P) lighting – Performance and design requirements

AS/NZS 1170	Structural Design Actions
AS/NZS 1254:2010	PVC-U pipes and fittings for stormwater and surface water applications
AS/NZS 1260:2017	PVC-U pipes and fittings for drain, waste and vent application
AS/NZS 1477:2017	PVC pipes and fittings for pressure applications
AS/NZS 1546:- - - -	On-site domestic wastewater treatment units
Part 1:2008	Septic tanks
AS/NZS 1547:2012	On-site domestic wastewater management
AS/NZS 2032:2006	Installation of PVC pipe systems
AS/NZS 2033:2024	Design and installation of polyethylene pipe systems
AS/NZS 2041:2011	Buried corrugated metal structures
Part 1:2011	Design methods
Part 2:2011	Installation
Part 4:2010	Helically formed sinusoidal pipes
Part 6:2010	Bolted plate structures
AS/NZS 2280:2014	Ductile iron pipes and fittings
AS/NZS 2566:- - - -	Buried flexible pipelines
Part 1:1998	Structural design
Part 1 Supp 1:1998	Structural design – Commentary
Part 2:2002	Installation
AS/NZS 3000:2018	Electrical installations
AS/NZS 2638:- - - -	Gate valves for waterworks purposes
Part 2:2011	Resilient seated
AS/NZS 3500:- - - -	Plumbing and drainage
Part 1:2018	Water services
Part 2:2018	Sanitary plumbing and drainage
AS/NZS 3518:2013	Acrylonitrile butadiene styrene (ABS) compounds, pipes and fittings for pressure applications
AS/NZS 3690:2009	Installation of ABS pipe systems
AS/NZS 3725:2007	Design for installation of buried concrete pipes
AS/NZS 3845:- - - -	Road safety barrier systems
Part 1:2015	Road safety barrier systems
Part 2:2017	Road safety devices
AS/NZS 3879:2011	Solvent cements and priming fluids for PVC (PVC-U and PVC-M) and ABS pipes and fittings
AS/NZS 4020:2018	Testing of products for use in contact with drinking water
AS/NZS 4058:2007	Precast concrete pipes (pressure and non-pressure)
AS/NZS 4129:2008	Fittings for polyethylene (PE) pipes for pressure applications

AS/NZS 4130:2018	Polyethylene (PE) pipes for pressure applications
AS/NZS 4131:2010	Polyethylene (PE) compounds for pressure pipes and fittings
AS/NZS 4158:2003	Thermal-bonded polymeric coatings on valves and fittings for water industry purposes
AS/NZS 4441:2017	Oriented PVC (PVC-O) pipes for pressure applications
AS/NZS 4586:2004	Slip resistance classification of new pedestrian surface materials
AS/NZS 4765:2017	Modified PVC (PVC-M) pipes for pressure applications
AS/NZS 4793:2009	Mechanical tapping bands for waterworks purposes
AS/NZS 4998:2009	Bolted unrestrained mechanical couplings for waterworks purposes
AS/NZS 5065:2005	Polyethylene and polypropylene pipes and fittings for drainage and sewerage applications

AUSTRALIAN STANDARDS

AS 1579:2001	Arc-welded steel pipes and fittings for water and waste-water
AS 1741:1991	Vitrified clay pipes and fittings with flexible joints – Sewer quality
AS 1906:- - - -	Retroreflective materials and devices for road traffic control purposes
Part 3:1992	Raised pavement markers (retroreflective and non-retroreflective)
AS 2200:2006	Design charts for water supply and sewerage
AS 2700:2011	Colour Standards for general purposes
AS 2870:2011	Residential slabs and footings – Construction
AS 2890:- - - -	Parking facilities
Part 5:1993	On-street parking
AS 3571:- - - -	Plastics piping systems – Glass-reinforced thermoplastics (GRP) systems based on unsaturated polyester (UP) resin
Part 1:2009	Pressure and non-pressure drainage and sewerage
Part 2:2009	Pressure and non-pressure water supply
AS 3681:2008	Application of polyethylene sleeving for ductile iron piping
AS 3996:2019	Access covers and grates
AS 4373:2007	Pruning of amenity trees

BRITISH STANDARDS

BS EN 295:- - - -	Vitrified clay pipes and fittings and pipe joints for drains and sewers
Part 1:2013	Requirements
Part 2:2013	Quality control and sampling
Part 3:2012	Test methods
Part 4:2013	Requirements for special fittings, adaptors and compatible accessories
Part 5:2013	Requirements for Perforated Pipes and Fittings
Part 6:2013	Requirements for vitrified clay manholes

Part 7:2013	Requirements for vitrified clay pipes and joints for pipe jacking
BS EN 805:2000	Water supply – Requirements for systems and components outside buildings

OTHER PUBLICATIONS

GENERAL

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

EARTHWORKS AND GEOTECHNICAL REQUIREMENTS

BRANZ. *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).

Crawford, S A, and Millar, P J. *The design of permanent slopes for residential building development*, EQC Research Project 95/183, *NZ Geomechanics News* (June 1998).

Ministry for the Environment and Ministry of Business, Innovation and Employment. *Planning and engineering guidance for potentially liquefaction-prone land*, Guideline by MBIE (Sept 2017).

Ministry for the Environment and Ministry of Business, Earthquake geotechnical engineering practice series (2021)

Module 1	Overview of the geotechnical guidelines
Module 2	Geotechnical investigations for earthquake engineering
Module 3	Identification, assessment, and mitigation of liquefaction hazards
Module 4	Earthquake resistant foundation design
Module 5	Ground improvement of soils prone to liquefaction
Module 6	Earthquake resistant retaining wall

New Zealand Geotechnical Society Inc. *Field description of soil and rock.* New Zealand Geotechnical Society Inc, 2005.

New Zealand Geotechnical Society Inc. *Geotechnical issues in land development.* Proceedings of New Zealand Geotechnical Society Symposium, Hamilton, 1996.

Opus International Consultants Ltd. Underground Utilities – Seismic Assessment and Design Guidelines, GNS Science, Edition 1 March 2017.

ROADS

Auckland Transport Code of Practice (ATCOP). Chapter 20: Public Transport – Busses. Auckland: ATCOP, 2017.

Auckland Transport. Urban Street and Road Design Guide, Auckland Transport Design Manual, 2019.

Austroads codes and guides, 2009. (Subject to the relevant New Zealand supplement).

Austroads. *Guide to road design – Part 3: Geometric design*. Austroads, 2009.

Austroads. Guide to road design – Part 6: Roadside Design, Safety and Barriers. Austroads, 2010.

Austroads. Guide to road design – Part 6A: Paths for Walking and Cycling. Austroads, 2017.

Austroads. *Guide to traffic management – Part 8: Local area traffic management*. Austroads, 2008.

Cement and Concrete Association of Australia. *Guide to residential streets and paths*. Cement and Concrete Association of Australia, 2004.

Ministry of Transport Government Policy Statement on Land Transport Funding 2018-19 - 2027-28.

New Zealand Transport Agency Waka Kotahi (NZTA).

Bridge manual. (SP/M/022) 3rd ed. Wellington: NZTA, 2016.

Cycle network and route planning guide. Wellington: Land Transport Safety Authority, 2004. Available at: http://www.nzta.govt.nz/resources/cycle-network-androute-planning/cycle-network.html

Pedestrian network guidance. Wellington: NZTA, 2024. Available at: https://www.nzta.govt.nz/walking-cycling-and-public-transport/walking/walking-standards-and-guidelines/pedestrian-network-guidance/

Safe System audit (SSA) procedures for transport projects. Wellington: NZTA, 2022. Available at: https://www.nzta.govt.nz/roads-and-rail/highways-information-portal/technical-disciplines/ safety-and-geometric-design/safety/safe-system-audits/

RTS 18: New Zealand on-road tracking curves for heavy vehicles. Wellington: Land Transport New Zealand, 2007. Available at: http://www.nzta.govt.nz/resources/road-traffic-standards/rts-18.html

Stormwater treatment standard for state highway infrastructure. Wellington: NZTA, 2010.

Transit Planning Policy Manual. (SP/M/001) Appendix 5B Accessway standards and guidelines. Wellington: NZTA, 2007

New Zealand guide to pavement structural design. Wellington: NZTA, 2017

New Zealand guide to pavement evaluation and treatment design. Wellington: NZTA, 2017

NZTA specifications (available at: http://www.nzta.govt.nz/resources/index.html)

B/2:2005	Construction of unbound granular pavement layers
B/5:2008	*In-situ stabilisation of modified pavement layers*
F/1:1997	*Earthworks construction*
F/2:2000	Pipe subsoil drain construction
F/2 notes:2000	Notes on pipe subsoil drain construction specification
F/3:2010	Specification for pipe culvert construction
F/3:2010 Notes	Notes on pipe culvert construction specification
F/5:2000	Specification for the corrugated plastic pipe subsoil drain construction
M/1:2007	Roading bitumens
M/3:1986	*Sub-base aggregate*

M/4:2006	Crushed basecourse aggregate
M/10:2014	Dense graded and stone mastic asphalt
P/3:1995	First coat sealing
P/4:1995	Resealing

Queenstown Lakes District Council (QLDC). *Bus Stop Policy and Standards.* Queenstown: QLDC 2021.

Queenstown Lakes District Council (QLDC). *Trail Design Standards and Specifications*: QLDC 2018.

Queenstown Lakes District Council (QLDC). *Southern Light Strategy 2017*. Queenstown: QLDC 2017.

United Kingdom Department for Transport. *Manual for streets.* London: Thomas Telford Publishing, 2007.

United Kingdom Transport Research Laboratory. *TRL661 – The manual for streets: evidence and research.* TRL, 2007.

STORMWATER, WASTEWATER, AND WATER SUPPLY

Auckland Council

Stormwater management devices in the Auckland region. Auckland Council Guideline Document, GD2017/001, 2017

Water sensitive design for stormwater. Auckland Council Guideline Document GD2015/004. Prepared by Boffa Miskell for Auckland Council, 2015

Soakage Design Manual. Auckland City Council. Prepared by Pattle Delamore Partners Ltd, 2003.

Australasian Society for Trenchless Technology (ASTT). *Guidelines for horizontal directional drilling, pipe bursting, microtunnelling and pipe jacking*. Greenwood, Western Australia: ASTT, 2009.

Austroads. *Guide to road design – Part 5: Drainage design*. Austroads, 2008.

Hicks, D M, and Mason, P D. *Roughness characteristics of New Zealand rivers*, Wellington: Water Resources Survey, DSIR Marine and Freshwater, 1991.

Janson, Lars-Eric. *Plastics pipes for water supply and sewage disposal*. 2003.

Lamont, P. 'Metrication: Hydraulic data and formulae.' *Water Services* Volume 81, numbers 972/3/4 (Reprinted by Kent Meters Ltd, UK)

Ministry for the Environment.

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

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

Tools for estimating the effects of climate change on flood flow – A guidance manual for local government in New Zealand. Wellington: Ministry for the Environment, 2010.

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

Najafi, M. *Trenchless technology – Pipeline and utility design, construction, and renewal*. McGraw-Hill, 2005.New Zealand Water and Wastes Association (Water New Zealand). *New Zealand pipe inspection manual.* 4th ed. Wellington: New Zealand Water and Wastes Association, 2019

Queenstown Lakes District Council (QLDC). *QLDC Guidelines for Environmental Management Plans*. Queenstown: QLDC June 2019.

Queenstown Lakes District Council (QLDC*). Pressure Sewer Policy*. Queenstown: QLDC 2024.

Stein, D. *Trenchless technology for installation of cables and pipelines*. Germany: Stein & Partner, 2005.

Uni-Bell. *Handbook of PVC pipe.* 4th ed. Dallas: Uni-Bell PVC Pipe Association, 2001.

Water Services Association of Australia (WSAA):

WSA 02-2002	Sewerage Code of Australia – 1999 and 2002
WSA 03-2002	Water Supply Code of Australia – 1999 and 2002
WSA 04-2005	Sewage Pumping Station Code of Australia – 2005
WSA 06-2008	Vacuum Sewerage Code of Australia – 2008
WSA 07-2007	Pressure Sewerage Code of Australia – 2007

LANDSCAPE

Talbot, T. *Guidance Document for Sports Field Development.* Auckland: Sport New Zealand, 2019.

NETWORK UTILITY SERVICES

Department of Labour. *Guide for safety with underground services*. Wellington: Department of Labour, 2002.

New Zealand Utilities Advisory Group (NZUAG). *National* Code of Practice *for utilities' access to the transport corridors.* Wellington: NZUAG, 2008.

NOTE – The NZUAG Code of Practice is an interim measure until a national Code of Practice is approved under the Utilities Access Act 2010.

NEW ZEALAND LEGISLATION

The provisions of this Code of Practice 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):

Building Act 2004, Building Regulations, and New Zealand Building Code (NZBC) 1992

Civil Defence Emergency Management Act 2016

Conservation Act 1987

Electricity Act 1992

Health and Safety at Work Act 2015

Health (Drinking Water) Amendment Act 2007

Historic Places Act 1993

Infrastructure (Amendments Relating to Utilities Access) Act 2010

Land Transfer Act 2017

Land Transport Rule (Traffic Control Devices) 2004

Local Government Act 1974 and Local Government Act 2002

Reserves Act 1977

Resource Management Act 1991

Utilities Access Act 2010

RELATED DOCUMENTS

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

GENERAL

Land Information New Zealand. New Zealand geodetic datum 2000 (NZGD2000)

Land Information New Zealand Vetical Datum 2016 (NZVD 2016)

Ministry for the Environment. *Climate change effects and impacts assessment – A guidance manual for local government*. 2nd ed. Wellington: Ministry for the Environment, 2008.

Queenstown Lakes District Council Town Centre Design Guidelines 2018

Queenstown Lakes District Council Town Centre Spatial Framework 2018

EARTHWORKS AND GEOTECHNICAL REQUIREMENTS

Fraser Thomas Ltd (B J Brown, P R Goldsmith, J P M Shorten, L Henderson) *BRANZ Study Report 120, Soil expansivity in the Auckland region.* Judgeford: BRANZ, 2003.

Ministry for the Environment. *Planning for development of land on or close to active faults – A guideline to assist resource management planners in New Zealand*. Wellington: Ministry for the Environment, 2004.

Sanders, W, and Glassey, P. (Compilers). *Guidelines for assessing planning policy and consent requirements for landslide prone land,* GNS Science Miscellaneous Series 7. Lower Hutt: Institute of Geological and Nuclear Sciences Limited, 2007.

ROADS

Concrete Masonry Association of Australia. *Concrete segmental pavements – Design guide for residential accessways and roads*. Sydney: Concrete Masonry Association of Australia, 1997.

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, and Part 2: Implementation guide*. Wellington: Ministry of Justice, 2005.

Ministry of Transport. *Connecting New Zealand: A summary of the government's policy direction for transport*. Wellington: Ministry of Transport, 2011.

Ministry of Transport *Government policy statement on land transport funding 2018-19 - 2027-28.* Wellington: Ministry of Transport, 2018.

Ministry of Transport. *Safer journeys – New Zealand's road safety strategy 2010 – 2020.* Wellington: Ministry of Transport, 2010.

New Zealand Transport Agency Waka Kotahi

Traffic note 48 – Light vehicle sizes and dimensions: Street survey results and parking space requirements – Information. Land Transport New Zealand, December 2004. Available at: http://www.nzta.govt.nz/resources/traffic-notes/docs/traffic-note-48.pdf

Land Transport Rule: Setting of Speed Limits 2022. Wellington: Ministry of Transport, 2022

Traffic control devices manual (TCD manual) | NZ Transport Agency Waka Kotahi (nzta.govt.nz)

NZTA register of network standards and guidelines. Wellington: NZTA, 2009. Available at: http://www.nzta.govt.nz/resources/nzta-register-network-standards-guidelines/

SNZ HB 44:2001 *Subdivision for people and the environment.* Wellington: Standards New Zealand, 2001.

STORMWATER, WASTEWATER, AND WATER SUPPLY

Auckland City Council. *On-site stormwater management manual*. Auckland: Auckland City Council, 2002.

Auckland City Council. *Soakage design manual.* Auckland: Auckland City Council, 2003.

Christchurch City Council. *Waterways, wetlands and drainage guide – Part A: Visions and Part B: Design.* 2003. Available at: http://www.ccc.govt.nz/cityleisure/parkswalkways/environmentecologywaterwayswetlandsdrainageguide/index.aspx

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/bridges-and-culverts/

New Zealand Water Environment Research Foundation (NZWERF) *On-site stormwater management guideline*. Wellington: NZWERF, 2004.

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.

Queenstown Lakes District Council (QLDC). *Asbuilt Plan Specification Requirements*. Queenstown: QLDC 2010

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

LANDSCAPE

Queenstown Lakes District Council (QLDC). *Community Open Spaces Asset Management Plan 2015-2030.* Queenstown: QLDC 2015

WEBSITES

Auckland Council	http://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
New Zealand Historic Places Trust	http://www.historic.org.nz
New Zealand Legislation	http://www.legislation.govt.nz
New Zealand Transport Agency	http://www.nzta.govt.nz/
Plastics Industry Pipe Association of Australia:	http://www.pipa.com.au
Plastics Industry Pipe Association of New Zealand (PIPA-NZ)	https://www.plastics.org.nz/about-us/sector-groups-main/pipa-nz
Trips Database Bureau	http://www.tdbonline.org/home
Water Services Association of Australia	https://www.wsaa.asn.au/

LATEST REVISIONS

The users of Code of Practice should ensure that their copies of the above-mentioned New Zealand Standards are the latest revisions. Amendments to referenced New Zealand and Joint Australian/New Zealand Standards can be found on http://www.standards.co.nz.

REVIEW OF NZS 4404:2010

Suggestions for improvement of NZS 4404:2010 will be welcomed. They should be sent to the Manager, Standards New Zealand, Private Bag 2439, Wellington 6140.

FOREWORD

A significant proportion of all new infrastructure is created by land development and subdivision projects. As a community, we need to get this right. This is why NZS 4404:2010 aims to encourage good urban design and remove road blocks to liveability and economic development in communities.

Some of the key changes from NZS 4404:2004 are:

(a) That road design needs to allow 'context' or 'place' to be given significant emphasis, and to require roads to achieve safe (slower) operating speeds;

(b) An emphasis on managing and treating stormwater 'before it gets into a pipe', together with a requirement to consider climate change.

(c) 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 be a preferred solution, especially if low impact on receiving waters downstream is critical;

(d) The sections on landscaping and reserves have been combined and significantly rewritten; and

(e) The section on utility services (section 8) has also been significantly amended in accordance with the latest network authorities' codes.

The change in the title from 'engineering' to 'infrastructure' signals that good subdivision design involves a multidisciplinary collaborative approach. NZS 4404 was first published in 1981 as the Code of Practice for urban land subdivision. In 2004 it became the Standard for Land development and subdivision engineering. In response to submissions on the draft 2010 version, and to clarify the place and role of NZS 4404, the committee has decided that the new name, Land development and subdivision infrastructure, best reflects its function.

NZS 4404:2010 is applicable to greenfield, infill, and brownfield redevelopment projects. It provides local authorities (LAs) and developers a Standard for the design and construction of subdivision infrastructure. It can be used on its own or, together with local codes, as a means to comply with Resource Management Act (RMA) consent conditions. It is not an urban design policy, guide, or method of master planning.

The impetus for the review of NZS 4404:2004 came from requests for changes from:

(f) The New Zealand Transport Agency Waka Kotahi (NZTA);

(g) Local Government New Zealand (LGNZ);

(h) The Ministry for the Environment (MfE);

(i) Pipe manufacturers;

(j) Territorial authorities (TAs), and;

(k) A number of individual users of the Standard.

The Queenstown Lakes District Council (QLDC) under copyright licence has reproduced NZS 4404:2010 and Council amendments with further modifications to produce this document for its use as a land development and subdivision Code of Practice within this geographical area of jurisdiction.

The revision was sponsored by LGNZ, NZTA, and MfE.

Innovative subdivision has been discouraged to some extent under the 2004 version of NZS 4404. The objectives of the 2004 version were to permit alternative solutions. However, in practice, well designed solutions that were not in accordance with the acceptable solutions specified by the Standard often had difficulty gaining RMA consents. This led to delays and additional costs or a less desirable design being adopted.

The review committee therefore challenged itself to produce a new Standard that:

(l) Encourages sustainable and modern design;

(m) Provides some certainty for designers and LAs; and

(n) Prevents the outcomes that can arise when the sole focus is cost minimisation, and adherence to minimum standards.

The committee recognises that there are tensions between these sometimes conflicting objectives and has balanced those tensions when deciding between allowing flexibility and prescribing clear rules.

The committee would like to thank the many people who between them made more than 1,900 comments and suggestions for improvements. The submissions were overwhelmingly in support of the new direction of the Standard. Every single comment and suggestion was reviewed by committee members and many have found their way into the final document. It is a significantly better Standard because of those submissions. The committee would also like to thank all those organisations that have allowed their documents to be used in the Standard or as reference documents. The committee has tried not to 'reinvent the wheel' where existing documents provide the appropriate standards. This is why many other publications including Standards are referenced by NZS 4404:2010.

Finally, we all need to applaud and be grateful for the countless hours and effort committee members contributed to this review. The only payment is the satisfaction of a well-written Standard that enjoys good community support. It is a Standard that helps develop people-oriented communities with land development and subdivision infrastructure that has a long life, and the minimum environmental impact compatible with good urban design.

OUTCOME STATEMENT

NZS 4404:2010 provides local authorities, developers, and their professional advisors with standards for design and construction of land development and subdivision infrastructure. NZS 4404:2010 encourages sustainable development and modern design that emphasises liveability and environmental quality. It will also provide as much consistency as possible on land development and subdivision infrastructure while still allowing flexibility for local variations to suit local circumstances.

QLDC Land Development and Subdivision Code of Practice

1 GENERAL REQUIREMENTS AND PROCEDURES

Subdivisions and developments shall also comply with all relevant policies or procedures adopted by the Council. Where ambiguities and inconsistencies exist between this code and any Policy or procedure adopted by the Council it is the developers responsibility to identify these and obtain guidance from the Council confirming which document should be followed.

This Code of Practice represents a set of minimum standards and good practice guidelines for developers, ensuring high quality and consistency of infrastructure provision across all of QLDC's various communities. These standards may be exceeded but not compromised, unless specifically agreed to by Council for a deviation.

Where community specific guidelines are available these shall be taken into consideration throughout the design and construction of subdivisions and development. Where community specific considerations cannot be met, written acceptance of an alternative method shall be obtained from the Council.

Any work carried out on Council Assets requires Council approval.

1.1 SCOPE

NZS 4404:2010 is recommended for adoption by local authorities (LAs). It is applicable to greenfield and infill development, as well as brownfield redevelopment projects. The Standard also serves as a basis for technical compliance for the subdivision and development of land where these activities are subject to the Resource Management Act. LAs may develop their own standards for land development or tailor outcomes sought to the particular needs of their local environments through their design guides, district plans, and codes of practice or development engineering manuals. However, it is recommended that NZS 4404 be adopted as the basis for these standards.

For some types of infrastructure, but not all, specific guidance and standards have been developed by QLDC, some of which have parameters which are reflected in this Code of Practice. Where QLDC has not developed its own standards, reference is often made to best practice guidance or standards developed by external agencies.

Section 1 of this Code of Practice concerns matters of general application and general requirements to be observed. Sections 2 to 8 of this Code of Practice provide good practice guidelines on particular types of infrastructure to be provided.

C1.1

NZS 4404:2010 does not include a statement of all minimum requirements for land development and subdivision infrastructure. It is not an urban design guide. LAs may specify their own minimum requirements, citing NZS 4404:2010 or their own bylaws or district plan as appropriate.

NZS 4404:2010 does not deal with the processes of compliance with the requirements of a district plan for subdivision or development activities or obtaining a resource consent for such activities. For these purposes reference can be made to the Ministry for the Environment website, http://www.mfe.govt.nz, and the plans and policies of the relevant TA.

1.2 INTERPRETATION

1.2.1 General

1.2.1.1 The full titles of referenced documents cited in this Code of Practice are given in the list of referenced documents.

1.2.1.2 The word 'shall' refers to practices which are mandatory for compliance with the Code of Practice. The words 'should' or 'may' indicate a recommended practice.

1.2.1.3 Clauses prefixed by 'C' and printed in italic type are intended as comments on the corresponding mandatory clauses. They are not to be taken as the only or complete interpretation of the corresponding clause. This Code of Practice can be complied with if the comment is ignored.

1.2.1.4 The terms 'informative' and 'normative' have been used in this Code of Practice to define the application of the appendix to which they apply. A 'normative' appendix is an integral part of a Standard, whereas an 'informative' appendix is only for information and guidance. Informative provisions do not form part of the mandatory requirements of this Code of Practice.

1.2.1.5 Schedules containing information to be provided in certificates or as-built plans are included at the end of sections to which they relate. Each schedule is copyright waived, meaning it may be photocopied for use in accordance with the Code of Practice.

1.2.2 Definitions

For the purpose of this Code of Practice, the following definitions shall apply:

Annual exceedance probability (AEP) — The probability of exceedance of a given occurrence, generally a storm, in a period of 1 year (1% AEP is equivalent to a 1 in 100-year Average Recurrence Interval (ARI) storm)

Carriageway — That part of a road consisting of the movement lane, shoulder, and includes parking andloading areas when provided within the road

Corridor manager — Has the same meaning given to it by the proposed utilities access legislation

NOTE – In preparing NZS 4404:2010, the Committee made every effort to align it with the infrastructure legislation and the utilities access legislation still before Parliament at the time this Standard is published. Readers will need to satisfy themselves on the final form of the definitions of code (see section 8) and corridor manager once this utilities access legislation comes into effect.

Crime prevention through environmental design — Has a set of four principles: surveillance, access management, terrirorial 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

Developer — An individual or organisation having the financial responsibility for the development project. Developer includes the owner

Developer's professional advisor — 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

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. This definition shall exclude Residential Flats.
Earthworks	The disturbance of land by the removal or deposition on or change to the profile of land. Earthworks includes excavation, filling, cuts, foot rating and blading, firebreaks, batters and the formation of roads, access, driveways, tracks and the deposition and removal of cleanfill.
Footpath	So much of any road or other area as is laid out or constructed by authority of the TA primarily for pedestrians; and may include the edging, kerbing, and channelling of the road
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 chartered professional engineer (CPEng) or an engineering geologist with recognised qualifications and experience in geotechnical engineering, and experience related to land development
Ground	Describes the material in the vicinity of the surface of the earth whether soil or rock
Independent qualified person (IQP)	A specialist approved by the TA and having the appropriate skills and qualifications to carry out specific procedures
Local authority	As defined in the Local Government Act 2002, and includes territorial authorities and regional **councils**
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
Movement lane	That part of the formed and sealed road that serves the link function in a road. It may have a shared use for other activities such as walking, cycling, parking, and play
Network utility operator	Has the same meaning given to it by section (s.) 166 of the Resource Management Act
Owner	In relation to any land or interest in land, includes an owner of the land, whether beneficially or as trustee, and their agent or attorney, and a mortgagee acting in exercise of power of sale; and also includes the Crown, the Public Trustee, and any person, TA, board, or other body or authority however designated, constituted, or appointed, having power to dispose of the land or interest in land by way of sale
Place	The function of space as a destination for people, influenced by the design of the space itself, as well as the adjacent land use. The strength of place function can vary depending on the intensity of use and character of the activity, whether formal as in a pedestrian shopping street or public park, or more informal as in play or casual interactions between neighbours on a public street.
Potable water	As defined in the Health (Drinking Water) Amendment Act

Primary flow	The estimated surface water run-off specified to be managed by the primary stormwater system. This flow may be piped or contained within relatively narrow confines under public control by reserve or easement
Private road	Any roadway, place, or arcade laid out within a district on private land by the owner of that land intended for the use of the public generally and has the same meaning given to it by s. 315 of the Local Government Act 1974
Private way	Any way or passage over private land within a district, the right to use which is confined or intended to be confined to certain persons or classes of persons, and which is not thrown open or intended to be open to the use of the public generally and includes any shared access or right of way and has the same meaning given to it by s. 315 of the Local Government Act 1974
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
Residential flat	A residential activity that, consists of no more than one flat in the same ownership as the residential unit; and is contained within the same residential unit; and if attached to a detached accessory building does not cover more than 50% of the total Gross Floor Area of the building containing the flat and detached accessory building; and contains no more than one kitchen and one laundry; and does not cover more than 35% of the total Gross Floor Area of the building(s) containing the residential unit and flat (but excluding accessory buildings)
Residential Unit	A residential activity which consists of a single selfcontained household unit, whether of one or more persons, and includes accedssory buildings. Where more thanone kitchen and/or laundry facility is provided on the site, other than a kitchen and/or laundry facility in a residential flat, there shall be deemd to be more than one residential unit.
Review and Acceptance	The purpose of QLDC completing a design/construction review and accepting the design/construction is to ensure the developer has provided sufficient supporting documentation. Acceptance or approval of the design and or construction does not transfer any liability to the Council and it has been provided on the basis that the developer has confirmed all elements of this Code of Practice have been complied with unless stated otherwise in the acceptance/approval letter.
Road	Has the same meaning given to it by s. 315 of the Local Government Act 1974
Secondary flow	The estimated surface water run-off in excess of the primary flow. In most cases this flow will be managed in an overland flowpath or ponding area that is protected by public ownership or easement
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 s. 315 of the Local Government Act 1974
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 s. 2 of the Resource Management Act
Swale	A constructed watercourse shaped or graded in earth materials and stabilised 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	A territorial authority (TA) defined in the Local Government Act 2002
Wāhi 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
Waterway	Means fresh water or geothermal water in a river, lake, stream, pond, wetland, or aquifer, or any part thereof, that is not located within the coastal marine area
Zone of Influence	A triangular area defined by lines extending 45° upwards from 150 mm below a pipe invert, to the ground surface.

1.2.3 Abbreviations

The following abbreviations are used in this Code of Practice:

ABS	acrylonitrile butadiene styrene
AD	average day - annual average of seasonal peaks and troughs of each day over the year
AEP	annual exceedance probability
AV	air valve
°C	degrees Celsius
CBD	central business district
CBR	California bearing ratio
CCTV	closed circuit television
CLS (SCL)	concrete lined steel (steel concrete lined)
CPTED	Crime prevention through environmental design
Code of Practice	Queenstown Lakes District Council Land Development and Subdivision Code of Practice
DI	ductile iron
DN	nominal diameter under the pipe manufacturing standard (this is not be to be assumed to be the Internal Diameter or Outside Diameter for any pipe, the manufacturers standard needs to be checked)

du	dwelling unit
ESA	equivalent standard axle
FAC	free available chlorine
FAR	floor-to-area ratio
FL	flange
FSL	finished surface level
GL	ground level
g/m³	grams per cubic metre
GRP	glass reinforced plastic
H	head (in metres)
h	hour
ha	hectare
HDD	horizontal directional drilling
IQP	independent qualified person
km	kilometre
km/h	kilometres per hour
kPa	kilopascal
L	litre(s)
LID	low impact design
m	metre
MDD	maximum dry density
MH	manhole or maintenance hole
min	minute(s)
MPa	megapascal
MS	maintenance shaft
m/s	metres per second
m³/s	cubic metres per second
mm	millimetres
NAASRA	National Association of Australian State Road Authorities
NES	National Environmental Standard

NIWA	National Institute of Water and Atmospheric Research
NPS	National Policy Statement
NZBC	New Zealand Building Code
NZHPT	New Zealand Historic Places Trust
NZTA	New Zealand Transport Agency Waka Kotahi
OSH	Occupational Safety and Health
p	person
PE	polyethylene
PE 80B	polyethylene with minimum required strength (MRS) of 8 MPa as defined in AS/NZS 4130 and AS/NZS 4131
PE 100	polyethylene with MRS of 10 MPa as defined in AS/NZS 4130 and AS/NZS 4131
PF	peaking factor
PIPA	Plastics Industry Pipe Association of Australia Ltd
PN	nominal pressure class (maximum rated operating pressure)
PP	polypropylene
PRV	pressure reducing valve
PVC	polyvinyl chloride
PVC-U	unplasticised polyvinyl chloride
PVC-M	modified polyvinyl chloride
PVC-O	orientated polyvinyl chloride
RMA	Resource Management Act
RRJ	rubber ring joint
s.	section
Soc	socket
STP	specified test pressure
TA	territorial authority
TMS	terminal maintenance shaft
UV	ultraviolet
VC	vitrified clay
vpd	vehicles per day

1.3 CONTEXT

This Standard is relevant to Acts such as the Resource Management Act, Building Act, Historic Places Act and other legislation. The purpose of NZS 4404:2010 is to provide standards for the implementation of well-designed land development and subdivision infrastructure projects that have obtained the necessary resource consents under the RMA, and comply with other legislation. LAs will be able to invoke compliance with this Standard and their own local additions and variations, to ensure that the sustainability, urban design, and environmental impact objectives of land development and subdivision projects are carried through to completion. The TA can agree to deviations of the Code at their discretion. The interrelationship between this Standard and these Acts is outlined below.

The Standard also provides best practice land development and subdivision infrastructure techniques in low impact design, climate change, and urban design.

1.3.1 Resource Management Act

The Resource Management Act 1991 (RMA) is the principal statute under which the development and subdivision of land is controlled.

Regional and district plans prepared under the RMA are the key resource management instruments that LAs implement to achieve sustainable management of natural and physical resources, which is the overarching purpose of the RMA.

This Code of Practice does not have a binding effect unless incorporated into a regional/district plan or bylaw. If the Code of Practice is not referred to in the plan or any bylaw, the Code of Practice can still serve as a technical compliance manual to assist in guiding decision-making and forming conditions of resource consent.

A national policy statement (NPS) and national environmental standard (NES) may also apply to a proposed development in addition to regional and district planning documents. However NPS and NES only apply once they are finalised and gazetted whereas regional and district plan provisions may apply to consent applications as soon as they are notified.

C1.3.1

Over time, central government may develop other NPS and NES which may affect decision-making by LAs on land development and subdivision, including national policy on freshwater management, and flood risk. The Ministry for the Environment's website should be referred to for any relevant NPS and NES.

The protection of historic heritage from inappropriate subdivision, use, and development is a matter of national importance under s. 6(f) of the RMA. The RMA's definition of historic heritage includes: historic sites, structures, places, and areas; archaeological sites; sites of significance to Māori including wāhi tapu; and surroundings associated with the natural and physical resources. Therefore regional/district plans should be reviewed to ascertain whether any development proposal affects historic heritage. Most plans have a historic heritage schedule, which lists the item protected, its location, and its sensitivity. A precautionary approach should be taken prior to any land development and subdivision infrastructure affecting historic heritage, with the TA consulted at the earliest stage (see 1.3.2).

Where applications for resource consents may affects sites of significance to Māori, consultation with the appropriate tangata whenua groups should occur prior to finalising plans or submitting applications for resource consent in order to give effect to Part II of the RMA.

1.3.2 Historic Places Act

In addition to the RMA, the Historic Places Act regulates the modification of archaeological sites on all land and provides for substantial penalties for unauthorised destruction, damage, or modification of these sites.

The Act makes it unlawful for any person to destroy, damage, or modify the whole or any part of an archaeological site registered with the New Zealand Historic Places Trust (NZHPT), without the prior authority of the NZHPT. This is the case regardless of whether:

(a) The site is registered or recorded by the council in planning documents;

(b) The land on which the site is located is designated;

(c) The activity is permitted under the district or regional plan; or

(d) A resource or building consent has been granted.

Therefore approval from the NZHPT is required if a site registered with the NZHPT is affected, in addition to any council approval that may be required.

Furthermore, if the site is known to be associated with pre-1900 human activity, or there is reasonable cause to suspect such an association, the developer should consult with the NZHPT prior to undertaking any earthworks or ground disturbance.

1.3.3 Building Act

The Building Act provides a national framework for building control to ensure that buildings are safe and sanitary and have suitable means of escape from fire. The Building Regulations made under the Act provide the mandatory requirements for building control in the form of the New Zealand Building Code. The Building Code contains the objective, functional requirements, and performance criteria that building works shall achieve.

The Building Amendment Act 2021 introduced new minimum information requirements for building products to support better informed decision-making by building consent authorities, building owners, builders, and designers. The Building (Building Product Information Requirements) Regulations 2022 designate a number of building products for which building product information must be provided and establish the minimum requirements for that information.

Where the development of land and subdivision infrastructure involves the creation of structures with associated site works, including specific aspects of stormwater management and the interaction of buildings, fences, and walls with 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.

The Code of Practice may be a higher standard than the Building Act and if bound by a Resource Consent Condition, the Code of Practice requirements will supersede the Building Act requirement where the Code of Practice is more stringent.

C1.3.3

Systems owned or operated by a network utility operator for the purpose of reticulation are not included in the definition of building under the Building Act.

1.3.4 Other Legislation

The Reserves Act, Conservation Act, and other Acts may also require consideration when undertaking land development and subdivision infrastructure. Covenants (a legal restriction or agreement recorded on the title of a property that is a matter of private contract) may also require consideration. For example, a Queen Elizabeth II Act Open Space Covenant is a legally binding protection document agreed between a landowner and the QEII National Trust.

1.4 LOW IMPACT DESIGN

Low impact design (LID) 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, LID provides an opportunity to identify and recognise 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.

1.5 CLIMATE CHANGE

Climate change is likely to increase the magnitude 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 the increased frequency of extreme weather events.

C1.5

Amendments to the Resource Management Act, the Local Government Act 2002, and the Building Act require LAs to have particular regard to the effects of climate change when making decisions under these Acts.

The government is considering the development of a number of other national policy instruments which may affect decision-making by local authorities, including a 'National policy statement on flood risk'. These would not take effect until they are gazetted.

1.6 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. NZS 4404 includes recommended best practices that support urban design protocol initiatives. The *New Zealand urban design protocol* identifies seven essential design qualities for good urban design:

(a) Context: seeing that buildings, places, and spaces are part of the whole town or city;

(b) Character: reflecting and enhancing the distinctive character, heritage, and identity of our urban environment;

(c) Choice: ensuring diversity and choice for people;

(d) Connections: enhancing how different networks link together for people;

(e) Creativity: encouraging innovative and imaginative solutions;

(f) Custodianship: ensuring design is environmentally sustainable, safe, and healthy;

(g) 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.

1.7 REQUIREMENTS FOR DESIGN AND CONSTRUCTION

1.7.1 Investigation and Design

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:

(a) Are experienced in the respective fields;

(b) Hold full membership in the respective professional bodies;

(c) Have appropriate professional indemnity insurance and public liability insurance.

The provisions of this Code of Practice do not reduce the responsibility of those professionals to exercise their judgement and devise appropriate solutions for the particular circumstances of each development.

1.7.2 Construction

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

(a) Have the appropriate experience in the relevant areas;

(b) Have the appropriate equipment;

(c) Have the appropriate public liability insurance;

(d) Meet the requirements of the Health and Safety in Employment Act.

1.8 ACCEPTANCE OF DESIGN AND CONSTRUCTION

1.8.1 Documents to be Submitted for Design Review and Acceptance

1.8.1.1 Prior to, or as a condition of, granting a resource consent for subdivision or development of land, or as otherwise required by a district plan, or as otherwise considered necessary by QLDC when considering applications to construct infrastructure, QLDC may require documents to be submitted including the following:

(a) Engineering review and acceptance application form and deposit

(b) Design, construction, operation and maintenance documentation including drawings, specifications and calculations for the following:

(i) Earthworks and geotechnical requirements

(ii) Roading and site access including a design and access statement (see 3.2.6 of NZS4404:2010) and a Safe System audit. Documentation shall demonstrate compliance with relevant resource consent conditions or explanations if deviations are proposed.

(iii) Stormwater (including overland flow paths and a catchment wide assessment if required by the Council)

(iv) Wastewater

(v) Water supply

(vi) Landscape

(vii) Network Utility Services

(viii) Lighting (including design parameters and isolux plot lines (provides the points of equal illuminance, in lux, from a specific stated mounting position. The diagram can be used to assess the distribution characteristics of the luminaire in addition to determining lighting levels)

(ix) Three Waters Facility Asset Identification Specifications (refer Appendix K)

(c) A geo-professional's report on the suitability of the land for subdivision or development if required by the Council

(d) Other reports as considered necessary by QLDC in the circumstances of the proposed infrastructure in order to meet the requirements of this code

(e) An access and maintenance strategy shall be provided for all non-standard assets to be vested to QLDC. Please refer to Council's Vesting of Roads and Reserves policy 2016 on Council's website. Unless otherwise agreed in writing with QLDC, or as required by relevant legislation, the strategy document shall be prepared on the basis that no specialist training or equipment shall be required to access the vested asset.

(f) A design certificate, for each design discipline, in the form of the certificate in schedule 1A of NZS 4404:2010. Each certificate shall include a schedule of documents to which it applies. The limit of damages shall be agreed with the Council.

(g) A Safety in Design Audit

(i) **Position Statement:** Legislation passed under the Health and Safety at Work Act (2015) requires workers and other persons be provided with the highest level of protection against harm as reasonably practicable. A key element of the legislation requires a person conducting a business or undertaking (PCBU) provide a duty of care to all persons who may be reasonably affected by a particular work, asset, structure or process.

(ii) **Duties and Responsibilities:** All PCBU's have a duty to ensure that designs (as defined by the 2015 HSWA) are without health and safety risks for their intended purpose for the entire lifecycle.

(iii) **Requirements:** All PCBU's shall ensure that, in accordance with the 2015 HSWA, all stages of the design and asset lifecycle have been considered and risks appropriately managed in accordance with the Hierarchy of Controls and other industry best practice as appropriate. As a general guide, it is expected that all PCBU's considered health and safety risks for:

a. Design, implementation, operation and maintenance, and decommissioning of a particular asset, structure, plant, process etc. Refer Appendix N for pipe decommissioning.

b. All persons who may reasonably be affected by such works and designs, including workers, contractors, maintenance personnel and the general public

(iv) **Deliverables:** Prior to works commencing, all PCBU's shall submit to Council evidence of a completed Safety in Design (SiD) hazard and risk assessment matrix, including actions identified to remove or reduce risks where identified. It is not Council's role to review or comment on submitted SiD documentation, and SiD information will held for regulatory and record keeping purposes only. It is expected that all PCBU's regularly review and assess hazard, risk and revise SiD assessments accordingly as a project evolves.

(h) Traffic signals to be designed in accordance with P43 Specification for Traffic Signals and the guidelines contained in section 9.0 and Appendix M.

All documents other than signed certificates shall be submitted electronically as an enabled PDF (searchable PDF, not a scanned copy). Colour hard copies of all documents shall be provided at any time if requested by QLDC.

All documents shall demonstrate that they have passed through an internal Quality Management System. As a minimum they shall clearly show that they have been checked and approved by a suitable person (refer to section 1.7 for the requirements of a suitable person) different from the document author.

1.8.2 Drawings

1.8.2.1 General

Design drawings shall be prepared in accordance with the LA's practices. Except where otherwise notified, the requirements are as set out in this section and in sections 2 to 8 of this Code of Practice. Drawings shall be accepted by the TA. All drawings shall be provided in a form required by the TA.

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.

1.8.2.2 Composition of drawings

Design drawings generally include the following:

(a) A locality plan giving the overall layout and location;

(b) Detailed plans, longitudinal sections, cross sections, and diagrams of the proposed developments;

(c) Special details where the standard drawings are not sufficient;

(d) 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 number or identifier.

1.8.2.3 Scale

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. Individual LAs may require other specific scales to be used.

1.8.2.4 Content of drawings

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

(a) The extent of the construction showing existing and proposed roads, and the relationship with adjacent construction, services, or property;

(b) 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;

(c) The extent of earthworks, including earthworks on proposed reserves, existing and proposed contours, areas of cut and fill, batter slopes, subsoil drainage, and silt control measures both temporary and permanent;

(d) 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;

(e) The horizontal and vertical location and alignment, lengths, sizes (including Outside Diameter (OD), Inside Diameter (ID) and Nominal Diameter (DN) for all PE Pipes), 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;

(f) 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;

(g) For water mains, the nominal static pressure head at the point of connection and at the lowest point; design pressure and maximum design pressure;

(h) 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 finalised and approved;

(i) 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.

1.8.2.5 Recording of infrastructure – As-built information

The TA may require the design drawings to be in a certain format, suitable for later addition of as-built information and inclusion in the TA asset map base. In particular, electronic plans may be required.

1.8.3 Design Basis for Documents Submitted for Review and Acceptance

1.8.3.1 Standard design basis

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

1.8.3.2 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. TA review and acceptance of an alternative design does not confer approval in general by the TA 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 review and acceptance in principle. It will be considered on its merits and should 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 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.

1.8.3.3 Life-cycle costing

Life-cycle costing may be used to consider options within 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 the TA. A reasonable balance shall be maintained between these short-term and long-term costs.

1.8.4 Review and Acceptance of Design

1.8.4.1 When it is satisfied that the design meets the requirements of this Code of Practice, or the TA's own provisions, or in the case of an alternative design, that the design satisfies the requirements of 1.8.3.2, the TA shall notify the owner that the design has been approved and endorse the plans, specifications, and other documents accordingly. For the purpose of this review and acceptance the TA 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 review and acceptance, the TA shall act without undue delay.

1.8.4.2 Review and Acceptance Before Commencing Construction

Construction shall not commence on site unless and until:

(a) Resource consents have been issued, except when no such consents are required; and

(b) The TA(s) have approved any other consents and the drawings, specifications, and calculations for the specific infrastructure that is required in accordance with 1.8.4.1.

C1.8.4.2

S. 116 of the Resource Management Act sets out when a resource consent commences. Generally this will be when any appeals against the grant of the consent have been disposed of. Where any appeals are unresolved, approval to commence work will need to be obtained from the Environment Court.

1.8.4.3 Suitably Qualified and Experienced Persons

Where investigations and reports are required by a Suitably Qualified and Experienced Person (SQEP), this person or persons will have nationally recognised qualifications and experience in the field they are working in. The person or persons will normally be expected to be professionally recognised in the area of competence claimed and to carry professional indemnity insurance to a level suitable for the purpose but in any case not less than $1,000,000 per project.

Council reserves the right to have any work peer reviewed regardless of any prior approval as to the acceptability of the suitably qualified person. The cost of all peer review work will be borne by the developer.

Specific requirements are outlined below that are required for any person to be deemed suitably qualified in these work areas

a. Traffic and transportation assessment, Safe System audits, and Safe System audits exemptions – Suitably Qualified and Experienced Person shall be Qualified in Traffic Engineering and work or have worked in a role whose primary activity is Traffic Safety Engineering;

b. Road Pavement Design for pavements designed for a medium load or above (5×10^5 to 5×10^6 ESA / ONRC Primary Collector or above) - Suitably Qualified and Experienced Person is required to sign off design and that person shall be either a CPEng with a practice area in Pavement Design or hold a Survey and Spatial New Zealand Annual Practising Certificate in the discipline of Land Development Engineering;

c. Stormwater engineering incorporating flood mitigation, catchment analysis or stormwater system design - Suitably Qualified and Experienced Person shall be either a CPEng with recognised Stormwater discipline competence or hold a Survey and Spatial New Zealand Annual Practising Certificate in the discipline of Land Development Engineering. Requirements may be relaxed at Council's sole discretion subject to the development site complying with the each of the following:

   (i) The development does not require the physical alteration, damming or re-routing of natural water courses; and

   (ii) Average ground slope does not exceed 20%; and

   (iii) The increase in stormwater runoff generated due to proposed works and prior to stormwater management is less than 10L/s for the 5% AEP event.

1.8.5 Notification of Contracts and Phases of Construction

1.8.5.1 The developer shall notify the TA, 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.

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

(a) Commencement of construction;

(b) Prior to concrete construction;

(c) Prepared earthworks and subsoil drainage prior to filling;

(d) Completed earthworks and prepared subgrade;

(e) Water, wastewater, and stormwater reticulation prior to backfilling;

(f) Water and wastewater reticulation during pressure testing;

(g) Finished basecourse before the commencement of road sealing;

(h) Disinfection of water mains.

At least 24-hours notice shall be given by the developer. Inspection shall be carried out within 24 hours of notification if possible. Further construction phases shall not proceed until inspection has been made.

C1.8.5.2

LA's may require the appointment of a 'developer's professional advisor' or 'independent qualified person (IQP)' in which case this requirement will be performed by that person.

1.8.6 Supervision of Construction

The level of supervision undertaken in connection with any construction shall be agreed between the TA 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.

The TA may require completion certification for construction and supervision be submitted to it on completion. Such certification may be required from the contractors undertaking the construction, or the developer, or the developer's professional advisor (if any). The certificates shall be in the form given in Schedules 1B and 1C.

C1.8.6

An appropriate level of supervision can be selected by reference to the Construction Monitoring Services information published by the Engineering New Zealand (EngNZ) and *the Association of Consulting Engineers New Zealand (ACE New Zealand).*

1.8.7 Connecting to Existing Services

1.8.7.1 Council's preference is that 3 Waters services are not installed in private property. In situations where 3 Waters infrastructure is required to be placed in private property (including private roads), the planning and development team need to consider who is best positioned to own and hold responsibility for the services prior to obtaining Engineering Acceptance. Council's default position is that water infrastructure should be vested to Council, if designed to Council standard, unless doing so will expose Council to unreasonable risk or expense. Council ownership helps to ensure that an appropriate level of service is provided to the entire community. However, in some situations vesting is not appropriate, these situations include those listed below:

(a) Where the line services multiple properties on a single lot

(b) Where the properties could reasonably be supplied by dedicated laterals supplied from the main located within the road reserve

(c) Where access to the pipe is impeded

(d) Where the pipe poses a significant risk to adjacent buildings or structures e.g. retaining walls

(e) Where the private road finish is to a higher standard than a typical Council road and would require special reinstatement treatments

(f) Where an unacceptable exemption is requested that deviates from the provisions of the Code of Practice

(g) Any other situation not expressly listed, at Council's sole discretion, is deemed to present an unacceptable risk to Council

If the 3 Waters services are deemed suitable for vesting the Resource Consent must require the developer to provide an Easement in favour of Council in regard to the buried services. This easement shall make mention that Council reinstatements will be asphalt or brushed concrete in roadways and no special reinstatements will be undertaken unless agreed by Council. In all instances, a written request shall be submitted to Council clearly stating the reason(s) for the intention to vest.

1.8.7.2 Connection of water, wastewater, stormwater, and other services 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 the network utility operator connections may be made by the owner, or contractor employed by the owner, if appropriately qualified and under the network utility operator's supervision.

1.8.7.3 The developer shall give the network utility operator 15 working days' notice of intention to connect to existing services. Where required, new services shall be tested and approved by the network utility operator prior to connection.

1.8.7.4 All trade premises connecting to QLDC's infrastructure network must ensure that their discharge limits comply to the parameters as set out in the current bylaw(s) relative to the infrastructure network.

1.8.8 Testing

Any infrastructure required to be tested by the developer shall be pre-tested and proved satisfactory by the developer before test by the network utility operator is requested.

Prior to requesting inspection by QLDC the developer shall submit copies of test certificates/reports confirming that the infrastructure has been inspected and proved satisfactory.

1.8.9 Maintenance

The developer shall maintain the infrastructure until it is formally taken over by the TA 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 such as building construction or for fair wear and tear or vandalism caused by public use of the roads that have been taken over by the TA or network authority.

Extended maintenance periods may be imposed if adequate testing and supervision cannot be demonstrated.

1.8.10 Complementation documentation

On completion of all subdivision and land development infrastructure, the developer shall provide the TA with the following:

(a) The geotechnical reports and as-built plans required by 2.6 of this Code of Practice;

(b) Asbuilts submitted for all Parks, Roading and Three Waters infrastructure and landscaping assets listed in Schedule 1D, and submitted according to the Asbuilt/Data Specifications on the QLDC Land Developments and Subdivisions website.

(c) 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;

(d) 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;

(e) Completion certificates as per Schedules 1B and 1C;

(f) 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;

(g) Other documentation required by the TA including, but not limited to:

- operation and maintenance manuals for 3 waters facilities, irrigation systems, specialised playground equipment, playground safety surfaces, toilets, all-weather sports surfaces, sports field lighting, drinking fountains;
- warranties for new facilities (involves electrical and mechanical plant or stormwater low impact design facilities); and
- asset valuations for all infrastructures to be taken over by the TA.

(h) A schedule of all assets to be taken over (vested) by Council. The schedule shall utilise either QLDC's Three Waters As-Built Specification or Asset Register Templates, as applicable. Please refer to Council's Vesting of Roads and Reserves Policy 2016 on Council's website.

(i) Following completion, the electrical contractor shall supply the following:

- Signed and completed Electrical Certificate of Compliance (CoC) and Electrical Safety Certificate (ESC).
- Signed and completed Record of Inspection (RoI) form.

1.8.11 Acceptance of Uncompleted Work

Where in the opinion of the TA 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 TA may approve the deferral of completion of an element of a consented and approved work, subject to satisfactory bonds being arranged.

1.9 BONDS AND CHARGES

1.9.1 Uncompleted Works

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

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

1.9.1.3 The amount of the bond shall be the estimated value of the uncompleted work plus a margin to cover additional costs estimated to be incurred by the TA in the event of default.

The bond amount shall be a minimum of 1.5 times the higher amount of two quotes approved by QLDC.

1.10 DEFECT LIABILITY BOND

Prior to the issue of a 224c certificate a defects liability bond shall be entered into by the developer for all assets to be vested to the Council. The bond shall be valued at 5% of the construction costs for all assets to be vested. The bond shall be for a

minimum of 12 months commencing on the date of 224c certification issue and will only be released following a site inspection by the Developer and the Council. The bond shall be secured by an appropriate guarantee or shall be in cash and lodged with the Council. Alternative arrangements may be agreed with the Council.

C1.9.1

A satisfactory system of bonding uncompleted works is needed to overcome delays in obtaining the deposit of land transfer plans for subdivision. A major factor can be the practical difficulties of fully completing the construction of a subdivision caused by inclement weather, shortages of machinery, materials, and labour and the difficulty of coordinating the many aspects required to achieve full completion of a substantially completed subdivision.

The authority to require bonds is given in s. 108(2)(b) and s. 108A of the Resource Management Act, and s. 109 of that Act deems bonds and covenants to be instruments registerable under the Land Transfer Act, running with the land and binding subsequent owners. Section 109 of the Resource Management Act also gives the TA the power to enter land and complete the work. Additional powers are given by s. 223 of the Resource Management Act to allow the deposit of a survey plan notwithstanding uncompleted work.

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)

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

……
……
……

Copyright waived

SCHEDULE 1C

CERTIFICATION UPON COMPLETION OF LAND DEVELOPMENT/SUBDIVISION

ISSUED BY:……
(Approved certifier firm)

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 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)

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 in relation to this land development/ subdivision, whether in contract, tort, or otherwise (including negligence), is limited to the sum of $…… (insert).

Outstanding works

……

Copyright waived

SCHEDULE 1D

AS-BUILT PLANS / ASSET DATA SPECIFICATION

As-built Information shall be submitted in accordance with the specifications below

Note, some assets are required to be submitted in both RAMM and GIS format.

*Assets on land to be vested as **reserve** which require a RAMM sheet submission as well as Open Spaces GIS Asbuilt submission:

- Sealed roads / footpaths / cycleways and associated culverts, drains, bridges
- Sealed/unsealed carparks or vehicle accessways
- Bridges / boardwalks
- Retaining walls, staircases, other structures with fall-height of >1.5m
- Amenity lighting such as; Illuminated bollards, uplighting, lighting cabling

Assets on land to be vested as **road which require Open Spaces GIS Asbuilt submission:

- Trees & Irrigation and any associated tree grills, tree pits
- Grass berms & garden beds

Three Waters	
Format: Pipes and Nodes - GIS, Facilities - Excel	
Three Waters and Open Spaces Asbuilt Submission Package Three Waters Facilities Asset Register Three Waters Facilities Asset Identification Specification	
Stormwater Pipes	Storm mains, mudtank/inlet leads, and laterals.
Stormwater Nodes	Storm manholes, valves, end structures, meters, treatment devices, mudtank/inlets, bends, and junctions
Stormwater Facilities	Stormwater treatment devices, wetlands, detention basins, detention tanks and soakage basins
Wastewater Pipes	Wastewater mains and laterals
Wastewater Nodes	Wastewater manholes, lampholes, valves, meters, bends, and junctions
Wastewater Facilities	Wastewater pumpstations and treatment plants
Watersupply Pipes	Watersupply mains and service laterals
Watersupply Nodes	Wastersupply valves (tobies/service, backflow preventers, boundary, line), meters, hydrants, bends, and junctions
Watersupply Facilities	Watersupply pumpstations, treatment plants, and reservoirs
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.	

Roading / Transport	
Format: RAMM Update sheet, GIS (where applicable) - Always check for latest version on website	
QLDC Website/Services/Resource Consents/land developments & subdivisions	
General	Approved Road Names, Metadata, traffic and testing information (e.g. roughness, CBR), and second coat detail, Details of any warranty's, especially any electrical

Road Structure	Surfacing and Pavement layers
Street Lighting	Poles, Brackets, Lights, illuminated signs, illuminated bollards, point of power supply, Installation Control Point (ICP), Electrical Certificate of Compliance (CoC), Electrical Safety Certificate (ESC), Record of Inspection (RoI) form, Cabling for lighting submitted via Parks data schema
Above Ground Assets	Signs, road markings, edge markers, minor structures, bus stops, manhole covers, railings, barriers, traffic islands, traffic calming
Structures	Retaining walls, Bridges, large Culverts
Drainage	Kerb and Chanel, surface water channels, mudtanks
Traffic Signals	Traffic signal apparatus (e.g. poles, lights, controls, communications)
Footpaths	Footpaths, cyclepaths, crossing points (tactiles)

Parks & Open Spaces	
Format: GIS	
Three Waters and Open Spaces Asbuilt Submission Package	
General	Approved reserve or development names where available
Vested Reserves	Lots to be vested as reserve
Furniture	Picnic tables, seats, benches
Structures	Boardwalks*, bridges*, fences, steps*, walls*, art and monuments, bike pumps, bike stands, bollards*, cattlestops, culverts*, cut-off drains, drink fountains, gates, pergolas, rotundas, shade sails, shelters, signs, stiles, BBQs, any ESCs and CoCs for electrical assets
Irrigation**	Pipe, electricity connections (with ESC and CoC), emitters, plumbing, control boxes, pumps, drainage
Playgrounds	Playground area, equipment, safety surfaces
Sports Areas	Bike parks, bowls green, cricket ground, cricket net, cricket wicket, golf course, half court, petanque, pump track, rugby/football, skate park, sport court multi, sport wall, sports field, swimming pool, tennis/cricket practice wall, tennis court, posts, post sleeves, nets, sportsfield lighting
Vegetation**	Gardens, grass/turf, hedges, park trees, street trees
Carparks	Carparks* and vehicle accessways* for the purpose of the adjoining park or reserve. Includes street parking.
Services	Services in reserves only –power outlets, septic tanks, water pumps, water taps, electrical cabling for lighting (with ESC and CoC).
Toilets	Toilets
Tracks & Trails	Tracks, trails, footpaths, cycleways, pump tracks – sealed* and unsealed
Water Body	Ponds, streams, lakes

1.11 COUNCIL APPROVED MATERIALS LIST

The current listing of Council approved materials can be found on the QLDC website.

Approved Materials – 1 Stormwater
Approved Materials – 2 Wastewater
Approved Materials – 3 Water Supply

NOTE – Approved Materials for Street Lighting can be found in Southern Light Technical Specification.

2 EARTHWORKS AND GEOTECHNICAL REQUIREMENTS

2.1 SCOPE

Where community specific guidelines are available these shall be taken into consideration throughout the design and construction of subdivisions and development. Where community specific considerations cannot be met, written acceptance of an alternative method shall be obtained from the Council.

This section sets out requirements for the assessment of land stability and the design and control of earthworks to ensure a suitable platform for the construction of buildings, roads, and other structures. A low impact design approach is preferred. Geotechnical assessment shall be undertaken by a geo-professional defined in 1.2.2 of this Code of Practice where:

(a) The assessment of land stability requires specialist expertise;

(b) 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;

(c) There is historical fill which has not been undertaken in accordance with any Standard or where natural slopes, banks, or batters are involved;

(d) The assessment of ground for the foundations of buildings, roads, services, and other infrastructure requires specialist expertise as weak ground may require special design;

(e) 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 TA requirements.

> ***C2.1***
>
> *NZS 4431 is applicable to the construction of earth fills for residential development including residential roading.*

2.2 GENERAL

2.2.1 Objective

The objective of this section is to set out some, but not necessarily 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 land form. 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.

A geo-professional shall meet the requirements of section 1.7.1 as amended by QLDC's Land Development and Subdivision Code of Practice Part 1, as well as:

- Ensure modifications to the existing natural environment are to be minimised or avoided in order to preserve the existing landscape and habitat features as far as is practicable;
- Ensure the resultant land forms for the completed subdivision are to provide for stable, safe landforms and access to these landforms for the proposed developments intended purpose.
- Where landforms require specialist design assessment to satisfy the point above. The landform design and construction compliance or limitations on the land forms post construction shall be adequately detailed and reported to council via a geotechnical completion report for inclusion on the landforms title or consent conditions to ensure landform conditions are adequately addressed in perpetuity.

2.2.2 Referenced Documents

A selection of useful guidance material on geotechnical and geomechanical issues in land development is set out in Referenced Documents. Related Documents lists additional material that may be useful.

2.2.3 Local Authorities Requirements

The TA may require an assessment of land stability to meet the provisions of the Resource Management Act and Building Act. The TA requires and relies on the assessment made by the geo-professional.

Special requirements apply when land is subject to erosion, avulsion, alluvium, falling debris, subsidence, slippage, rotation, creep, or inundation from any source. In such situations reference needs to be made to s. 106 of the Resource Management Act and, for subsequent building work, s. 71 of the Building Act.

Advice should be sought from the regional council for earthworks and consent requirements.

The methods used and investigations undertaken are defined by the TA and the geo-professional.

This Code of Practice does not set those requirements or set standards for assessing geotechnical risk.

2.2.4 Geotechnical 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:

(a) Check regional and district plans, records, and requirements prior to commencement of geotechnical assessment;

(b) 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;

(c) Before construction commences, to review the drawings and specifications defining any earthworks or other construction and to submit a written report to the TA on the foundation and stability aspects of the project;

(d) Before and during construction, to determine the extent of further geo-professional services required (including geological investigation);

(e) Any work necessary to manage the risk of geotechnical instability during the construction process;

(f) 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;

(g) During construction, to undertake regular inspection consistent with the extent and geotechnical issues associated with the project;

(h) On completion, to submit a written report to the TA 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.

2.3 DESIGN

2.3.1 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;
g) Setting of compaction standards for fill material;
h) Erosion, sediment, and dust control;
i) Seismic considerations;
j) Weather conditions (eg. Frost)

2.3.2 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 where there is doubt about the stability or suitability of the ground for the proposed development, or there are any TA or local practice requirements for geotechnical involvement in the project.

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:

(a) 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.

(b) 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 should 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;

(c) 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, GNS Landslide Planning Guidance 2024 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;

(d) Ground movement and existing fill areas:

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 deliberate 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. Refer to *Module 4: Earthquake resistant foundation design* (MBIE, 2021);

(e) Stream instability:

There is a potential for instability through changes to the current ground conditions, such as stream erosion and lateral spread;

(f) Local conditions:

A wide range of soil types exists throughout Queenstown Lakes District 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 must also be considered. Refer to *Planning and Engineering Guidance for Potentially Liquefaction-Prone Land* (MBIE, 2017) and the *Earthquake Geotechnical Engineering Practice Guidelines* (MBIE, 2021). The TA may have information on the soil types in its area, including potentially contaminated land;

(g) 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* (NZGS) for risk classification and (Cook et al) for peer review.)

C2.3.2

The preliminary evaluation should be carried out in the context of the total surroundings of the site, and should not be influenced by details of land tenure, territorial, or other boundary considerations. Where the preliminary evaluation discloses the potential for slope instability, other geotechnical or geological hazards, or the need for major foundations or for earthworks, the geo-professional should be involved at an early stage in the planning of the development.

2.3.3 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:

(a) 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:

  (i) The minimisation of the risk of damage to property occurring through ground movement in the form of slips, subsidence, creep, erosion, or settlement

(ii) The minimisation of the risk of damage to property occurring through flooding, or surface water run-off

(iii) 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

(iv) The efficiency of overall land utilisation 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

(v) The need to create suitably graded areas for playing fields and other community facilities, and

(vi) The enhancement of the general environmental character of the area;

(b) The general nature and shape of the ground including:

(i) The geological nature and distribution of soils and rock

(ii) Existing and proposed drainage conditions, and the likely effects on groundwater

(iii) Previous history of ground movements in similar soils in the area

(iv) Performance of comparable cuts and fills (if any) in adjacent areas, and

(v) Air photography and other sources of information which should be reviewed and incorporated into any slope stability assessment;

(c) Soil data as applicable for areas which:

(i) Are intended to form in situ bases for fills

(ii) Are intended to yield material for the construction of fills

(iii) Are intended to be exposed as permanent batters, and

(iv) Are to remain as permanent slopes or cut areas;

(d) Borings, probings, or open cuts as necessary to:

(i) Classify the soil strata by field and visual methods

(ii) Evaluate the likely extent and variation in depths of the principal soil types, and

(iii) Establish the natural groundwater levels;

(e) Soil information required for:

(i) Further sampling and testing which may be required on representative soil types

(ii) Relating subsequent soil test properties to relevant strata over the site

(iii) Assessment and design for slope stability

(iv) Assessment and design for foundations suitable for the finished site, and

(v) Assessment and design for road subgrades.

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

2.3.4 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).

2.3.5 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:

(a) Soils with high shrinkage and expansion;

(b) Compressible soils;

(c) Volcanic soils;

(d) Soils subject to liquefaction;

(e) Soils prone to dispersion (such as loess).

C2.3.5

The geo-professional should refer to the TA for hazard maps or information on special soil types in the locality if unfamiliar with the area.

2.3.6 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.

C2.3.6

Commercial and industrial developments often have specialised 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.

2.3.7 Erosion, Sediment, and Dust Control

2.3.7.1 Minimisation of Effects

Earthworks shall be designed and constructed in such a way as to minimise 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 earthworks operation shall be considered during the planning and design phase. If necessary, specific measures shall be incorporated to control dust.

C2.3.7.1

Most LAs have requirements for erosion, sediment, and dust control or these will be set in resource consents for the project. Such conditions should be referred to and taken into account in the early stages of planning a project.

2.3.7.2 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.

Content requirements for the preparation of Environmental Management Plans (EMP) associated with land development activities shall be in accordance with QLDC Guidelines for Environmental Management Plans.

Protection measures shall include the following as appropriate:

(a) Erosion control mechanisms:

(i) 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

(ii) 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

(iii) 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 minimise water infiltration

(iv) The completed battered surfaces of fills to be topsoiled and vegetated, or otherwise resurfaced to reduce run-off velocities

(v) Control of erosion and sediment discharge may require planting, environmental matting, hydroseeding, drainage channels, or similar measures at an early stage in the earthworks construction phase

(vi) Dust control may require frequent watering during construction along with establishment of the permanent surface at an early stage in the construction phase;

(vii) Where final level organic topsoil is to be re-spread to satisfy erosion and revegetation requirements across the completed earthfills or bare stripped soils and where future buildings are proposed then the thickness of organic topsoil shall be more than 100mm and less than 300mm. this is not applicable in landscaping areas.

(b) Sediment management devices:

(i) The surfaces of fills and cuts to be graded to prevent ponding

(ii) 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

(iii) Temporary barriers or silt fences using silt control geotextiles, to be used to reduce flow velocities and to trap sediment

(iv) Sections of natural ground to be left unstripped to act as grass (or other vegetation) filters for run-off from adjacent areas.

2.3.8 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.

2.3.9 Retaining Walls

Where retaining walls are needed, specific design is required. Initial designs should be discussed with the Council before detailed design is carried out. The following are general criteria for retaining walls.

Retaining walls shall be designed of permanent materials and have an expected life in excess of 50 years. They should also be aesthetically designed to be compatible with the appearance of the surrounding area.

Safety barriers shall be provided in accordance with NZS 4404:2010 section 3.3.4 as modified by this code.

A building consent is required when there is a surcharge weight on the upper side of a retaining wall, or if the retaining wall is over 1500mm in height.

The approval of the Council is required for any works or structures on the road reserve. Approval will only be given where the Council is satisfied that no practical alternative exists to installing the structure on the road carriageway.

All walls within the road reserve shall be designed by a Chartered Professional Engineer in accordance with the NZ Building Code and a building consent obtained where required. Retaining walls below any road carriageway, and supporting road reserve shall be designed to allow for future vehicle surcharging (from anywhere in the road reserve) against the wall.

The design shall consider future maintenance requirements including drainage maintenance. This includes allowance for mowing of grassed areas by installing mowing strips.

2.3.10 Cut and Fill Batters

A suitably qualified person shall provide a site-specific design (including benching if appropriate) for approval by Council where cut or fill batters:

- Are steeper than 2 horizontal to 1 vertical;
- Exceed 3m in height;
- Are constructed using moisture content susceptible soils; or
- Have features that Council deems to require specific engineering input.

The minimum width of any bench shall be 1.8m. Stormwater shall be conveyed to a point clear of the filling and discharge in such a manner as to prevent erosion.

Unless formed in rock, all batters shall be formed such that they may be reinstated with grass or other consistent vegetation.

The edge of the batter should be a minimum of 600mm behind the kerb or back edge of the footpath.

Safety barriers shall be provided in accordance with NZS 4404:2010 section 3.3.4 as modified by this code.

2.4 APPROVAL OF PROPOSED WORKS

The approval process for land development and subdivision design and construction shall be in accordance with section 1 of this Code of Practice. Land stability assessments and the design and control of earthworks require approval from the LAs.

2.5 CONSTRUCTION

Earthworks shall be carried out to the standards detailed in the approved specifications and drawings, and any requirements in a regional or district plan or consent issued by the TA.

The construction control testing shall be carried out by a testing laboratory or competent person under the control of the geo-professional, and to the recognised testing standards as deemed appropriate.

The testing laboratory shall have recognised registration or quality assurance qualifications.

2.6 FINAL DOCUMENTATION

2.6.1 Geotechnical Completion Report

- For all developments where a new title or lot is created a geo-professional shall submit a geotechnical completion report to the developer and the TA accompanied by a statement of professional opinion as set out in Schedule 2A. The geotechnical Completion report shall identify the following: Any specific design requirements which would necessitate the building design deviating from NZS 3604;
- Any specific design requirements or recommendations which would necessitate alternative foundation designs deviating from NZS 3604;
- The Schedule 2A certification shall include a statement under Clause 3(e) covering Section 106 of the Resource Management Act 1991;
- 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 should 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;
- The documentation will also detail any areas with development constraints or geotechnical conditions;
- For other developments where there are no earthworks or the natural ground is unaffected by earthworks the geotechnical completion report will comprise the geotechnical assessment report if prepared, or if absent the completion report shall investigate and provide as a minimum the investigations in accordance with section 2.3.2 of this COP and section 3.3.7 of NZS 3604:2011 or subsequent versions and sections related to subsurface investigations for each building platform area or lot;
- 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.

2.6.2 As-built Drawings 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. 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 Code of Practice or areas where the standards have been varied from the original construction specification.

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

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, falling debris (including soil, rock, snow and ice), subsidence (including liquefaction induced subsidence), inundation (including flooding, overland flow, storm surge, tidal effects and ponding) 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)

3 ROADS

3.1 SCOPE

Where community specific guidelines are available these shall be followed throughout the design and construction of subdivisions and development. Where community specific considerations cannot be met, written acceptance of an alternative method shall be obtained from the Council.

This section sets out requirements for the design and construction of roads for land development and subdivision. Section 3 provides engineering design and construction solutions for most situations.

3.2 GENERAL

3.2.1 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 of carrying all utility services underground, provide for the management of stormwater, and contribute to quality urban design.

3.2.2 Related Standards and Guidelines

A selection of currently available documents which provide an appropriate basis for road design is set out in Referenced Documents. Related Documents lists additional material that may be useful. These are not exclusive. Other Standards, guidelines, and design responses may be used where appropriate and accepted by the TA.

Standards and Guidelines shall include all policies and guidelines adopted by QLDC.

3.2.3 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.

Every street functions as both a movement corridor and a place for activity by people, with the relative balance between the two informed by the predominant nature of activity on the street. The strength of a street as a place is primarily dependent on the number of people using the street for everyday activities, and its importance as a destination. The strength of a street as a link is primarily dependent on the number of people using the street to pass through to destinations elsewhere. In addition, streets are also corridors for utilities and community amenities.

Roads serve the following functions:

(a) A **place** for access and interaction, including:
  (i) Providing for human interaction
  (ii) Facilitating commerce and business
  (iii) Enabling access to buildings, lots, and public spaces
  (iv) Parking;

(b) A **link** for connection and movement of people and goods including the following user groups:
  (i) Pedestrians
  (ii) Cyclists
  (iii) Public transport
  (iv) Freight and goods vehicles
  (v) Private motor vehicles

(vi) Other modes which are not vehicles;

(c) A **corridor** for utility and amenity infrastructure, including:

(i) Stormwater treatment and conveyance

(ii) Road lighting

(iii) Landscaping and street furniture

(iv) Utility services

(v) Signals, signs, and markings

(vi) Safety, convenience, and crime prevention.

3.2.4 Place and link context

The two fundamental roles of a road are to provide a space for interaction between people for a range of purposes and access to land uses so that movement between places can occur.

3.2.4.1 Place context

Place context is defined for both the specific land use served and the broader area type in which it is located.

The land use characteristic is defined according to the description of predominant activities in individual areas. Descriptions include live, play, shop, work, and learn, in addition to activities associated with growing, manufacturing, and transporting goods and products.

Table 3-1 describes the relationship between land use, area type, and transport context. Table 3-1 should be used as a guide for decision-making on transport infrastructure and services. This table addresses:

(a) **Geographic area**: Four area types are identified to establish the context of place: rural, suburban, urban, and centre.

(b) **Land use**: Four land use types are identified: live and play (residential and parks), shop and trade (retail and services), work and learn (offices and schools), and make, grow, and move (agricultural, industrial, and warehouses).

(c) **Transport**: As a matrix, the area context and land use classification system describe sixteen individual place contexts that indicate the types, times, intensity, and mode of trips that can be expected to occur in neighbourhoods. This land use framework describes the typical elements of road links that are to accommodate the needs of the expected users.

3.2.4.2 Link context

Link context is classified by the extent of access and the degree of through movement intended to be served. This Code of Practice includes three levels of link context:

(a) **Lane and Shared Space:** A road, or in the case of shared space a public space with vehicular access, that provides very high local access and very limited through movement connectivity. Very low vehicle speeds with shared pedestrian and vehicle access predominate.

(b) **Local road:** A road that provides access and connectivity for a local area. Low vehicle speeds, pedestrian and local amenity values predominate.

(c) **Connector/collector road:** A road that provides circulation in local areas and links to arterial roads, while balancing this with pedestrian and local amenity values. Higher vehicle speeds and access for all modes of transport including public transport predominate.

All proposed speed limits must be shown to conform to national rules and guidelines. This includes following any warrant or other procedural requirements to determine the appropriate speed limit.

C3.2.4.2

Arterial roads and motorways are not included in this Code of Practice. These roads are subject to specific design standards to be agreed with the road controlling authority to ensure through movement connectivity associated with the broader sector in which such roading is located. The following descriptions are included for information:

(a) Minor arterial road: A road that provides access between connector/collector and major arterial roads. Minor arterial roads have a dominant through vehicular movement and carry the major public transport routes. Access to property may be restricted and rear servicing facilities may be required. Urban traffic volumes are typically 8,000 vpd to 20,000 vpd and rural from 1,000 to 5,000 vpd with a higher proportion of heavy vehicles. Typical urban operating speeds are 40 to 60 km/h and rural 80 to 100 km/h.

(b) Major arterial road: A road that provides interconnections between major sectors of a large area linked with external areas and distributes traffic from major intercity links. Access is generally at grade but may be limited. Urban traffic volumes are typically greater than 20,000 vpd and rural 5,000 vpd with a significant number of heavy vehicles. Typical urban operating speeds are 50 to 70 km/h and rural 80 to 100 km/h.

(c) Motorway: Motorways have the highest link function and have no frontage access. Typical operating speed is 100 km/h.

Where a development connects to the NZTA state highway network, the developer should refer to the NZTA approval process as per the Transit Planning Policy Manual: Appendix 5B.

3.2.5 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:

(a) Shorter travel distances;

(b) An increased number of alternative routes for all types of users;

(c) Increased opportunity for interaction;

(d) Improved access to public transport, cycling and walking networks, and access to destinations.

Development design shall ensure connectivity to properties and roads that have been developed, or that have the potential to be developed in the future. The design process should ensure the following maximum walking distances from a lot to a connector/collector or arterial road:

(a) **Rural:** No maximum distance. The design should maximise future connectivity to a suburban network;

(b) **Suburban**: 400 m. A shorter distance shall be considered near centres and public transport routes;

(c) **Urban:** 300 m;

(d) **Centre:** 200 m.

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

3.2.6 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 3.2 and 3.3 of this Code of Practice and specifically address:

(a) Road dimensions and layout;

(b) Link and place functions;

(c) Connectivity;

(d) How target operating speeds will be achieved;

(e) How LID principles have been considered for stormwater run-off from the roads.

(f) How cyclists will be provided for

(g) Car parking

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.***C3.2.6***

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.

3.2.7 Safe System audits

Safe System audits carried out in accordance with the NZTA Safe System audits procedures for projects shall be provided for the preliminary design phase at resource consent of all publicly accessible roads in the Queenstown Lakes District. Detailed design and post construction safe system audits may be required at Councils discretion.

Safe System audits should be completed by suitably qualified persons are is independent from the project. A Safe System audit should be undertaken by a team comprised of a minimum of 2 members. The site is to be visited by the team unless and exception is applied for and granted by QLDC. SSA is undertaken at the time of resource consent application to reduce the need for change at the time of Engineering acceptance.

Safe System Auditors shall also provide confirmation of the design's compliance with relevant resource consent conditions or identify any deviations from those conditions. Any recommendations of the Safe System Audits shall be completed to the Council's satisfaction. Exemption from providing Safe System audits shall be granted by the Council at its sole discretion. Safe System audits shall also be provided for private road networks when considered necessary by QLDC.

Safe System 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.

3.2.8 Vesting

All roads that provide access to 12 or more dwelling units shall vest in the Queenstown Lakes District Council as Legal Public Road.

Exemptions to vesting requirements above will only be provided at Council's discretion and demonstration of compliance with clause 3.3.16.

3.2.9 Curb side rubbish collection services

QLDC will not provide curb side rubbish collection services to private roads or no exit roads that do not comply with this Code of Practice.

Table 3-1: Land use and area type matrix describing typical place and transport context

LAND USE	AREA TYPE			
	RURAL	**SUBURBAN**	**URBAN**	**CENTRE**
LIVE AND PLAY (Residential and parks) Homes, home-based businesses, and mixed use developments with residential uses, as well as parks and low impact recreation. *Transport: These land uses primarily generate home-based and internal circulation trips (recreation, social, school, and retail). Home-based work trips are concentrated at peak periods, while other types of trips are dispersed across time periods. Streets to these land uses prioritise recreation walking and cycling over vehicle movement.*	Low density, generally no more than 4 units per hectare located outside the urban limits. *Transport: Private motor vehicles are the predominant form of transport with low trip volumes throughout the day.*	Low and moderate density housing generally up to 15 units per hectare in an area where housing is the exclusive or dominant use. *Transport: Private vehicles are the predominant form of transport but public transport should provide peak period service on arterials and connector/collectors. Non-motorised trips are primarily recreational and occur on local roads.*	Moderate and high density housing often in combination with other uses such that combined population of residents, employees, and students is typically 50 per hectare or greater. *Transport: A higher portion of trips are made on public transport and by walking and cycling. There is lower priority for the provision of residential parking in urban areas.*	Moderate and high density housing often in combination with other uses such that combined population of residents, employees, and students is typically 200 per hectare or greater. *Transport: Residents typically walk or cycle to nearby destinations and rely on public transport for longer trips, and they may choose not to own a vehicle. Provision for residential and commuter parking is a low priority in centres.*
SHOP AND TRADE (Retail and services) Retail or other service where most trips to the business are by customers and clients, rather than employees. *Transport: A large volume of destination trips occur across time periods, especially weekends and peak shopping times to these land uses. A low-to-moderate volume of freight truck traffic is served. Streetscapes may serve as connections for destination users to reach several or numerous businesses in the area.*	Isolated or small clusters of stores or service-based businesses located outside the urban limits. *Transport: Most trips are made in private motor vehicles with low trip volumes throughout the day.*	Includes both traditional town centres and newer shopping centres of generally 1-2 storeys where the dominant use is retail and services businesses and the combined retail and commercial floor-to-area ratio (FAR) is typically under 0.3 (gross). *Transport: Most trips are made in private motor vehicles with moderate and high trip volumes, especially on weekends, requiring these land uses to have large amounts of parking allocated to each site.*	Retail and services focused in a town centre or concentrated along an urban corridor in combination with other uses. The combined population of residents, employees, and students is typically 50 per hectare or greater. *Transport: Trips are made on a variety of modes at all times with limited amounts of shared and paid parking.*	Moderate to high density land uses include retail mixed with other uses in an urban or town centre. Centres typically have, or are planned to have, a combined population of residents, employees, and students of 200 per hectare or greater. *Transport: Public transport services are typically focused on centres, and centres are among the most highly connected and walkable environments. Provision for parking is the lowest land use priority in centres.*
WORK AND LEARN (Offices and schools) Areas dominated by businesses or schools where the most important trips to the business	Individual or small clusters of activities located outside the urban limits, such as school campuses and	Low rise office buildings (typically 1-2 storeys) and school campuses with an area wide average FAR of less than 0.3, including	Low and mid-rise office buildings that often include street-front retail and services focused in a town centre or	Mid-rise and high-rise office buildings that usually include mixed uses, including street-front retail and multi-family housing. Centres typically have, or are planned to have, a combined

LAND USE	AREA TYPE			
	RURAL	**SUBURBAN**	**URBAN**	**CENTRE**
are made by employees (typically offices) and students. *Transport: A large volume of destination trips occur at peak periods on weekdays. A low-to-moderate volume of freight truck traffic is served. Streetscapes may serve as connections for a variety of users, especially during lunch periods as well as other times when clients or customers may visit work places. Roads near schools will require special design needs to accommodate younger pedestrians.*	research facilities. *Transport: Most trips are made in private motor vehicles with most trips occurring during peak periods.*	any retail component. *Transport: Most trips are made in private motor vehicles during peak periods, requiring these land uses to have large amounts of parking allocated to each site.*	concentrated along an urban corridor. The combined population of residents, employees, and students is typically 50 per hectare or greater. *Transport: Trips are made on a variety of modes at all times with limited amounts of shared and paid parking.*	population of residents, employees, and students of 200 per hectare or greater. *Transport: Public transport services are typically focused on centres, and centres are among the most highly connected and walkable environments. Provision for parking is the lowest land use priority in centres.*
MAKE, GROW, AND MOVE (Agricultural, industrial, and warehouses) Areas dominated by businesses where the most important trips to the business are made by heavy delivery trucks (typically farms, warehouses, and industries). *Transport: A moderate-to-large volume of freight trips occur (year around or seasonally) and should be accommodated in the road link network. Streetscapes are designed to accommodate heavy freight movements. Where these are larger in number and need to be served, the freight, link function is crucial to service the land use function.*	Farms, light industry, and warehouses located outside the urban limits. *Transport: Road links are predominantly designed to accommodate freight truck movements and those generated by employees and business customers, Special vehicle areas may be provided to accommodate specialised freight needs.*	Industrial parks. *Transport: Road links are predominantly designed to accommodate freight truck movements and those generated by employees and business customers. Parking may also be provided for some employees, and special vehicle areas may be provided to accommodate specialised freight needs*	Would not normally occur except where activities have little impact on or otherwise support surrounding land uses.	Would not normally occur except where activities have little impact on or otherwise support surrounding land uses.

3.2.10 Defect liability period

All roads are covered by at least one-year defects liability period whereby the performance of the completed road is closely monitored. Defects liability will be extended where required for any agreed where required exceptions from the Code or where it is considered to be a risk of early failures. If a second coat chip seal is applied by the Developer, a pavement inspection shall be arranged with QLDC prior to expiry of the 12 months Defect liability period. The Defect liability period will be extended to 12 months from the second coat seal date to cover the new seal.

During the defects liability period, the Contractor and Designer are to inspect the site a minimum of every 8 weeks, defects which appear during this time are to be remedied within 7 days of identification. Council may notify the Developer of any defects during this period.

Reasons for defect failure must be clearly understood and the proposed remediation must be relayed to Council for acceptance prior to remediation taking place. Liability for defects will remain the developers' until QLDC accept the remediation.

QLDC will undertake an inspection prior to the end of the defects liability period to identify outstanding defects. Details of any identified defect will be passed to the developer to address as per the above process. Once all defects are resolved, QLDC will issue a certificate stating that defect liability period has come to an end.

3.3 DESIGN

3.3.1 Design requirements

Table 3-3 should be used as the basis for road design. 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. Road widths shall be planned to cope with estimated long-term community needs even though construction may be carried out only to shorter-term requirements.

Alternative movement lane widths may be adopted to suit particular design considerations. These shall be subject to specific design consideration and approval by the TA. Such cross sections may include landscaped features, painted median facilities, or variations to parking provision. Movement lanes should avoid widths of 5.7 m to 7.2 m and 7.5 m to 9.0 m where these widths may cause confusion between movement and parking functions.

C3.3.1

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, although a narrow berm for services may be necessary.

There are three movement lane types. These are:

(a) *A width in the range 5.5 m – 5.7 m providing for ability to park on one side of the road and one through lane, or alternatively two through lanes. This is often not defined at the engineering stage and is instead left to road users to choose. This type of road is provided for in the standard and is typically appropriate for shorter streets of up to approximately 250 m, to assist with achieving a slower operating speed.*

(b) *A width in the range of 7.2 m – 7.5 m providing an ability for either two parked cars and one through movement, or one parked car and two through movements. This is typically not defined through the provision of parking bays although it may be. There may be cases in lower parking demand situations where this width is achieved with varied pinch points to provide a road with two through lanes and a parking bay.*

(c) *A width in the range 9.0 m – 9.5 m providing ability for two through lanes and two parking lanes. Depending on parking demand this can either be achieved with landscaping such as tree boxes/pits and recessed parking, or by maintaining full flexibility with a straight edge.*

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. In general a wider standard total carriageway cross section can be developed where parking is shared in the movement lane, however if this is not a frequent occurrence then the outcome will be an unnecessarily wide road and the target speed outcome will not be achieved without other managed intervention. Where parking is less frequent, consideration shall be given to narrowing the travelling carriageway and recessing the parking or to introducing landscaping into the carriageway to reduce the appearance

of apparent formed width. Where the designer proposes to develop a shared street design that varies from that shown in Table 3-3, a full description and assessment of the frequency and extent of interactions of this nature shall be described in the design and access statement.

Roads shall be designed to account for stormwater and keep potential groundwater below structural pavement layers. On rural roads, side drains or swales shall be provided to carry stormwater and keep potential groundwater below structural pavement layers. 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 when the primary system is overloaded (see 4.3.4.2).

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 3.3.19.5, 4.3.7.6, and 4.3.7.9.

Any design should be coordinated with the relevant landscape design requirements covered in section 7.

Table 3-3 should be read in conjunction with 3.3.1.

All designs shall be suitable for the climatic conditions experienced in the Queenstown Lakes District.

The assessment of traffic loading shall be on the basis of full development to the extent defined in the current district plan. Where a road services adjacent land then the full development to the extent defined in the current district plan of all the land serviced by the road shall be included in the assessed traffic loading.

The assessment of residential traffic loading shall be on the basis of eight vehicle movements per Residential Unit per day.

Where the new roads being installed are required by Council to service adjacent future development as part of the future Council network then those roads will be designed and constructed on the basis of full development to the extent defined in the current district plan.

The cost of increased road construction to service adjacent future development will be apportioned between the applicant and the Council and agreed in writing with the Council's Strategy and Asset Planning Team prior to construction.

3.3.1.1 A movement lane may include a single lane operating in a one-way configuration or in two directions. Normal camber is 4%, except asphalt may be 3%. Maximum superevaluation is 6%. Superelevation is not required where design speed is less than or equal to 50 km/hr.

3.3.1.2 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.

3.3.1.3 Each on-street/road parking/passing area should be a minimum 2.1 x 6 m, and a loading area a minimum 2.5 x 12 m, each with appropriate entry and departure tapers outside of the movement lane. Indented car parking shall be a minimum of 2.5m x 6.1m. To allow vehicles to pass, accesses shall have widening to not less than 5.5 m over a 15 m length.

3.3.1.4 Where not shown in the table cyclists shall be provided with separate movement lanes if identified in a local or regional cycle network.

3.3.1.5 Side and rear access should not be the primary access.

3.3.1.6 Minimum gradient is 0.4%. Maximum gradients shall be as indicated in the table. Steeper gradients may be acceptable for shorter lengths of road in hilly country or low overall speed environments subject to TA approval.

3.3.1.7 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

3.3.1.8 All carriageways shall be sealed for the first 10 m from the intersection with another sealed road.

Private access ways and drive ways shall also be sealed from the carriageway to the property boundary

Where a private way adjoins a Collector Road or higher, it shall have a 5m traffic width and 6.5m road reserve width for a minimum of 6m from road boundary.

3.3.1.9 Where the gradient of a public road is steeper than 12.5%, a resolution of the TA or a District Plan allowance is required. Refer to s. 329 (road gradients) of the Local Government Act 1974.

NOTE – The typical plan and cross section images in Table 3-3 are also set out in Appendix E. Copyright on these is waived.

3.3.2 Road geometric design

3.3.2.1 Design parameters

Roads shall be designed to the basic standards in Table 3-3 of this Code of Practice which take precedence over any other referenced design guides. Detailed design must be completed following the relevant Austroads guides, and supplemental guides and technical memoranda listed in on the NZTA's Geometric Design webpage at:

https://www.nzta.govt.nz/roads-and-rail/road-engineering/geometric-design/

Parking provisions for narrow movement lanes as per 3.3.2.4 below.

3.3.2.2 Sight distance

All roads shall be designed with sight distances that match the target operating speed. Reducing a driver's field of vision in conjunction with other design and management measures is a recognised method for achieving an appropriate speed environment (see 3.3.5).

On connector/collector and arterial roads, 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 or NZTA guides.

Planting within sight lines of pedestrian crossing access areas is to have a maximum mature height of 500mm. Any deviations will require approval from Council.

3.3.2.3 Widening on horizontal curves

In some areas the developed road geometry may be constrained, horizontal alignments may involve low radius, or the proportion of commercial vehicles may predominate, such as in a make and move environment. In such instances, movement lanes shall be assessed to determine the need for localised additional width, for example on low radius horizontal curves where the passage of vehicles has the potential to reduce safety. The Austroads Guide to road design – Part 3: Geometric design provides useful guidance on this.

3.3.2.4 Parking provisions for narrow carriageways

Parking on carriageways less than 7.2m in width shall be restricted to one side of the movement lane and road markings will be required to outline where parking is not permitted to meet this criteria.

3.3.2.5 Design and check vehicle requirements

Roads and intersections shall be designed to accommodate the check and design vehicles in Table 3-3, unless otherwise approved or required by the TA. Design vehicles, including clearance lines on each side of the vehicle, shall be shown to undertake all applicable manoeuvres on roads and at intersections within

the

lane lines for the direction of travel. Checking vehicles shall be shown to undertake all applicable manoeuvres on roads and at intersections within the kerb lines. An additional 500mm clearance shall be shown on each side of all vehicles.

Table 3-2: Design/Check Vehicle Requirements

Intersection Type	Typical standard design vehicle	Typical standard check vehicle
Intersections with arterial roads and rural intersections	To be agreed with QLDC on a case-by-case basis	
Intersections between collector roads or between a collector road and a local road	Tour coach Radius: 12.5m	Semi-trailer Radius: 12.5m
All other intersections	Medium rigid truck Radius: 10m	Tour coach Radius: 12.5m

Table 3-3: Road design standards

PLACE CONTEXT			DESIGN ENVIRONMENT				LINK CONTEXT					TYPICAL PLAN AND CROSS SECTION SEE APPENDIX E FOR LARGER VERSION OF FIGURES	FIGURE NUMBER
Area	**Land use**	**Local attributes**	**Locality served**	**Target operating speed** (km/h)	**Min. road reserve width** (m)	**Max. grade**	**Pedestrians**	**Passing, parking, loading, and shoulder (each side)**	**Cyclists**	**Movement lane (excluding shoulder)**	**Classification**		
Notes	See 3.2.4 & table 3-1	See table 3-1	See table 3-1	See 3.3.5	See 1.2.2, 3.3.1.9, & 3.4.16		See 3.3.11	See 3.3.6 & 3.3.1.4	See 3.3.1.4, 3.3.8, & 3.3.11.2	See 1.2.2, 3.3.1.1, 3.3.1.2, 3.3.1.3, 3.3.1.10, 3.3.11.3	See 3.2.4.2 & 3.3.16 (Typical max. volumes)		
Rural (3.3.1.7, 3.3.1.8, & 3.3.1.9)	**Live and play**	Access to lifestyle or clustered housing	1 to 6 du	20	6	16%	Shared (on shoulder and berm)	Passing bay required every 100m if visibility is available from bay to bay. If visibility is not available, passing bays every 50 m. total shoulder 0.5 m, each side, sealed	Shared (in movement lane)	2.50	Lane (this would normally be a private road or private way)		**E1**

PLACE CONTEXT			DESIGN ENVIRONMENT				LINK CONTEXT					TYPICAL PLAN AND CROSS SECTION SEE APPENDIX E FOR LARGER VERSION OF FIGURES	FIGURE NUMBER
Area	**Land use**	**Local attributes**	**Locality served**	**Target operating speed** (km/h)	**Min. road reserve width** (m)	**Max. grade**	**Pedestrians**	**Passing, parking, loading, and shoulder (each side)**	**Cyclists**	**Movement lane (excluding shoulder)**	**Classification**		
Notes	See 3.2.4 & table 3-1	See table 3-1	See table 3-1	See 3.3.5	See 1.2.2, 3.3.1.9, & 3.4.16		See 3.3.11	See 3.3.6 & 3.3.1.4	See 3.3.1.4, 3.3.8, & 3.3.11.2	See 1.2.2, 3.3.1.1, 3.3.1.2, 3.3.1.3, 3.3.1.10, 3.3.11.3	See 3.2.4.2 & 3.3.16 (Typical max. volumes)		
	Live and play	Access to lifestyle or clustered housing	1 to 20 du	30	9	16%	Shared (on shoulder and berm)	Total shoulder 0.5 m, sealed	Shared (in movement lane)	5.5 - 5.7	Lane (~ 200 vpd)		**E2**
	Live and play	Access to housing	1 to 150 du	70	15	12.5%	Shared (on shoulder and berm)	Total shoulder 1.0 m, sealed shoulder 0.5 m	Shared (in movement lane)	5.5 - 5.7	Local road (~ 1000 vpd)		**E3**

PLACE CONTEXT			DESIGN ENVIRONMENT				LINK CONTEXT					TYPICAL PLAN AND CROSS SECTION SEE APPENDIX E FOR LARGER VERSION OF FIGURES	FIGURE NUMBER
Area	**Land use**	**Local attributes**	**Locality served**	**Target operating speed** (km/h)	**Min. road reserve width** (m)	**Max. grade**	**Pedestrians**	**Passing, parking, loading, and shoulder (each side)**	**Cyclists**	**Movement lane (excluding shoulder)**	**Classification**		
Notes	See 3.2.4 & table 3-1	See table 3-1	See table 3-1	See 3.3.5	See 1.2.2, 3.3.1.9, & 3.4.16		See 3.3.11	See 3.3.6 & 3.3.1.4	See 3.3.1.4, 3.3.8, & 3.3.11.2	See 1.2.2, 3.3.1.1, 3.3.1.2, 3.3.1.3, 3.3.1.10, 3.3.11.3	See 3.2.4.2 & 3.3.16 (Typical max. volumes)		
Rural (3.3.1.7, 3.3.1.8, & 3.3.1.9)	**Shop and trade**	Side or rear service access	Up to 100 m in length between streets, 1 to 20 lots	10	6	16%	Shared (in movement lane)	Passing bay required every 100m if visibilty is available from bay to bay. If visibility is not available, passing bays every 50 m. Kerbed edge or total shoulder 0.5 m, sealed	Shared (in movement lane)	2.75 - 3.00	Lane (~ 200 vpd)		**E4**
	Shop and trade	Access to trade	Rural village shops	40	15	10%	1.5 m each side	Parking and loading may occur in the movement lane or be separate and recessed. See 3.3.6. Kerbed edge or total shoulder 1.0 m, sealed shoulder 0.5 m	Shared (in movement lane)	5.5 - 5.7	Local road (~ 1,000 vpd)		**E5**

PLACE CONTEXT			DESIGN ENVIRONMENT				LINK CONTEXT					TYPICAL PLAN AND CROSS SECTION SEE APPENDIX E FOR LARGER VERSION OF FIGURES	FIGURE NUMBER
Area	**Land use**	**Local attributes**	**Locality served**	**Target operating speed** (km/h)	**Min. road reserve width** (m)	**Max. grade**	**Pedestrians**	**Passing, parking, loading, and shoulder (each side)**	**Cyclists**	**Movement lane (excluding shoulder)**	**Classification**		
Notes	See 3.2.4 & table 3-1	See table 3-1	See table 3-1	See 3.3.5	See 1.2.2, 3.3.1.9, & 3.4.16		See 3.3.11	See 3.3.6 & 3.3.1.4	See 3.3.1.4, 3.3.8, & 3.3.11.2	See 1.2.2, 3.3.1.1, 3.3.1.2, 3.3.1.3, 3.3.1.10, 3.3.11.3	See 3.2.4.2 & 3.3.16 (Typical max. volumes)		
	Make and move	Primary freight access	Rural activities	up to 100	20	10%	1.5 m each side	Total shoulder 1.0 m, sealed shoulder 0.5 m	On sealed shoulder where it is a local authority defined cycle route	5.5 - 5.7	Local road (~ 1,000 vpd)		**E6**
Rural (3.3.1.7, 3.3.1.8, & 3.3.1.9)	**Make and move**	Access to office and education	1 to 200 lots	up to 60	20	10%	1.5 m each side	Parking and loading may occur in movement lane or be separate and recessed. Refer clause 3.3.6. Total shoulder 1.0 m, sealed shoulder 0.5 m	On sealed shoulder where it is a local authority defined cycle route	5.5 - 5.7	Local road (~ 1,000 vpd)		**E7**

PLACE CONTEXT			DESIGN ENVIRONMENT				LINK CONTEXT					TYPICAL PLAN AND CROSS SECTION SEE APPENDIX E FOR LARGER VERSION OF FIGURES	FIGURE NUMBER
Area	**Land use**	**Local attributes**	**Locality served**	**Target operating speed** (km/h)	**Min. road reserve width** (m)	**Max. grade**	**Pedestrians**	**Passing, parking, loading, and shoulder (each side)**	**Cyclists**	**Movement lane (excluding shoulder)**	**Classification**		
Notes	See 3.2.4 & table 3-1	See table 3-1	See table 3-1	See 3.3.5	See 1.2.2, 3.3.1.9, & 3.4.16		See 3.3.11	See 3.3.6 & 3.3.1.4	See 3.3.1.4, 3.3.8, & 3.3.11.2	See 1.2.2, 3.3.1.1, 3.3.1.2, 3.3.1.3, 3.3.1.10, 3.3.11.3	See 3.2.4.2 & 3.3.16 (Typical max. volumes)		
	All other situations (where not specified elsewhere)	All (serving land uses not specified elsewhere in this table)	-	up to 100	20	10%	Separate from the carriageway, 1.5 m each side	Total shoulder 1.5 m, sealed shoulder 1.0 m	On sealed shoulder where it is a local authority defined cycle route	5.5 - 5.7	Connector/collector (~ 2,500 vpd)		**E8**
Suburban	**Live and play**	Access to houses/ townhouses	1 to 3 du or 1 to 6 du	10	3.6 m for up to 3 du or 4.5 m for up to 6 du	16%	Shared (in movement lane)	Allow for passing up to every 50 m	Shared (in movement lane)	2.75 - 3.0	Lane (this would normally be a private road or private way)		**E9**

PLACE CONTEXT			DESIGN ENVIRONMENT				LINK CONTEXT					TYPICAL PLAN AND CROSS SECTION SEE APPENDIX E FOR LARGER VERSION OF FIGURES	FIGURE NUMBER
Area	**Land use**	**Local attributes**	**Locality served**	**Target operating speed** (km/h)	**Min. road reserve width** (m)	**Max. grade**	**Pedestrians**	**Passing, parking, loading, and shoulder (each side)**	**Cyclists**	**Movement lane (excluding shoulder)**	**Classification**		
Notes	See 3.2.4 & table 3-1	See table 3-1	See table 3-1	See 3.3.5	See 1.2.2, 3.3.1.9, & 3.4.16		See 3.3.11	See 3.3.6 & 3.3.1.4	See 3.3.1.4, 3.3.8, & 3.3.11.2	See 1.2.2, 3.3.1.1, 3.3.1.2, 3.3.1.3, 3.3.1.10, 3.3.11.3	See 3.2.4.2 & 3.3.16 (Typical max. volumes)		
Suburban	**Live and play**	Side or rear service access	Up to 100 m in length between streets, 1 to 20 lots	10	6	16%	Shared (in movement lane)	Allow for passing up to every 50 m	Shared (in movement lane)	2.75 - 3.00	Lane (~ 200 vpd)		**E10**
	Live and play	Access to houses/ townhouses	1 to 20 du	20	9	16%	Shared (in movement lane)	Shared (in movement lane)	Shared (in movement lane)	5.5 - 5.7	Lane (~ 200 vpd)		**E11**

PLACE CONTEXT			DESIGN ENVIRONMENT				LINK CONTEXT					TYPICAL PLAN AND CROSS SECTION SEE APPENDIX E FOR LARGER VERSION OF FIGURES	FIGURE NUMBER
Area	**Land use**	**Local attributes**	**Locality served**	**Target operating speed** (km/h)	**Min. road reserve width** (m)	**Max. grade**	**Pedestrians**	**Passing, parking, loading, and shoulder (each side)**	**Cyclists**	**Movement lane (excluding shoulder)**	**Classification**		
Notes	See 3.2.4 & table 3-1	See table 3-1	See table 3-1	See 3.3.5	See 1.2.2, 3.3.1.9, & 3.4.16		See 3.3.11	See 3.3.6 & 3.3.1.4	See 3.3.1.4, 3.3.8, & 3.3.11.2	See 1.2.2, 3.3.1.1, 3.3.1.2, 3.3.1.3, 3.3.1.10, 3.3.11.3	See 3.2.4.2 & 3.3.16 (Typical max. volumes)		
	Live and play	Primary access to housing	1 to 200 du	40	15	12.5%	1.5 m one side or 1.5 m each side where more than 20 du or more than 100 m in length	Shared parking in the movement lane up to 100 du, separate parking required over 100 du	Shared (in movement lane)	5.5 - 5.7	Local road (~ 2,000 vpd)		**E12**
Suburban	**Live and play**	Primary access to housing	Up to 800 du	50	20	10%	2.0 m each side	Parking is separate and recessed. See 3.3.6. Public transport is likely (see clause 3.3.1.4, 3.3.1.5)	Separate provision where local authority defined cycle route	2 x 4.2	Connector/collector (~ 8,000 vpd)		**E13**

PLACE CONTEXT			DESIGN ENVIRONMENT				LINK CONTEXT					TYPICAL PLAN AND CROSS SECTION SEE APPENDIX E FOR LARGER VERSION OF FIGURES	FIGURE NUMBER
Area	**Land use**	**Local attributes**	**Locality served**	**Target operating speed** (km/h)	**Min. road reserve width** (m)	**Max. grade**	**Pedestrians**	**Passing, parking, loading, and shoulder (each side)**	**Cyclists**	**Movement lane (excluding shoulder)**	**Classification**		
Notes	See 3.2.4 & table 3-1	See table 3-1	See table 3-1	See 3.3.5	See 1.2.2, 3.3.1.9, & 3.4.16		See 3.3.11	See 3.3.6 & 3.3.1.4	See 3.3.1.4, 3.3.8, & 3.3.11.2	See 1.2.2, 3.3.1.1, 3.3.1.2, 3.3.1.3, 3.3.1.10, 3.3.11.3	See 3.2.4.2 & 3.3.16 (Typical max. volumes)		
	Shop and trade, work and learn	Side or rear service access	Suburban village, access to office and education, 1 - 20 lots	10	6	10%	Shared (in movement lane)	Recessed loading bays in accordance with 3.3.6	Shared (in movement lane)	3.5	Lane (~ 200 vpd)		**E14**
	Shop and trade, work and learn	Access to trade, office and education	Suburban village 1 - 200 lots	40	18	10%	3.0 m each side	Parking and loading bays both sides may be in the movement lane or recessed. See 3.3.6	Shared (in movement lane)	5.5 - 5.7	Local road (~ 2,000 vpd)		**E15**

PLACE CONTEXT			DESIGN ENVIRONMENT				LINK CONTEXT					TYPICAL PLAN AND CROSS SECTION SEE APPENDIX E FOR LARGER VERSION OF FIGURES	FIGURE NUMBER
Area	**Land use**	**Local attributes**	**Locality served**	**Target operating speed** (km/h)	**Min. road reserve width** (m)	**Max. grade**	**Pedestrians**	**Passing, parking, loading, and shoulder (each side)**	**Cyclists**	**Movement lane (excluding shoulder)**	**Classification**		
Notes	See 3.2.4 & table 3-1	See table 3-1	See table 3-1	See 3.3.5	See 1.2.2, 3.3.1.9, & 3.4.16		See 3.3.11	See 3.3.6 & 3.3.1.4	See 3.3.1.4, 3.3.8, & 3.3.11.2	See 1.2.2, 3.3.1.1, 3.3.1.2, 3.3.1.3, 3.3.1.10, 3.3.11.3	See 3.2.4.2 & 3.3.16 (Typical max. volumes)		
Suburban	**Make and move**	Side or rear freight access	Industrial area	10	11	10%	Separate footpath one side	Loading bays shall be separate and recessed. See 3.3.6	Shared (in movement lane)	3.5	Lane (~ 200 vpd)		**E16**
	Make and move	Primary freight access	Industrial area	40	18	10%	1.5 m each side	Parking and loading bays both sides may be in the movement lane or recessed. See 3.3.6	Shared (in movement lane)	2 x 4.2	Local road (~2,000 vpd)		**E17**

PLACE CONTEXT			DESIGN ENVIRONMENT				LINK CONTEXT					TYPICAL PLAN AND CROSS SECTION SEE APPENDIX E FOR LARGER VERSION OF FIGURES	FIGURE NUMBER
Area	**Land use**	**Local attributes**	**Locality served**	**Target operating speed** (km/h)	**Min. road reserve width** (m)	**Max. grade**	**Pedestrians**	**Passing, parking, loading, and shoulder (each side)**	**Cyclists**	**Movement lane (excluding shoulder)**	**Classification**		
Notes	See 3.2.4 & table 3-1	See table 3-1	See table 3-1	See 3.3.5	See 1.2.2, 3.3.1.9, & 3.4.16		See 3.3.11	See 3.3.6 & 3.3.1.4	See 3.3.1.4, 3.3.8, & 3.3.11.2	See 1.2.2, 3.3.1.1, 3.3.1.2, 3.3.1.3, 3.3.1.10, 3.3.11.3	See 3.2.4.2 & 3.3.16 (Typical max. volumes)		
	Shop and trade, work and learn, make and move	All, roads serving multi-purpose areas involving most or all of the indicated land uses, not specified elsewhere in this table.	All, or combinations of these land uses	50	23	10%	2.5 m each side, 3.5 m each side for shop and trade, work and learn	Parking separate and recessed. See 3.3.6. Public transport is likely (see 3.3.1.4, 3.3.1.5)	Separate provision where local authority defined cycle route	2 x 4.2	Connector/collector (~ 8,000 vpd)		E18

PLACE CONTEXT			DESIGN ENVIRONMENT				LINK CONTEXT					TYPICAL PLAN AND CROSS SECTION SEE APPENDIX E FOR LARGER VERSION OF FIGURES	FIGURE NUMBER
Area	**Land use**	**Local attributes**	**Locality served**	**Target operating speed** (km/h)	**Min. road reserve width** (m)	**Max. grade**	**Pedestrians**	**Passing, parking, loading, and shoulder (each side)**	**Cyclists**	**Movement lane (excluding shoulder)**	**Classification**		
Notes	See 3.2.4 & table 3-1	See table 3-1	See table 3-1	See 3.3.5	See 1.2.2, 3.3.1.9, & 3.4.16		See 3.3.11	See 3.3.6 & 3.3.1.4	See 3.3.1.4, 3.3.8, & 3.3.11.2	See 1.2.2, 3.3.1.1, 3.3.1.2, 3.3.1.3, 3.3.1.10, 3.3.11.3	See 3.2.4.2 & 3.3.16 (Typical max. volumes)		
Urban	**Live and play**	Access to lifestyle or clustered housing	1 to 3 du or 1 to 6 du	10	3.6 m for up to 3 du or 4.5 m for up to 6 du	16%	Shared (in movement lane)	Allow for passing up to every 50 m	Shared (in movement lane)	2.75 - 3.0	Lane (this would normally be a private road or private way)		**E19**
	Live and play	Side or rear service access	1 to 20 du	10	6	16%	Shared (in movement lane)	Parking is required and shall be separate and recessed	Shared (in movement lane)	2.75 - 3.00	Lane (~ 200 vpd)		**E20**

PLACE CONTEXT			DESIGN ENVIRONMENT				LINK CONTEXT					TYPICAL PLAN AND CROSS SECTION SEE APPENDIX E FOR LARGER VERSION OF FIGURES	FIGURE NUMBER
Area	**Land use**	**Local attributes**	**Locality served**	**Target operating speed** (km/h)	**Min. road reserve width** (m)	**Max. grade**	**Pedestrians**	**Passing, parking, loading, and shoulder (each side)**	**Cyclists**	**Movement lane (excluding shoulder)**	**Classification**		
Notes	See 3.2.4 & table 3-1	See table 3-1	See table 3-1	See 3.3.5	See 1.2.2, 3.3.1.9, & 3.4.16		See 3.3.11	See 3.3.6 & 3.3.1.4	See 3.3.1.4, 3.3.8, & 3.3.11.2	See 1.2.2, 3.3.1.1, 3.3.1.2, 3.3.1.3, 3.3.1.10, 3.3.11.3	See 3.2.4.2 & 3.3.16 (Typical max. volumes)		
	Live and play	Access to houses / townhouses	1 to 20 du	20	9	16%	Shared (in movement lane)	Shared (in movement lane)	Shared (in movement lane)	5.5 - 5.7	Lane (~ 200 vpd)		**E21**
Urban	**Live and play**	Primary access to housing	1 to 200 du	30	15	12.5%	1.5 m one side or 1.5 m both sides where more than 20 du or more than 100 m in length	Parking may occur in the movement lane or be separate and recessed. See 3.3.6	Shared (in movement lane)	5.5 - 5.7	Local road (~ 2,000 vpd)		**E22**

PLACE CONTEXT			DESIGN ENVIRONMENT				LINK CONTEXT					TYPICAL PLAN AND CROSS SECTION SEE APPENDIX E FOR LARGER VERSION OF FIGURES	FIGURE NUMBER
Area	**Land use**	**Local attributes**	**Locality served**	**Target operating speed** (km/h)	**Min. road reserve width** (m)	**Max. grade**	**Pedestrians**	**Passing, parking, loading, and shoulder (each side)**	**Cyclists**	**Movement lane (excluding shoulder)**	**Classification**		
Notes	See 3.2.4 & table 3-1	See table 3-1	See table 3-1	See 3.3.5	See 1.2.2, 3.3.1.9, & 3.4.16		See 3.3.11	See 3.3.6 & 3.3.1.4	See 3.3.1.4, 3.3.8, & 3.3.11.2	See 1.2.2, 3.3.1.1, 3.3.1.2, 3.3.1.3, 3.3.1.10, 3.3.11.3	See 3.2.4.2 & 3.3.16 (Typical max. volumes)		
	Live and play	All other land use activity types within this area type not specified elsewhere in this table.	All	50	20	10%	2.0 m each side	Parking separate and recessed. See 3.3.6. Public transport is likely (see 3.3.1.4, 3.3.1.5)	Separate provision where local authority defined cycle route	2 x 4.2	Connector/collector (~ 8,000 vpd)	(a)	**E23**
	Shop and trade	Side or rear service access	1 to 20 lots	10	6	16%	Shared (in movement lane)	Loading bays shall be recessed	Shared (in movement lane)	2.75 - 3.00	Lane (~ 200 vpd)	(b)	**E24**

PLACE CONTEXT			DESIGN ENVIRONMENT				LINK CONTEXT					TYPICAL PLAN AND CROSS SECTION SEE APPENDIX E FOR LARGER VERSION OF FIGURES	FIGURE NUMBER
Area	**Land use**	**Local attributes**	**Locality served**	**Target operating speed** (km/h)	**Min. road reserve width** (m)	**Max. grade**	**Pedestrians**	**Passing, parking, loading, and shoulder (each side)**	**Cyclists**	**Movement lane (excluding shoulder)**	**Classification**		
Notes	See 3.2.4 & table 3-1	See table 3-1	See table 3-1	See 3.3.5	See 1.2.2, 3.3.1.9, & 3.4.16		See 3.3.11	See 3.3.6 & 3.3.1.4	See 3.3.1.4, 3.3.8, & 3.3.11.2	See 1.2.2, 3.3.1.1, 3.3.1.2, 3.3.1.3, 3.3.1.10, 3.3.11.3	See 3.2.4.2 & 3.3.16 (Typical max. volumes)		
Urban	**Shop and trade**	Access to lots or shop or trade units	1 to 20 lots	10	11	12%	Shared (in movement lane)	Parking may occur separate and recessed. See 3.3.6	Shared (in movement lane)	2.75 - 3.00	Lane (~ 200 vpd)	(c)	**E25**
	Shop and trade	Primary access to trade	1 to 200 lots	30	20	10%	3.5 m each side	Parking and loading bays may occur in the movement lane or be separate and recessed. See 3.3.6	Shared (in movement lane)	5.5 - 5.7	Local road (~ 2,000 vpd)	(d)	**E26**

PLACE CONTEXT			DESIGN ENVIRONMENT				LINK CONTEXT					TYPICAL PLAN AND CROSS SECTION SEE APPENDIX E FOR LARGER VERSION OF FIGURES	FIGURE NUMBER
Area	**Land use**	**Local attributes**	**Locality served**	**Target operating speed** (km/h)	**Min. road reserve width** (m)	**Max. grade**	**Pedestrians**	**Passing, parking, loading, and shoulder (each side)**	**Cyclists**	**Movement lane (excluding shoulder)**	**Classification**		
Notes	See 3.2.4 & table 3-1	See table 3-1	See table 3-1	See 3.3.5	See 1.2.2, 3.3.1.9, & 3.4.16		See 3.3.11	See 3.3.6 & 3.3.1.4	See 3.3.1.4, 3.3.8, & 3.3.11.2	See 1.2.2, 3.3.1.1, 3.3.1.2, 3.3.1.3, 3.3.1.10, 3.3.11.3	See 3.2.4.2 & 3.3.16 (Typical max. volumes)		
	Work and learn	Side or rear service access	1 to 20 lots	10	6	16%	Shared (in movement lane)	Parking and loading bays shall be separate and recessed. See 3.3.6	Shared (in movement lane)	2.75 - 3.00	Lane (~ 200 vpd)	(e)	**E27**
Urban	**Work and learn**	Access to lots or work or learn activities	1 to 20 lots	10	11	12%	Shared (in movement lane)	Parking and loading bays shall be separate and recessed. See 3.3.6	Shared (in movement lane)	2.75 - 3.00	Lane (~ 200 vpd)	(f)	**E28**

PLACE CONTEXT			DESIGN ENVIRONMENT				LINK CONTEXT					TYPICAL PLAN AND CROSS SECTION SEE APPENDIX E FOR LARGER VERSION OF FIGURES	FIGURE NUMBER
Area	**Land use**	**Local attributes**	**Locality served**	**Target operating speed** (km/h)	**Min. road reserve width** (m)	**Max. grade**	**Pedestrians**	**Passing, parking, loading, and shoulder (each side)**	**Cyclists**	**Movement lane (excluding shoulder)**	**Classification**		
Notes	See 3.2.4 & table 3-1	See table 3-1	See table 3-1	See 3.3.5	See 1.2.2, 3.3.1.9, & 3.4.16		See 3.3.11	See 3.3.6 & 3.3.1.4	See 3.3.1.4, 3.3.8, & 3.3.11.2	See 1.2.2, 3.3.1.1, 3.3.1.2, 3.3.1.3, 3.3.1.10, 3.3.11.3	See 3.2.4.2 & 3.3.16 (Typical max. volumes)		
	Work and learn	Primary access to office and education	1 to 200 lots	30	20	10%	3.5 m each side	Parking and loading bays may occur in the movement lane or be separate and recessed. See 3.3.6	Shared (in movement lane)	5.5 - 5.7	Local road (~ 2,000 vpd)	(g)	**E29**
	Mixed use	Multiple user access	1 to 200 lots	30	20	10%	3.5 m each side	Parking and loading bays may occur in the movement lane or be separate and recessed. See 3.3.6	Shared (in movement lane)	5.5 - 5.7	Local road (~2,000 vpd)	(h)	**E30**

PLACE CONTEXT			DESIGN ENVIRONMENT				LINK CONTEXT					TYPICAL PLAN AND CROSS SECTION SEE APPENDIX E FOR LARGER VERSION OF FIGURES	FIGURE NUMBER
Area	**Land use**	**Local attributes**	**Locality served**	**Target operating speed** (km/h)	**Min. road reserve width** (m)	**Max. grade**	**Pedestrians**	**Passing, parking, loading, and shoulder (each side)**	**Cyclists**	**Movement lane (excluding shoulder)**	**Classification**		
Notes	See 3.2.4 & table 3-1	See table 3-1	See table 3-1	See 3.3.5	See 1.2.2, 3.3.1.9, & 3.4.16		See 3.3.11	See 3.3.6 & 3.3.1.4	See 3.3.1.4, 3.3.8, & 3.3.11.2	See 1.2.2, 3.3.1.1, 3.3.1.2, 3.3.1.3, 3.3.1.10, 3.3.11.3	See 3.2.4.2 & 3.3.16 (Typical max. volumes)		
Urban	**Mixed use**	Neighbourhood centres (and all other areas serving multiple land uses not listed elsewhere in this table)	200 to 800 lots	50	23	10%	2.5 m each side	Parking is preferred separate and recessed. See 3.3.6. Public transport is likely (see 3.3.1.4, 3.3.1.5)	Separate provision where local authority defined cycle route.	2 x 4.2	Connector/collector (~ 8,000 vpd)	(i)	**E31**
Centre	**Mixed use**	Side or rear service access	1 to 20 lots	10	6	16%	Shared (in movement lane)	Parking and loading bays (shared in movement lane). See 3.3.6	Shared (in movement lane)	5.7	Lane (~ 200 vpd)	(j)	**E32**

PLACE CONTEXT			DESIGN ENVIRONMENT				LINK CONTEXT					TYPICAL PLAN AND CROSS SECTION SEE APPENDIX E FOR LARGER VERSION OF FIGURES	FIGURE NUMBER
Area	**Land use**	**Local attributes**	**Locality served**	**Target operating speed** (km/h)	**Min. road reserve width** (m)	**Max. grade**	**Pedestrians**	**Passing, parking, loading, and shoulder (each side)**	**Cyclists**	**Movement lane (excluding shoulder)**	**Classification**		
Notes	See 3.2.4 & table 3-1	See table 3-1	See table 3-1	See 3.3.5	See 1.2.2, 3.3.1.9, & 3.4.16		See 3.3.11	See 3.3.6 & 3.3.1.4	See 3.3.1.4, 3.3.8, & 3.3.11.2	See 1.2.2, 3.3.1.1, 3.3.1.2, 3.3.1.3, 3.3.1.10, 3.3.11.3	See 3.2.4.2 & 3.3.16 (Typical max. volumes)		
	Mixed use	Access to lots or mixed use activities	1 to 20 lots	20	11	12%	Shared (in movement lane)	Parking and loading bays may occur in movement lane or be separate and recessed. See 3.3.6	Shared (in movement lane)	5.5 - 5.7	Lane (~ 200 vpd)	(k)	**E33**
Centre	**Mixed use**	Primary access and local movement	1 to 200 lots	30	20	10%	2.5 m each side	Parking and loading bays may occur in movement lane or be separate and recessed. See 3.3.6	Shared (in movement lane)	5.5 - 5.7	Local road (~ 2,000 vpd)	(l)	**E34**

PLACE CONTEXT			DESIGN ENVIRONMENT				LINK CONTEXT					TYPICAL PLAN AND CROSS SECTION SEE APPENDIX E FOR LARGER VERSION OF FIGURES	FIGURE NUMBER
Area	**Land use**	**Local attributes**	**Locality served**	**Target operating speed** (km/h)	**Min. road reserve width** (m)	**Max. grade**	**Pedestrians**	**Passing, parking, loading, and shoulder (each side)**	**Cyclists**	**Movement lane (excluding shoulder)**	**Classification**		
Notes	See 3.2.4 & table 3-1	See table 3-1	See table 3-1	See 3.3.5	See 1.2.2, 3.3.1.9, & 3.4.16		See 3.3.11	See 3.3.6 & 3.3.1.4	See 3.3.1.4, 3.3.8, & 3.3.11.2	See 1.2.2, 3.3.1.1, 3.3.1.2, 3.3.1.3, 3.3.1.10, 3.3.11.3	See 3.2.4.2 & 3.3.16 (Typical max. volumes)		
	Mixed use	Shared spaces, accessway, mall, and community reserve	Varies, specific design required	10	11	None if steps	Shared (in movement lane)	Activity space	Shared (in movement lane)	2.75 - 3.00 vehicle movement space, total space by design	Local road (~ 2,000 vpd)	(m)	**E35**
	Mixed use	Urban street	200 to 800 lots	40	23	10%	4.0 m each side	Parking and or loading is separate and recessed. See 3.3.6. Public transport is likely (see 3.3.1.4, 3.3.1.5)	Where local authority defined cycle route	2 x 4.2	Connector/collector (~ 8,000 vpd)	(n)	**E36**

3.3.3 Pavement structural design

Generally pavements shall be flexible designs. Other types of pavements shall be subject to TA approval. Pavements shall be designed in accordance with the NZTA NZ Guide to pavement structural design and NZ guide to pavement evaluation and treatment design with a design life of 25 years.

Where applicable the assessment of Equivalent Standard Axels (ESA) shall include a growth rate of 6% per annum for any existing traffic loading.

C3.3.3

For roads of connector/collector class or above, structural design should be undertaken by mechanistic design methods. For other roads, where they are chipseal, mechanistic or other industry standard chart based methods may be used.

3.3.3.1 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.

3.3.3.2 California Bearing Ratio Tests

CBR values shall generally be determined in the laboratory according to 6.1 of NZS 4402.6.

For local roads an alternative method of determining subgrade CBR in non-granular materials by Scala Penetrometer (10 m alternating lane) may be acceptable for clay and colluvial materials.

Figure 3.1 shows a correlation between Scala penetration and CBR values. This should be used conservatively.

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.

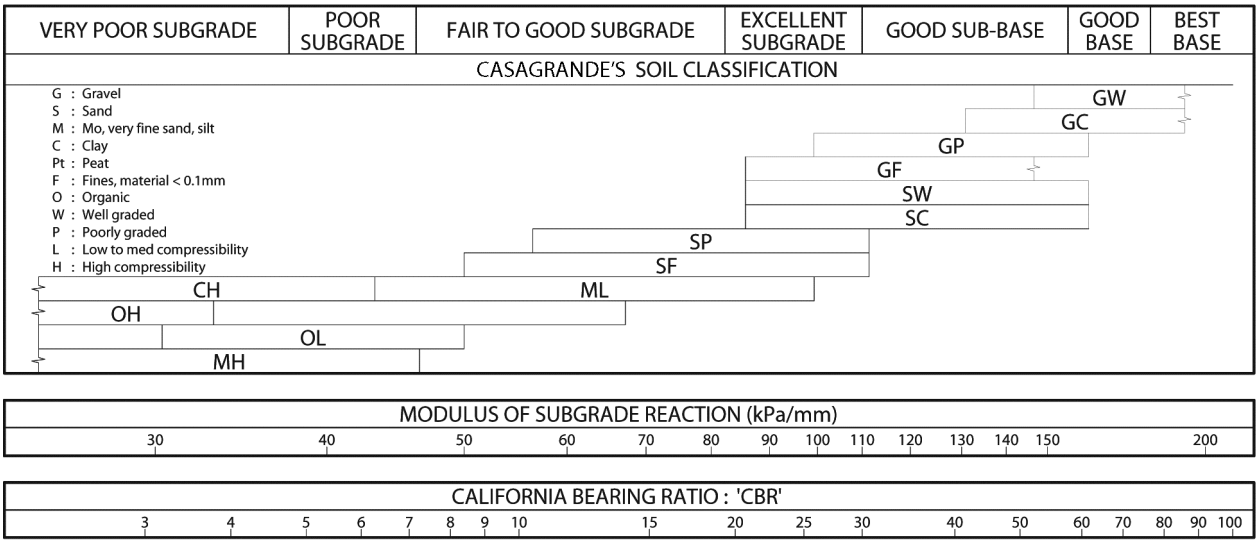
Where CBR values are required for aggregates, these shall be based on laboratory tests prepared on the fraction passing the 19 mm sieve but a CBR of more than 30 shall never be used. The use of CBR on metal layers shall only be in conjunction with consideration of the CBR and stiffness of lower layers.

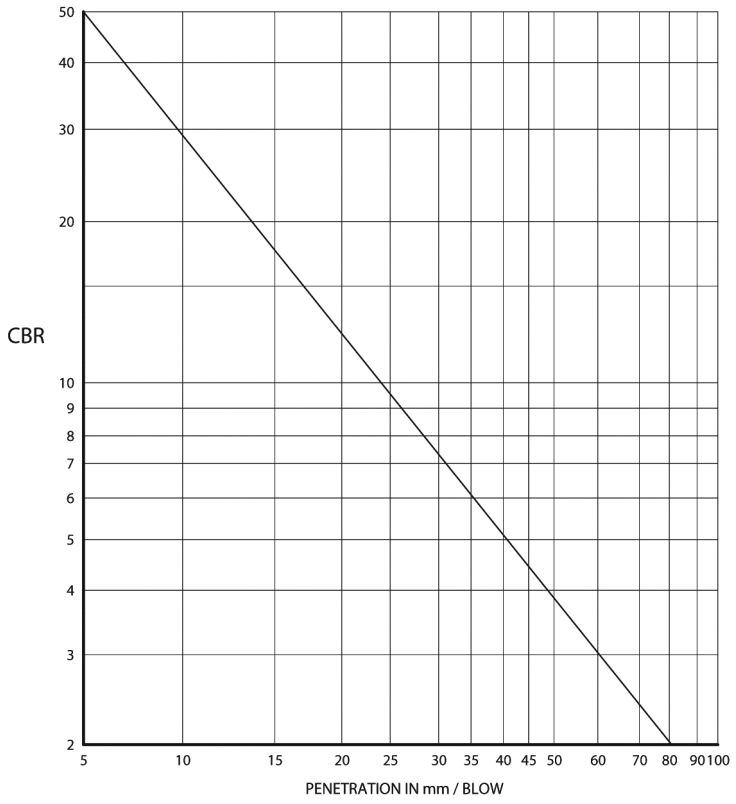
The use of Scala Penetrometer to determine the CBR value on local roads with clay and colluvial materials shall be approved by the Council at its sole discretion.

And

CBR values shall be determined by an IANZ (International Accreditation New Zealand) accredited laboratory. Details of the CBR values determined, together with certification by the accredited laboratory shall be submitted for approval by Council prior to the issue of a certificate in accordance with clause 224c of the Resource Management Act 1991.

In the case of roads with asphalt surfacing, designers must submit mechanistic design modelling to support the assumed deflections. Any assumptions in the design model such as the subgrade CBR, would ideally be explored and supported with geotechnical testing prior to the EA stage to minimise the risk of changes being required to the design during the construction phase.





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

Figure 3.1 – Parameter relationship

3.3.4 Safety barrier provisions

Where roads, private ways or other vehicular accesses, where the target operating speed is 60 km/hr or less, whether public or private, runs parallel with land which drops away to a height of greater than 1.0m within 2.0m of the road or footpath, the side shall be provided with safety barriers to protect vehicular traffic.

For roads with speeds greater than 60 km/hr, the clear zone requirements defined in Austroads Guide to Road Design - Part 06 apply, and if these cannot be achieved, then a barrier may be necessary and the final decision is at the discretion of Council.

3.3.4.1 Pedestrian and cycle barriers

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.

3.3.4.2 Urban vehicle barriers

Where safety barriers for vehicles in urban areas are necessary, they shall comply with the design requirements of NZTA RTS 11: Urban roadside barriers and alternative treatments.

3.3.4.3 Rural vehicle barriers

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

3.3.5 Target operating speed

Traffic management shall be included in road design to ensure that the target operating speed shown in Table 3-3 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, planting and landscaping, and street furniture and art works.

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 3.2 provides information on estimating traffic speeds for particular circumstances.

C3.3.5

The two key geometric factors that contribute to achieving the target operating speed are carriageway width and forward visibility. Figure 3.2 can be used to give an indication of the speed at which traffic will travel for a given carriageway width/forward visibility combination. (Reference: UK Department for Transport, 'Manual for streets'. Figure 3.2 is adapted from figure 7.16 in the reference and 'TRL661 – The manual for streets: evidence and research'). It is recommended that the user interpolate the design street width between the guide lines shown to determine relative street width and forward visibility.

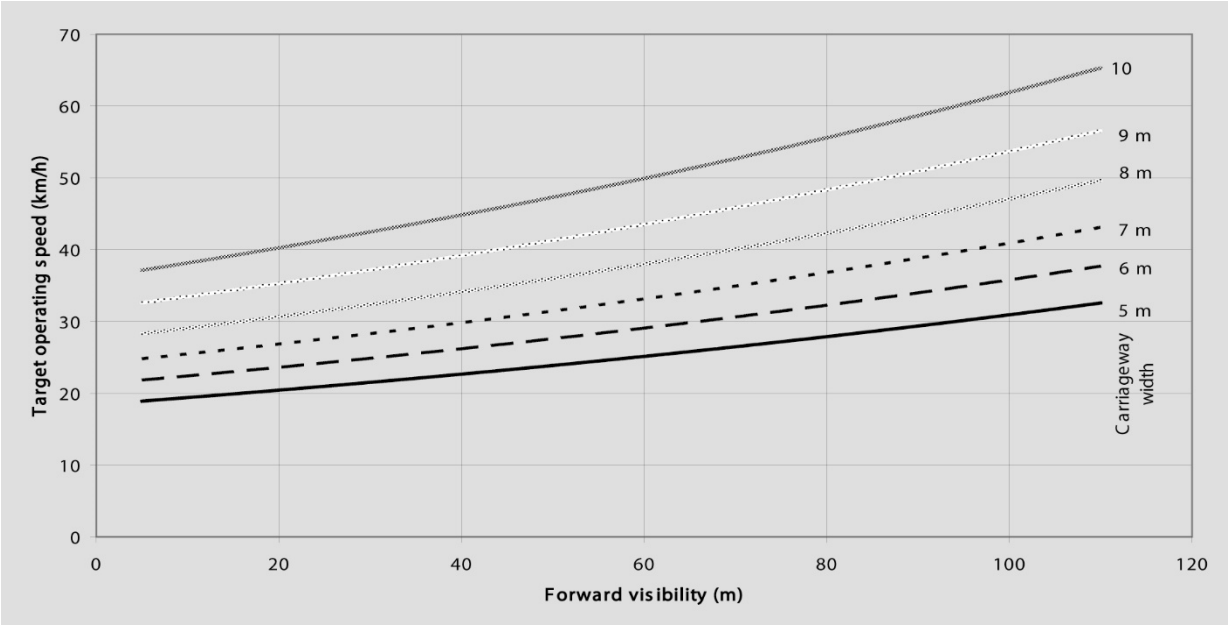


Figure 3.2 – Influence of road geometry on speed

3.3.6 Parking, Passing, and Loading

Public parking and loading can be provided either on-street including indented, or off-street in vested public car parks. Facilities shall meet the needs of the area and the requirements of the TA, and shall be addressed in the design and access statement (see 3.2.6). For a residential subdivision, where physically possible the minimum on-street parking provision will be 1 car park per residential unit/lot (based on permitted density) – see C3.3.6 below. Further guidance on parking demand associated with land use can be found on the Trips Database Bureau website http://www.tdbonline.org/home and NZTA Research Report 363.

C3.3.6

The total number of on-street car parks is to be assessed based on the proposed and surrounding land uses and any requirements for on-site parking as specified in the Transport Section of the District Plan. For example, a residential subdivision in the Low Density Residential Zone with no other non-residential activities/land uses in the vicinity will have a minimum on-street parking requirement of 1 car

Passing provision shall be in accordance with the design guidance in Table 3-3 and the requirements of the TA.

Acceptable and alternative on-street car park and loading dimensions should be taken from AS 2890.5 and/or the Austroads guides. Acceptable dimensions and construction details for indented parallel parking bays in suburban residential areas are shown in Drawing B5-3 Parking Bay. These should have minimum dimensions of 5.4 m x 2.5 m for a middle bay, or 6.0 m for an end bay, with appropriate entry and departure tapers. All indented parking bays shall be designed and constructed to avoid sharp corners. Corners shall be designed and constructed with adequate radii to allow for cleaning by street cleaners utilising rotary brushes.

Parking bays should be evenly distributed along the street. When parking bays are located in front of properties, consider the possible location of the property access, which may need restriction by a Consent Notice or Encumbrance. Parking bays are not permitted over a driveway or within 1 m distance from the prolongation of the driveway.

Parking and loading shall not be provided so that it has the potential to obstruct the movement of emergency or service vehicles along a road (e.g. as a result of parking on both sides of the road). Alternate provision within sites

may be demonstrated in addition to the requirements of the district plan, particularly when establishing rules for new subdivisions.

Where limited or no off-street parking is being provided, loading zones should be considered to allow for deliveries and passenger service vehicles. P&I must provide acceptance of any proposed loading zones in the carriageway on vested roads.

3.3.7 Intersection and Alignment Design

The angle of intersection should be 90°, although a minimum angle of 70o 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.

All road intersections in 'live and play' areas below arterial class should have a kerb radius at intersections of 4 m to 6 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 the TA. These dimensions shall be superseded by dimensions suitable for the manoeuvring of the design vehicle as outlined in section 3.3.2.5.

All intersections in 'make and grow' areas should have a minimum kerb radius of 13.5 m with corner splays of 6 m, or subject to specific design.

Intersections in all other 50 km/h 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.

Reference can also be made to Austroads guides.

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

3.3.8 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. An 8m rigid truck (10m radius) shall be catered for in any areas where rubbish collection will occur. The design of turning facilities for light vehicles shall be in accordance with AS 2890.5. See figure B5-1 and B5-2 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.

Areas required for turning shall be suitably marked to maintain access and prevent parking from blocking the turning area. Markings shall be in accordance with clause 3.3.12

3.3.9 Bus Stops

Bus Stops may be required on vested roads as part of a subdivision resource consent at Council's sole discretion; when planning and designing for bus stops, it must be demonstrated that designs are consistent with the *QLDC Bus Stop Policy* and associated *QLDC Bus Stop Technical Specifications*, 2022 (draft and final).

3.3.10 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.

3.3.11 Footpaths, Accessways, cycle Paths, and Berms

When planning and designing for pedestrians, developers should design to the latest NZTA guidance documents and liaise with QLDC when the proposed design does not comply with the NZTA guidance documents. It is to be noted that where there are differences in Policy direction with regards to pedestrian planning and design, the CoP supersedes the direction in all other relevant documentation. If unable to align with the guidance, a deviation can be sought.

Pedestrians, cyclists, and berms shall be provided for in accordance with Table 3-3. Dimensions, strength, durability, and finish shall be appropriate to their use and expected loadings. Paths shall be designed in accordance with Austroads guides and NZTA *Pedestrian Network Guidance.*

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.

Footpaths shall be separated from the kerbline by a minimum of 0.9m berm except:

a) At indented parking bays

b) In Commercial Town Centres

c) In steep terrain when approved by Council

3.3.11.1 Footpaths and Accessways

Footpaths shall be provided in accordance with the NZTA "Pedestrian Network Guidance", and to a minimum of 1.5m wide surfaced over their full width and timber edging, or an alternative approved material shall be installed for all footpaths. Footpaths that are grass bordered shall be curved at turns or splayed at 45º to prevent damage from grass maintenance. The crossfall should be no greater than 2%. Wider footpaths or areas of local widening will often be required by the TA where higher use or other needs dictate such widening.

Tactile pavers must be designed and installed in accordance with “RTS 14 - Guidelines for facilities for blind and vision impaired pedestrians”. A flat footpath is regarded as having a 1 in 12 slope or less. Refer to NZS 4121:2001, Design for Access and Mobility - Buildings and Associated Facilities and NZTA Pedestrian Network Guidance.

All tactile pavers shall have AS/NZS 4586:2004 Class V slip resistance to be confirmed by suppliers. Tactile pavers shall be either Yellow UV Stabilised Thermoplastic Polyurethane Studs, 316 Marine Grade Stainless Steel Studs or Yellow ceramic tiles or tactile tiles as specified in Council's Approved Materials List. Where tactile tiles are used, an appropriate adhesive shall be used and agreed to by Council.

Pedestrian / cycle accessways should be provided between cul-de-scas, 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:

(a) Be direct and no greater than two properties long;

(b) 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;

(c) Be sited to ensure high levels of community use;

(d) Be amenity landscaped without compromising safety;

(e) Have provision for the disposal of stormwater;

(f) Be provided with pedestrian level lighting; and

(g) Have a legal width not less than 5.5 m.

3.3.11.2 Cycling Facilities

Separated cycle paths from carriageways shall be provided where they form part of an identified cycling network or where good design requires separation from the carriageway. Useful guidance on cycleway design can be found in *Auckland Transport publication: Urban Street and Road Design Guide, 2019, Austroads Guide to Road Design Part 6A: Paths for Walking and Cycling, 2017, and NZTA webpage: Cycling Network Guidance – planning and design.*

Stormwater disposal shall be provided to all off-road cycle paths.

Lighting on cycle paths is to be provided in accordance with QLDCs Southern Light: Part Two – Technical Specifications, or where Council considers appropriate.

In addition to cycle paths, the requirements of supporting cycle infrastructure should also be considered when implementing cycle facilities, such as wayfinding signage and cycle parking. Cycle facilities may be required on vested roads as part of a subdivision resource consent at Council's sole discretion. When designing cycle facilities, the webpage: Designing a Cycling Facility, should be followed.

If there are conflicts between the Code and other documents referenced with regards to cycling facilities, the Code supersedes the direction provided in all other relevant documentation.

3.3.11.3 Footpath and Cycle Path Surfacing

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:

a) Concrete;
b) Asphaltic concrete.

Other acceptable surfacing for footpaths are:

c) Concrete pavers;
d) Other pavers may be approved by a TA in areas of high aesthetic value;
e) Chipseal (grade 6) may be approved by a TA in areas of very low pedestrian traffic;
f) Metal surfaces may be appropriate in rural areas;
g) Permeable or porous paving may be approved by a TA.

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.

3.3.11.4 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 the TA 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 90th percentile car.

Berms shall be of adequate width to:

a) Achieve safe clearances between the carriageway edge and any obstacle;
b) Allow running of utility services and placing of lighting poles within the berm unless approved otherwise by the utility provider or the TA;
c) Provide adequate space between the road reserve boundary and the carriageway edge to enable residents to safely enter the road traffic;
d) Allow room for efficient road edge and edge drain maintenance; and
e) Allow adequate space for the effective operation and maintenance of any form of stormwater management device.

3.3.12 Traffic signs, marking, and road furniture

The design shall incorporate all required road marking, signs, and other facilities appropriate to the place and link context. Roads should be designed to minimise the need for traffic signs and marking.

Designs shall satisfy the Land Transport Rule: Traffic Control Devices (TCD) and linked traffic sign specification, and the NZTA *Pedestrian Network Guidance.* All road markings and traffic signs shall comply with the TCD manuals and are to be approved by the TA. When these documents don't specify, Austroads should be used as the standard. Any line marking required must receive two coats with the 2nd coat carried out within 24 hours of the first coat.

All fire hydrants shall be marked in accordance with NZS 4522:2010.

Road name signs shall comply with the TA's current road names standards and their mounting shall be provided by the developer to the TA's requirements. Placement of the road name signs shall be in accordance with TCD (2004), except for the sign positioning in Table 7.7 at T intersections of: (a) minor road with minor road, or (b) minor road with undivided major road shall have positions 1 and 2 switched.

Where mountable or nib kerbs are used adjacent to a grassed berm, 'no parking off a roadway' signage must be used. The use of the signage elsewhere will be approved by Council on a case-by-case basis.

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

Reflective raised pavement markers shall not be used to provide for road marking or to identify fire hydrants.

3.3.13 Trees and Landscaping

See section 7 of this Code of Practice.

3.3.14 Road Lighting

All road lighting shall be designed and installed in compliance with the recommendations of AS/NZS 1158, Austroads guides or guidelines adopted by the TA at that time.

All lighting should comply with QLDCs Southern Light Part One – A Lighting Strategy and Part Two – Technical Specifications.

And

All lighting assets including but not limited to columns, lamps and mountings shall be approved by Council's Strategy and Asset Planning Team

The electrical installation contractor shall carry out all testing and inspections in accordance with the Electricity Act 1992, the Electricity (Safety) Regulations 2010 and the Australian/New Zealand Wiring Rules (AS/NZS 3000).

3.3.15 Bridges and Culverts

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

Particular features to be considered/covered include:

a) Widths/lengths:
b) All bridges and culverts shall be designed with a width to accommodate movement lane, cycle, and pedestrian needs of the road (see Table 3-3);

c) Roadside barriers:
d) See 3.3.4;

e) Batter slope protection:
f) All culverts shall have anti-scour structures to protect batter slopes, berms, and carriageways;

g) Clearance over traffic lanes:
h) 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;

i) Foundations:
j) 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;

k) For waterway design see section 4.

3.3.16 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 the TA's specific requirements, unless alternative designs by the developer's professional advisor are approved by the TA.

3.3.16.1 Plan and gradient design

Table 3-3 should be used as a guide for the widths of elements required for accesses.

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 Appendix B Drawing B5-1 and Drawing B5-2.

For accesses serving fewer than three lots or 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:

(a) Not be steeper than 1 in 6 for any private way used for vehicle access

(b) In residential zones where a private way serves no more than 2 residential units the maximum gradient may be increased to 1 in 5 provided:

i. The average gradient over the full length of the private way does not exceed 1 in 6; and

ii. The maximum gradient is no more than 1 in 6 within 6m of the road boundary; and

iii. The private way is sealed with non-slip surfacing.

(c) Not be less than 1 in 250.

C3.3.16.1 (a) and (b)

The TA 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 3.5% with a construction tolerance of +/- 0.5%.

To allow vehicles to pass, accesses shall have widening to not less than 5.5 m over a 15 m length at not more than 50 m spacing. Rural accesses may have passing bays at up to 100 m distances where visibility is available from bay to bay.

3.3.16.2 Stormwater design

All shared urban accesses shall be surfaced and have their edges defined by a structural edge.

Rural accesses shall be formed with safe water tables/edge drains along but adequately clear of each side of the access.

Accesses sloping up from the road 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. Stormwater shall discharge via an appropriately sized and designed stormwater system acceptable to the TA (see Drawing B5-9) for examples of typical sump to driveway or right of way). Rural side drains shall not discharge directly to the roadside drain. Where accesses pass over the side drain they shall be provided with a culvert of size appropriate for the design flow but not less than 300 mm diameter.

Accesses that slope down from the road 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 follow designed overland flow paths.

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

3.3.16.3 Pavement design

Private pavements shall be designed as for public roads but no residential or rural pavement shall have a minimum formation thickness of less than 150 mm for flexible pavements or 100 mm for concrete pavements.

Commercial and industrial pavement shall be provided with adequate supporting design to ensure that it will have a life of 20 years.

Acceptable surfacing for accesses includes asphaltic concrete (30 mm minimum thickness), chipseals, in situ concrete or concrete pavers.

Acceptable asphalt concrete design should be in accordance with the NZTA Specification M/10 and all subsequently referenced NZTA specifications.

3.3.17 Crossings

3.3.17.1 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 and to any lots, front or rear where access points are clearly identifiable at the subdivision or development stage.

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 NZTA *Pedestrian Network Guidance*. Structural design shall be adequate to carry the loads to be expected over its design life. All crossings shall be surfaced with asphalt or concrete or paving stone as approved by the TA.

Crossings shall be in accordance with diagrams contained in Appendix B.

Where stormwater drainage is provided by swale or open drain, crossings shall be provided as specified in 3.3.17.2.

Pram and wheelchair crossings shall be provided at all road intersections and pedestrian crossings. 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 satisfy the NZTA *Pedestrian Network Guidance*.

3.3.17.2 Rural

All shared crossings and anywhere 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. The crossing shall be sealed to not less than the standard of the road surface and to the road boundary. 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 and end treatments shall be sized appropriately for the catchment intercepted but shall be a minimum of 300 mm diameter.

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.

3.3.18 Fencing

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

3.3.19 Road run-off

3.3.19.1 Integration of road run-off with development stormwater system

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 4 of this Code of Practice with the aim of minimising downstream negative

effects and mitigating road instability and erosion problems. Some guidance on integrated catchment management is set out in NZTA Stormwater treatment standard for state highway infrastructure.

3.3.19.2 Design

For stormwater run-off design see section 4 of this Code of Practice.

3.3.19.3 Subsurface drains

Where considered necessary by the TA or the developer's professional advisor, piped subsurface drainage shall be provided to protect road formations from deterioration or loss of strength caused by a high water table and as part of swale stormwater systems. Design shall be in accordance with 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 typical details of under-kerb drainage and subsoil drainage see Appendix B Drawing B5-4.

3.3.19.4 Side drains/water tables

Rural roads shall have normal camber (see Table 3-3) 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 have outlets protected from scour and shall be located to minimise the risk of slope instability.

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

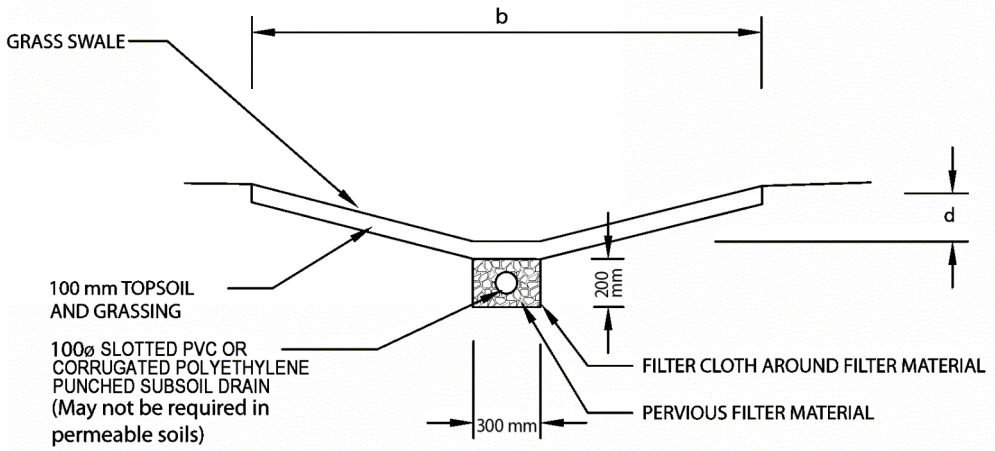
3.3.19.5 Swales

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 of the road, and must be of sufficient width to accommodate services (if needed), plant growth and maintenance (see 7.3.5).

Where swales are used they shall be designed by a suitably qualified person in accordance with TA 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 3.3.

Rip rap lined swales should be avoided, unlesss specifically agreed with QLDC. Where the swale is adjacent to a road then the safety concerns with regard to check dams shall be taken into consideration.

See 4.3.7.6 for swale design and section 7 on landscaping design and practice.



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 3.3 – Swale Cross Section

3.3.19.6 Kerbs and channels

Where kerbs and channels are to be provided on carriageways they should comply with Appendix B Drawing B5-8 Kerb and Dished Channels, or their slip-formed equivalent may be used subject to the approval of the TA. 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. Refer to NZS 4121:2001 for requirements.

3.3.19.7 Sumps

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

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

(a) 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. Appendix B Drawing B5-12 show details of common types of grated inlet;

(b) Back entry inlet sumps: Back entry inlets are less affected by blockage, and they are more effective in intercepting flows in sag areas;

(c) 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. Appendix B Drawing B5-11 to B5-14 show typical examples of this type of inlet.

Appendix B Drawing B5-9 shows an acceptable detail for sumps in accessways, footpaths, and rights of way. A flat channel or yard sump and various styles of hillside sump are shown in Drawing B5-10 to Drawing B5-14.

A double back-entry sump for road low points is shown in Appendix B Drawing B5-14.

All grates shall be of a design that are cycle friendly. Grate slots shall not run parallel to the direction of carriageway travel.

And

The invert level of all sump chambers shall be greater than 450mm below the invert level of the outlet pipe.

All sumps shall incorporate a siphon or alternative solution acceptable to the Council

3.3.19.7.1 Sump location

Sumps shall be located:

(a) To ensure that the total system design flow enters the pipe system and that surface flows across intersections are minimised. 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;

(b) 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;

(c) Not further apart than 90 m along any surface system.

3.3.19.7.2 Sump design

Sumps should be designed to intercept and convey stormwater run-off flow from design storm of the AEP set out by the TA, or otherwise stated in section 4 of this Code of Practice, while allowing a reasonable frequency and degree of traffic interference. Depending on the road classification, as specified by the TAs, portions of the road may be inundated during major storm events. See 4.3.4.2 for allowable floodwater depths.

The following general guidelines should be used in the design of sumps:

(a) General safety requirements
  (i) 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
  (ii) Openings are sufficiently small to prevent entry of debris that would clog the stormwater system
  (iii) Openings be sized and oriented to provide for safety of pedestrians and cyclists. Cycle-friendly sump grates shall be used where required by the TAs. 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;

(b) 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 follows:

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	Sumps include back entry capacity only

(c) The use of silt traps is encouraged in all sumps to provide partial treatment to stormwater at the source, but in all cases, trapped sumps should be used where discharge to a soakage device is permitted.

3.3.19.7.3 Sump gratings

Sump grating areas shall be sized generously to allow for partial blockage to ensure that side-channel water does not bypass sumps when velocities are high.

Cycle-friendly sump grates shall be used where cyclists can be expected or when required by the TA. 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.

3.3.19.7.4 Sump leads

Sump leads should be designed to be of sufficient size to convey all the design capacity of the sump to the system. The minimum size of the lead for public sumps shall be 200 mm diameter, but 300 mm diameter is desirable to minimise inlet losses and blockage risk. For double sumps with a single outlet and other high capacity sumps, the minimum size of lead required is 300 mm diameter. For private sumps, the minimum diameter should be 150 mm.

3.3.19.7.5 Secondary flow provisions

At all points where sump blockage may occur, or where design capacity may be exceeded, which could lead to overflow into private property, the provision of designed secondary flow paths protected by public ownership or easement shall be made (see 4.3.4.2).

3.4 CONSTRUCTION

3.4.1 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.

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.

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

All construction methods and materials shall be suitable for the climatic conditions experienced in the Queenstown Lakes District. Basecourse preparation and subsequent road sealing shall not occur in the period between 15 May and 15 September each year. QLDC may agree to extensions if conditions and treatments allow.

3.4.2 Materials for flexible pavements

3.4.2.1 Transition layer

A transition layer may be required for traffic loading in excess of 1 x 10^5 ESA where the subgrade is soft, to prevent ingress of the soft soils into the pavement layers. The transition layer may be filter metal complying with appropriate NZTA specifications or an approved geotextile filter fabric. 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.

3.4.2.2 Sub-base

The subbase metal shall be AP 65 and shall meet the following requirements:

(a) Can be crushed or uncrushed

(b) At least 60% by mass shall pass the 37.5 mm standard sieve.

(c) At least 45% by mass shall pass the 19 mm standard sieve.

(d) Not more than 70% by mass shall pass the 9.5 mm standard sieve.

(e) Not more than 10% by mass shall pass the 0.300 mm standard sieve.

(f) Not more than 7% by mass shall pass the 0.075 mm standard sieve;

(g) Crushing resistance to be greater than 110 kN when tested in accordance with Test 3.10 of NZS 4407.

(h) The sand equivalent shall not be less than 40 when aggregate is tested according to NZS 4407, Test 3.6 Sand Equivalent Test. Where uncrushed AP65 is proposed, it is the contractor's responsibility to ensure that it can achieve the requirements of NZTA B/2 Specification.

3.4.2.3 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:

(a) NZTA M/4:2006

(b) Local basecourse acceptable to the TA

This may be used for local roads in live and play areas and footpaths, kerb crossings, and shared accessways.

Material sourced from the Shotover River shall not be used in basecourse layers.

3.4.3 Road surfacing

3.4.3.1 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:

(a) Hot laid asphaltic concrete of minimum compacted thickness 30 mm, laid over a 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) Concrete block pavers; and

(e) Stone block surfacing where designed for aesthetic effects.

(f) Metalled surface at the sole discretion of TA.

Minimum surfacing standards shall be in accordance with NZTA M/10 Specification, except where given in Table 3-4 to the named facilities to resist scuffing and local load effects.

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

Table 3-4: Recommended surfacing standards

Facility	Minimum surfacing
Residential turning zones (intersections, culdesacs, roundabouts, and turning heads)	Segmental concrete pavers, concrete, 30 mm asphaltic concrete
Public carparks (excl. parallel parks)	Segmental concrete pavers, concrete, 30 mm asphaltic concrete
Commercial and industrial turning zones (intersections, culdesacs, roundabouts, and turning heads)	Segmental concrete pavers, concrete, 50 mm asphaltic concrete
Traffic islands and bus stops	Segmental concrete pavers, concrete, 50 mm asphaltic concrete

3.4.3.2 Road surface tolerances and texture

The finished surface of new roads shall have a NAASRA roughness satisfying the TA's standards at the time of construction. 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.

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 the TA.

Roughness readings are not required on lengths 150m or less e.g. cul-de-sacs, as the shape requirements as per NZTA/TNZ Specifications are expected to be sufficient to control isolated bumps over this short length. The average and maximum readings shall exclude values affected by intersecting streets, platforms and road humps.

A NAASRA roughness test is recommended to be undertaken prior to surfacing however it is the finished surface which must satisfy Council Standards. . For possible remedial purposes, it may be prudent to conduct this test at the pre-seal stage at the basecourse level. The Contractor shall supply to the Design Consultant and QLDC sufficient information to confirm all performance criteria have been achieved as part of the RAMM data required by QLDC.

Depending on the road environment, consideration will be taken into account for short, low speed urban roads. It is recognised that survey equipment has operational limits. These include a minimum speed below which the quality of the data collected is compromised. Therefore the Survey Contractor must advise the Client of the minimum speed and other conditions that adversely affect the data quality and advise how the data may be flagged when these situations are encountered. These limitations must be passed to Council along with the completed survey data.

Surface Ride for new, rehabilitated or reconstructed pavements

The new pavement must have an average dynamic roughness, when measured over a length of 100m, of less than 60 NAASRA counts/km for any three consecutive results and no individual value greater than 70 within the extent of the re-surfacing area unless it can be clearly attributable to a permanent feature such as a bridge joint.

Surface Ride for Resurfacing Sites

The pre-resurfacing site roughness measure must be obtained from RAMM database – high speed roughness count. Where these measures do not exist, testing must be performed. The average roughness count must be used to benchmark the resurfacing works, as described below.

The new surface when measured over a length of 100m must achieve an average NAASRA roughness less than the value calculated using the formula below. No two consecutive counts must exceed 70 and no individual count greater than 80 within the extent of the resurfacing are permitted unless this can be clearly attributable to a permanent feature such as a bridge joint.

NAASRA Count Criteria = 0.7D + 5 (D = average NAASRA roughness measure determined before the commencement of asphalt resurfacing.)

Where the roughness improvement criteria is not satisfied, remedial works must be undertaken to bring the roughness to the acceptable limit at no additional cost to the Council.

Surface Irregularities

The finished surface shall be 5mm above channel fenders or concrete kerbs and shall not hold water and there shall be no point where the general surface varies more than 5mm from a 3m straightedge laid longitudinally, with a cumulative total of all visible gaps of not more than 10mm, or more than 5mm from a 1m straight-edge laid transversely, including across service boxes and joints. All service covers must be

raised during new surfacing or resurfacing operations to be flush with the adjacent finished pavement surface level.

Density

The density requirements for the compacted mat are as defined in the NZTA M/10 specification or as stated in the specific contract requirements.

Flushing, Shoving, Segregation and other Defects

The asphalt surfacing must not exhibit any signs of flushing, shoving or segregation following completion of the works and at completion of the defect liability period. Water cutting is not an acceptable remedy for flushed surfaces.

> ***C3.4.3.2***
>
> *In the cases of narrow traffic islands and bus stops, where loading is concentrated, the use of stabilised base course is also desirable.*

3.4.4 Road surfacing materials

All materials used in road surfacing shall comply with the appropriate NZTA specifications.

The Contractor shall supply to the Design Consultant and QLDC details of aggregate grading, residual binder content, details of any polymers used and other relevant information for the material to be used seven days prior to the commencement of work. Once applied to the pre-seal surface, a stand down period of 48 hrs will be enforced. This is to allow time for the emulsion coat to harden and to allow a good adhesion of this coat to the pavement surface. An inspection by the QLDC Inspector will occur during this period to ensure that the entire surface has been covered and that no areas have been missed or damaged.

After any rain event the pavement should be allowed to dry out prior to the application of any membrane surface. This could be a 48 hour period in a big event.

A polymer modified seal should be designed to meet the district's challenging conditions (>2% shall be added where the site stress factor from Table 6-2 of CSNZ is greater than 4 and/or where the site is in winter shade for greater than 4 hours daily.)

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

3.4.4.1 First and second coat chip seals

When chip seals are used, QLDC require a second coat seal to be undertaken the following season (either a single coat or two coat depending on the situation, single coats are generally not considered appropriate in our urban environment) as the first coat (even a two coat first coat) is not considered to be fully waterproof and therefore leaves the pavement susceptible to the freeze/thaw conditions in the district.

For single coat first coat seals the chip size shall generally be grade 3 on all roads. Alternatively a two coat first coat with grade 3/5 chip may be appropriate where higher stresses from traffic are expected. The binder application rate shall be designed to suit the conditions and chip size, refer to 'Chip sealing in New Zealand'

https://www.nzta.govt.nz/resources/chipsealing-new-zealand-manual/chipsealing-in-new-zealand/

When there is a second coat required to be undertaken by the developer, the defects liability period for the second coat will be extended to 12 months beyond the second coat seal date. For second coat seals the chip size shall generally be grade 4 or 5. Two coat second coat seals may also be appropriate with grade 4/6 acceptable for local roads and grade 3/5 for other roads. The second coat seal is the responsibility of the developer and must be applied in the season following the first coat. Refer to Chapter

6 for appropriate treatment selection and Chapter 9 for design of 'Chip sealing in New Zealand' at https://www.nzta.govt.nz/resources/chipsealing-new-zealand-manual/chipsealing-in-new-zealand/

There are 2 options available for completion of the second coat seal, depending on the ownership of the road:

1) Independently by the developer, this includes private roads and right of ways. A bond will be required if this work will occur post-224c certification to ensure it is completed within the next available sealing season following the first coat application. Details of the second coat seal shall be provided to Council on completion via the Roading Asset data provision/RAMM update sheet process. Council will retain 5% of the bond for 12 months following completion of the second coat to cover any defects occurring within that period.

2) For Council-vested roads, the work may be completed as part of the Council's annual sealing programme and the developer covers costs paid to the council for undertaking this work. The developer shall provide payment to Council to cover the cost of this work prior to 224c certification for subdivision.

For either option, the developer is responsible for undertaking the second coat pre-reseal repairs as per 3.4.10. These should be identified and rectified within the defect liability period.

Basis of calculating the estimated costs for a second coat will be based on the average cost of current QLDC reseal rate including a minimum 8% contingency for contract Preliminary and General and design costs.

3.4.4.2 Hot laid asphaltic concrete surfacing

Hot laid asphaltic concrete surfacing shall comply with Waka Kotahi specification M/10 or equivalent approved by the TA. The mix used shall be appropriate to the end use and thickness being placed. A waterproof membrane seal is to be applied to the basecourse prior to AC surfacing for all thin AC (defined as non-structural surfacing below 100mm in thickness) as follows:

(a) Hot bitumen or bitumen emulsion may be used. No cutters are preferred, however if a small amount (<2%) is to be included it must be addressed in a specific design.

(b) The residual binder quantity required must be detailed in the surfacing design but should not be less than 1.0 litre/m2 at 15ºC ambient temperature. Unless agreed otherwise, a Grade 4 sealing chip is to be used as the cover material at an approx. spread rate of 150m2/m3 to achieve visible windows in the chip surface.

(c) Membrane seals must be adequately protected prior to placement of the AC to ensure that there is little or no damage to the membrane prior to AC surfacing.

(d) Where the membrane is to be subjected to traffic, or there will be an extended period (4 weeks or more) before placing the asphalt on green field sites the membrane seal should be specifically designed taking into consideration when the asphalt will be placed.

Where membranes are damaged prior to AC surfacing the following repairs method should be used:

(e) For repairs larger than 150x150mm a waterproof membrane seal (single coat Grade 4 or similar) must be re applied to the damaged area before paving. The membrane seal must extend beyond the exposed area by 200mm.

(f) Where the damage is less than 150mm x 150mm then a compacted layer of dense graded asphalt may be used to patch the area.

Application of Tack Coats

(g) The purpose of a tack coat is to promote bonding between the layers, for example between successive layers of asphalt i.e. structural asphalt lifts, or where AC is to be applied to an existing trafficked chipseal (i.e. open road). A tack coat is not a substitute for a membrane seal.

(h) A tack coat is not required on a green field site where a fresh membrane seal has been applied.

3.4.4.3 Other asphaltic 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 30 mm.

3.4.4.4 Concrete

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

Concrete for kerbs and channel shall be of not less than 20 MPa, 28-day strength.

3.4.4.5 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 the TA.

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.

3.4.5 Subgrade testing

Testing of the subgrade is required on all roads classified as a Primary Collector or above (ONRC Categories) or at the discretion of the designer for lower road classifications.

The tests required below are mandatory on all roads:

(a) Site specific scalas (see section 3.3.3.2)
(b) Soaked CBR results (see section 3.3.3.2)
(c) Proof Rolling (documented)

The tests required below are optional on roads below Primary Collector classification or at the discretion of the designer (it is the designer's responsibility to provide target deflections) as follows or mandatory for classifications above Primary Collector:

(d) Benkelman Beam testing or Falling Weight Deflectometer

Where the extent of cut or fill for the project is too great to make subgrade CBR testing feasible at the design stage, it should be done on completion of earthworks when subgrade levels have been exposed. Even in cases where the subgrade has been tested as part of the design its condition shall be reviewed on exposure during construction 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 the TA before placing of pavement layers commences.

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 ravelling develop in the subgrade, the area so affected shall be scarified and clean material added and recompacted.

No tolerance on the subgrade level that reduces the depth of construction will be allowed. Unsuitable foundation soils shall be removed to meet design requirements.

Ordinary traffic shall not be permitted to traverse the excavated subgrade surface. The Contractor's operations shall not cause pugging or sponging of the subgrade, both of which will affect the way the subgrade reacts to water, which in turn will affect the bearing capabilities of the subgrade material. Nor shall the construction traffic be allowed to disturb the subgrade surface, creating undulations in the surface which may disturb any of the allowable tolerances in the Sub-base material thickness above. These layer thickness tolerances ware discussed in section 3.4.7. Contractors shall match site conditions with their plant selection and construction techniques e.g. layer depth, to ensure this does not occur.

The finished subgrade shall be trimmed, rolled and finished in accordance with the requirements of clause 11 of NZTA F/1: 1997.

Where the Design Consultant considers that oversize materials compromise the ability to achieve the specified compaction or the finishing requirements of NZTA F/1, Section 10 and 11, then the requirements of Table 2 of the NZTA F/1 shall apply.

3.4.6 Spreading and compaction of metal course aggregates

The metal course aggregates shall be placed on the prepared subgrade in layers. The aggregate layers shall be of adequate thickness and stiffness to ensure that with adequate compaction the minimum required deflections are achieved.

3.4.7 Sub-base

Sub-base material shall be placed in layers thin enough to ensure requisite compaction and compaction standards are achieved. Sub-base shall be compacted in accordance with 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 and in such a condition that there is adequate drainage at all times. The laying procedure shall be arranged to minimise segregation. Grader use shall be restricted to essential shaping and final trimming, with minimum working of the final surface.

The finished compacted surface shall nowhere have depressions that hold water and there shall be no point on the surface that will vary more than 30mm either from a 3m straight-edge laid parallel to the centre of the road, or from a camber board placed at right angles to the centreline.

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.

3.4.7.1 Sub-base testing

Mandatory sub-base testing requirements:

(a) Nuclear Densometer (NDM)
(b) Stringline or Total Station Grid
(c) Materials Properties
The Contractor shall provide QLDC in total a minimum of two conforming sets of acceptance test

results for the subbase from each aggregate source at the start of the project. One additional set for each 1,000m³ required over 2,000m³ for subbase.

i. Spreader test/ Mat Test in accordance with NZS 4407:2015, Test 2.4.6 (Stockpile Sampling) and/or NZS 4407:2015, Test 2.4.7 (freshly spread layers)
ii. If stockpiled on site, in accordance with NZS 4407:2015, Test 2.4.6.3.2 (Machine stockpile)

The design consultant shall investigate any tests that fail, including retesting if required. The QLDC inspector shall be notified of the outcome of the investigation for acceptance.
All of the test results and stringline profiles are to be provided to the QLDC inspector at the time of the AP65 inspection.

3.4.8 Basecourse

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

Where approved by the TA, cement stabilised basecourses should be placed and compacted in accordance with the 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 finished surface just prior to sealing or surfacing shall be uniform in texture, have no segregated areas, excess dust, or excess moisture. It shall be tightly compacted and present a clean stone mosaic that remains bound when swept. The finished surface shall have no depressions that hold water.

3.4.8.1 Basecourse testing

Mandatory Basecourse testing requirements:

(a) Nuclear Densometer
(b) Benkelman Beam
(c) NAASRA (only mandatory on roads over 150m in length)
(d) Materials Properties

The Contractor shall provide QLDC in total a minimum of two conforming sets of acceptance test results for the subbase from each aggregate source at the start of the project. One additional set for each 1,000m3 required over 2,000m3 for subbase.

i. Spreader test (pavement additives) / Mat Test (granular layers) in accordance with NZS 4407:2015, Test 2.4.6 (Stockpile Sampling) and/or NZS 4407:2015, Test 2.4.7 (freshly spread layers)
ii. If stockpiled on site, in accordance with NZS 4407:2015, Test 2.4.6.3.2 (Machine stockpile)

3.4.9 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, ravel, 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.

3.4.10 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 the TA. The road is to be swept at time of inspection; however, this may not be for a period of longer than 24 hours prior to seal.

3.4.11 Deflection testing prior to surfacing

Prior to placing the surfacing layer (except for cast in situ concrete roads) deflections shall be tested by the Benkelman Beam Method or Falling Weight Deflectometer.

Table 3-5 provides deflection requirements for flexible pavements with flexible surfacing. At least 90% of all tests shall comply with the standards appropriate to the road type. Table 3-5 below shall be considered as a minimum standard for deflections. In addition, no test shall give deflections greater than 25% above the 90th percentile deflection.

Table 3-5: Pavement deflection standards

Class	ONRC Class	Strategic Significance	ONRC Metric/Class Differentiator	Asphalt Surface	Chipseal Surface	Curvature Function (mm)
GT4	ONRC - Arterial	Connectors providing significant movement of people through or between neighbourhoods and towns.	Urban > 5,000 Rural > 3,000	1	1.2	0.15
GT5	ONRC - Primary Collector	Major collectors that link neighbourhoods to townships/districts.	Urban > 3,000 Rural > 1,000	1	1.2	0.17
GT6	ONRC - Secondary Collector	Minor collectors that link local areas to neighbourhoods.	Urban > 1,000 Rural > 1,000	1	1.5	0.17
GT7	ONRC - Access	Movement within a local area or to access areas outside the local area.	Urban < 1,000 Rural < 200	1	1.5	0.17

GT8	ONRC - Low Volume	Low volume movement within a local area.	Urban < 200 Rural < 50	1.6	1.5	0.2

Readings shall be taken in the wheel path in both lanes and at a maximum interval of 10 m.

3.4.12 Surfacing specification

Chipsealing construction standards shall comply with NZTA specifications P/3 for first coat seals and P/4 for resealing.

Asphaltic concrete construction standards shall comply with NZTA specification M/10. This code defines the tolerances for all of the components which comprise the asphalt layer. This includes the aggregates used, mineral fillers and binders which all affect the viscosity of the surfacing layer being applied.

The mix designations, namely AC10, AC14, AC20 and AC28 which are used for medium to heavy traffic loads and DG7, DG10, DG14 and DG20 which are for light to medium traffic loads, are all clearly defined.

3.4.13 Bitumen application rate

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

The base and edges of all areas to be covered by the asphaltic concrete, except prime coats, but including membranes shall be tack coated with a bitumen emulsion complying with NZTA M/10 and uniformly applied at a residual application rate of 0.15 l/m 2. The surface prior to tack coating shall be clean and free of surface water, dust, sand, grit or any other material that could impair the adhesion of the tack coat. The application of the tack coat shall consider truck access to the paver and possible tracking by truck wheels which could damage the tack coat surface finish.

Note, all carriageway areas that include asphalt must have a membrane seal. The only areas which do not require a membrane seal are footpaths.

3.4.14 Footpaths and cycle paths

3.4.14.1 Concrete

Concrete footpaths and cycle paths shall be formed over not less than 100 mm of compacted metal. 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.

Minimum concrete thickness for paths is 100 mm. Concrete in both footpaths and kerb and channel shall be cured for at least 7 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 3.4.4.5.

Where required, vehicle and pedestrian crossings shall be constructed in accordance with the TA standard details (refer to Drawing B5-18, B5-19. And B5-24 and 3.3.11.1 - Tactile pavers shall be required at

pedestrian kerb crossings in accordance with *RTS 14 - Guidelines for facilities* for blind and vision impaired pedestrians. A flat footpath is regarded as having a 1 in 12 slope or less).

All tactile pavers shall have AS/NZS 4586:2004 Class V slip resistance. Tactile pavers shall be either Yellow UV Stabilised Thermoplastic Polyurethane Studs, 316 Marine Grade Stainless Steel Studs or Yellow ceramic tiles or tactile tiles as specified in Council's Approved Materials List. Where tactile tiles are used, an appropriate adhesive shall be used and agreed to by Council.

3.4.14.2 Asphaltic concrete

Asphaltic concrete footpaths and cycle paths shall be placed over not less than 100 mm of compacted basecourse after removal of all organic and soft subgrade. Asphaltic concrete shall be laid in a minimum layer thickness of 30 mm of mix M/10 material. Asphalt concrete paths shall not puddle water and shall be edged with either concrete or ground treated timber where abutting berms or other grassed areas.

3.4.14.3 Concrete pavers

Concrete pavers for footpaths shall be placed over not less than 100 mm of compacted basecourse 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.

3.4.14.4 Surface finish, tolerances

The surface finish should be determined in relation to the anticipated service conditions in accordance with NZS 3114. Reference to the type and frequency of loading, impact, abrasion, chemical resistance, and other factors such as hygiene, dust prevention, skid resistance and aesthetics where applicable shall be provided in the design.

3.4.15 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 2 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. Finished tolerances and standards shall satisfy the design standards.

3.4.16 Berms and landscaping

Berms shall be formed after all other construction has been completed. Grassed and planted areas shall have 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 topsoiling, 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 the TA.

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 the TA.

For additional requirements for swales see 3.3.19.5.

Any landscaping in the road reserve shall be in accordance with section 7 of this Code of Practice.

3.4.17 Surface finish and tolerances on kerbs, paths, and accessways,

3.4.17.1 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.

3.4.17.2 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.

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.

3.4.18 Cover for manholes and chambers, surface boxes for housing meters and valves

In trafficable areas, where strength, performance and stability are required, cover for manholes and chambers, surface boxes for housing meters and valves, should be in accordance with the council approved material lists.

3.4.19 Progress inspections

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

3.4.20 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 the TA.

3.4.21 As-built and completion documentation

On completion of construction, information and documents as required by the TA shall be provided by the developer's professional advisor. (See Schedule 1D for further information.) The information provided shall provide sufficient detail to enable the TAs to complete the road assessment and maintenance management database input.

4 STORMWATER

4.1 SCOPE

Where community specific guidelines are available these shall be taken into consideration throughout the design and construction of subdivisions and development. Where community specific considerations cannot be met, written acceptance of an alternative method shall be obtained from the Council.

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 and rainfall patterns 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.

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.

4.2 GENERAL

4.2.1 Objectives

The designer shall agree the approach to be taken for stormwater with the Property and Infrastructure Team of Council prior to commencing any work and may agree the approach prior to or when applying for resource consent.

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

The stormwater system shall include provision for:

(a) A level of service to the TA's customers in accordance with the authority's policies;

(b) Minimised adverse environmental and community impact;

(c) Protection from potential adverse effects to aquatic ecosystems;

(d) Compliance with environmental requirements;

(e) Adequate system capacity to service the fully developed catchment;

(f) Long service life with consideration of maintenance and life-cycle cost;

(g) Application of low impact design solutions;

(h) Climate change.

4.2.2 Legislation and guidance manuals

Referenced legislation is listed in the Referenced Documents section 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 Referenced Documents and Related Documents. They are non-statutory in themselves but may be required to be complied with under regional or district plan rules.

4.2.3 Local authorities' requirements

The requirements of relevant regional and district plans on stormwater shall be met. Regional plan requirements will generally be limited to effects of stormwater on the natural environment. The TA exercises control over infrastructure associated with land development and subdivision.

Authorisation will be required from the regional council for the discharge of stormwater unless the discharge is to an existing and consented stormwater system and meets any conditions which apply to the existing system. Other activities often associated with stormwater infrastructure which need to be authorised by the regional council include: the diversion of natural water during construction, the permanent diversion of natural water as a consequence of the development, activities in the bed or on the banks of a natural waterway, and damming waterways.

The discharge of clean stormwater and other activities where effects are considered minor may be authorised as a permitted activity subject to certain conditions in the regional plan. Authorisation may also be by way of a comprehensive consent held by the TA for a large area or entire catchment.

In other circumstances site specific discharge permits and water permits shall be obtained. Advice should be sought from the LAs at the earliest stage of planning for stormwater infrastructure and receiving waters.

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

C4.2.3

The division of responsibilities between TAs and regional councils is set out in the Resource Management Act.

4.2.4 Catchment management planning

Stormwater management planning should be carried out on a subcatchment 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 the LAs 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-construction are no greater than pre-development.

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

The designer shall be responsible for checking that the capacity of the downstream network is adequate for any proposed increase in discharge with the Council.

4.2.5 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 minimise 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.

4.2.6 System 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 will also be required.

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.

4.2.7 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 the TA 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 maintained. This is likely to be a requirement of any authorisation from the regional council.

4.2.8 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 TA will be required.

Stormwater treatment is to be included in stormwater systems that service off-road carparks that have 10 or more parking spaces. Justification for the stormwater treatment systems for the level of treatment should be provided to QLDC for approval.

4.2.9 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.

Rainfall design charts shall be adjusted to take into account the predicted increase in rainfall intensities from the effects of climate change.

C4.2.9

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.

'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.

4.3 DESIGN

4.3.1 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.

4.3.2 Structure plan

The TA may provide a structure plan setting out certain information to be used in design, such as flows, sizing, upstream controls, pipe layout, treatment, or mitigation requirements. Catchment management plans should 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 catchment management plan for the area, this Code of Practice, and any requirements of the TA, as appropriate.

4.3.3 Future development

Unless agreed in writing by the Council where further subdivision or development is allowed for within the current district plan upstream of the one under consideration the council shall require infrastructure to be constructed to the upper limits of the subdivision/development to allow for future connections.

The assessment of required capacity shall be on the basis of full development to the extent defined in the current district plan. Where infrastructure may service adjacent land then the full development to the extent defined in the current district plan of all the land that may be serviced by the infrastructure shall be included in the capacity calculations.

Where the new infrastructure being installed is required by Council to service future development then that infrastructure will be designed and constructed on the basis of full development to the extent defined in the current district plan.

The cost of increased infrastructure to service adjacent future development shall be agreed in writing with the Council's Strategy and Asset Planning Team prior to commencing work.

4.3.4 System design

4.3.4.1 Primary and Secondary Systems

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

A stormwater system consists of:

(a) A primary system designed to accommodate a specified design rainfall event; and

(b) A secondary system to ensure that the effects of stormwater run-off from events that exceed the capacity of the primary system are managed, including occasions when there are complete blockages of critical culverts and other critical structures in the primary system. The system designer shall identify all critical structures and components within the primary network and apply appropriate blockage factors. The approach taken to identify the critical structures and determine the blockage factors to be applied is to be confirmed with Council's Property and Infrastructure department.

The secondary system shall apply the following assumptions for primary piped network based on pipe size (d – diameter):

- d ≤ DN600, 100% blocked
- DN600 < d ≤ DN1050, 50% capacity reduction
- d > DN1050, 10% capacity reduction

The secondary system design shall apply the following assumptions to culverts based on culvert size (d - diameter or smaller side if rectangle):

- d < DN1500, 100% blocked
- d ≥ DN1500, 50% blocked, unless demonstrated by specific design to Council approval that a lower blockage factor can be applied

4.3.4.2 Secondary systems

Secondary systems shall consist of ponding areas and overland flow paths to manage excess run-off. Where possible, secondary systems shall be located on land that is, or is proposed to become public land. Where this is not possible or practical in the opinion of council, these may be located in private land. If located on private land, the secondary system shall be protected by legal easements in favour of the TA or by other encumbrances prohibiting earthworks, fences, or other structures, as appropriate.

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 in all events up to 1% AEP design storm event shall be limited to a 100 mm maximum height at the centre line, and roads shall be passable by pedestrians as defined by the flow depth x average velocity ($d_g V_{ave}$) specified below:

Lower likelihood	$d_g V_{ave}$ <0.6 m2/s
Higher likelihood	$d_g V_{ave}$ <0.4 m2/s

NOTE - A higher likelihood of pedestrians crossing the overland flowpath is provided where pedestrians are directed to, or most likely to cross water paths (such as marked crossings and corners of intersections).

d_g = flow depth in the channel adjacent to the kerb i.e. at the invert (m)

V_{ave} = average velocity of the flow (m/s)

Where the accessway to a dwelling is the only feasible pedestrian egress from a property to the adjoining road then if that access is being used as an overland flow path the flow depth x average velocity ($d_g V_{ave}$) for 1% AEP design storm shall meet the higher risk requirement outlined above. The feasibility of pedestrian egress shall consider those that have low mobility e.g. the elderly, children, etc.

The TA should be consulted to confirm design requirements.

C4.3.4.2

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.

4.3.5 Design criteria

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 the TA for either review or records or both.

The design shall accommodate all upstream catchments. (The catchment area shall be based on geographical and topographical boundaries and not development boundaries).

Discharge to an existing reticulated network, or other Council owned stormwater network, shall require consent/permission from the Council.

Discharge to be at a rate no greater than would have occurred for the pre-developed catchment during a 20% AEP rainfall event with no initial infiltration unless greater capacity in the downstream stormwater network can be proven through modelling or first principle hydraulic calculations. The designer shall undertake the necessary design and prepare design drawings compatible with the TA's design and performance parameters. Designers shall ensure the following aspects have been considered and where appropriate included in the design:

(a) The size of pipes, ponds, swales, wetlands, and other devices in the proposed stormwater management system;

(b) How the roading stormwater design is integrated into the overall stormwater system;

(c) The type and class of materials proposed to be used;

(d) System layouts and alignments including:

  (i) Route selection showing infrastructure to be vested located on Council Land only, unless specifically agreed with QLDC;

  (ii) Topographical and environmental aspects (see 5.3.4.3);

  (iii) Easements - The stormwater infrastructure shall be centrally located within the easement. Easements shall be provided for all storm water systems that are to be vested in Council or the system owner where they cross any private land. An easement shall be 3 m wide or to the full extent of the zone of influence, whichever is greater, or unless otherwise agreed by Council;

  (iv) Clearances from underground services and structures (see 5.3.7.10 and 5.3.7.11);

  (v) Provision for future extensions;

  (vi) Location of secondary flowpaths;

(e) Hydraulic adequacy (see 4.3.9.5); and

(f) Property service connection locations and sizes (see 4.3.11).

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

For catchments less than 10 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 New Zealand Building Code (NZBC) clause E1/VM1 provides guidance in the design of pipes, culverts, and open channel hydraulics.

4.3.5.1 Design Storms

Council has 3 primary objectives for stormwater quantity management. These are:

I. Preventing onsite flooding and frequent overland flows discharging from sites across adjacent properties;

II. Preventing the surcharge of downstream primary drainage network and flooding of downstream properties; and

III. Preventing downstream flooding and downstream overland flow path and receiving environment erosion.

4.3.5.1.1 Catchment assessment

QLDC defines 2 catchment types for hydrology and hydraulic assessment: 'simple' and 'complex'. A simple catchment is defined as:

- Less than 10ha;
- Homogeneous surface conditions; and
- Has no external catchment overland runoff onto the development.
- Does not discharge to a sensitive receiving environment.

A complex catchment is any catchment that does not meet all the definitions of a simple catchment above.

QLDC defines 2 development catchment states below:

- A pre-development catchment is defined as the natural state of the land immediately prior to human alteration, or an existing developed catchment as altered by approved earthworks or legally established works. Previously consented works are considered to be pre-development only if the site works were undertaken and approved as per the consented plans. Any changes or amendments will require approval from QLDC.A post-development catchment is defined as the maximum impervious area restricted by the District Plan or other legal instrument (e.g. resource consent, consent notice, etc.).

A catchment plan showing the full extent of all catchments and flow paths must be provided for all catchment areas used in runoff calculations. The catchment plan must include a scale and show overland flow paths and lengths.

4.3.5.1.2 Design Storms

All developments shall provide primary network drainage for the post-development 5% AEP peak flowrate from all contributing catchments.

When discharging to an existing primary drainage network with unknown drainage capacity or existing downstream capacity issues, the onsite primary drainage network discharge peak flow rate shall be as follows:

- For catchments with Tc ≤ 60 minutes, discharge to downstream shall be no greater than the 20% AEP pre-development peak flow rate for a 60 minute storm event
- For catchments with Tc > 60minutes, discharge to downstream shall be no greater than the 20% AEP pre-development peak flow rate

When discharging to new primary drainage network with known drainage capacity, the onsite primary drainage network downstream discharge post-development peak flow rate shall be no

greater than the 5% AEP pre-development peak flow rate unless otherwise approved by Council.

Overland flow downstream discharges of the 1% AEP post-development peak flowrate shall be no greater than the 1% AEP pre-development peak flow rate unless otherwise approved by Council.

When assessing the discharges, the following is required:

- Post-development (historical rainfall) to be compared with pre-development (historic rainfall) and shown to be no greater
- Post-development (climate change adjusted rainfall) to be compared with pre-development (climate change adjusted rainfall) and shown to be no greater

Further detail on the rainfall events is in Section 4.3.5.1.3.

All overland discharges and discharges to informal waterways must maintain downstream hydrological regimes for all storm events through onsite attenuation and multiple storm event outlet controls. The downstream flows must replicate pre-development hydrological regimes. If the pre-development hydrological regimes are not mimicked, it shall be justified to Council satisfaction why this can't be achieved and why the altered downstream discharge is acceptable.

For any discharges to a watercourse or other sensitive environmental receiver (either directly, or further downstream) a detention system must be provided to protect and mitigate erosion effects for more frequent rainfall events. The system for detention is to be designed to capture the difference between the pre-development and post-development runoff volumes for a 20 mm rainfall event, whilst incorporating full drain-down over a period of 24 hours.

4.3.5.1.3 Rainfall

Post-development catchment runoff calculations for the primary stormwater network must use HIRDS V4 RCP 6.0 for 2081-2100 rainfall intensities and depths at a minimum.

Post-development catchment runoff calculations for the secondary stormwater network must use HIRDS V4 RCP 8.5 for 2081-2100 rainfall intensities and depths.

Pre-development catchment runoff calculations must use HIRDS V4 historical rainfall intensities and depths.

4.3.5.1.4 Runoff

For instantaneous peak flow calculations, the standard Rational Method calculations can be used (i.e. C.I.A.).

For sizing and design of a stormwater infrastructure with storage components (i.e., soakage or attenuation systems), software modelling must be used with a 24-hour Nested Storm Hyetograph created for the design storms in Section 4.3.5.1.2. However, the following exceptions to this can be applied:

- For catchments consisting of 100% roof areas, the E1VM1 Method for stormwater infrastructure with storage components can be used.
- For simple catchments with a time of concentration ≤ 10mins (pre-development and post-development) a Rational excess rainfall hyetograph and a triangular unit hydrograph with the time to peak equal to the 3/4 the time of concentration and base time equal to the 2 times the peak time can be used.

When undertaking Rational Method calculations, the time of concentration for catchments must be calculated using the Horton Method with the Equal-Areas Method used to determine catchment slope. Horton roughness coefficients in Table 4-1 should be used

Table 4-1: Horton n values for different surface conditions.

Surface condition	Horton's n value
Paved surface	0.012
Bare soil surface	0.020
Grassed surface	0.025
Tussock grassland	0.035
Forests	0.050

When undertaking Rational Method calculations, the Rational runoff coefficients provided in Table 4-2 should be used.

Table 4-2: Rational runoff Coefficients.

Land Type and Slope	Soil permeability		
	High	Medium	Low
Forests			
Flat (0–2%)	0.10	0.20	0.30
Rolling (2–10%)	0.10	0.30	0.40
Hilly (10–30%)	0.20	0.40	0.50
Tussock grassland			
Flat (0–2%)	0.15	0.30	0.40
Rolling (2–10%)	0.20	0.40	0.50
Hilly (10–30%)	0.30	0.50	0.60
Pastural (and brownfield development)			
Flat (0–2%)	0.20	0.40	0.50
Rolling (2–10%)	0.30	0.50	0.60
Hilly (10–30%)	0.40	0.60	0.70

Table 4-3: Soil Permeability Range (mm/hour)

High	Medium	Low
>50	5 – 50	<5

All complex catchment modelling must follow a well-established stormwater hydrology, hydraulic and modelling methods. All complex catchment modelling that deviates in any way from the method provided in the Code above must be preapproved by Council and modelling results will require verification by a Council approved independent review prior to acceptance by Council.

A complete copy of all stormwater models shall be provided to Council at no charge if requested. All underlying assumptions (such as catchment areas, time of concentration and losses, etc.) shall be clearly stated so that a comprehensive review of calculations and results is possible. Applicants should provide access to a PC with modelling licence and the stormwater model if needed.

4.3.5.2 Freeboard

The minimum freeboard height additional to the computed top water flood level of the 1% AEP design storm should be as follows or as specified in the district or regional plan:

Freeboard	**Minimum height**	
Habitable dwellings (including attached garages)	0.5	m
Commercial and industrial buildings	0.3	m
Non-habitable residential buildings and detached garages	0.2 m	

Inset section about 1% AEP – also check Tauranga guidance

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.

Enclosed carparks do not require freeboard, however, where they are basement carparks measure shall be taken to avoid external overland flows being directed into the carpark.

For structural designs related to a Building Consent, the freeboard requirements of the Building Code shall apply.

4.3.5.3 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 inTable 4-4. The Colebrook-White and Manning formulae can be found in *Metrication: Hydraulic data and formulae* (Lamont). Manufacturers' specifications should also be referred to.

C4.3.5.3

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 emphasises 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 4-4: Guide to roughness coefficients for gravity stormwater pipes concentrically jointed and clean

Description	**Colebrook-White coefficient k** (mm)	**Manning roughness coefficient** (n)
Circular pipes		
PVC	0.003 – 0.015	0.008 – 0.009
PE	0.003 – 0.015	0.008 – 0.009
Vitreous clay	0.15 – 0.6	0.010 – 0.013
Concrete – machine made to AS/NZS 4058	0.03 – 0.15	0.009 – 0.012
Corrugated metal	–	0.012 – 0.024
GRP (glass reinforced plastic)	0.003 – 0.015	0.008 – 0.009
Culverts		
Concrete pre-cast (pipes and boxes)	0.6	0.016
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 AS 2200 table 2 and notes, and *Metrication: Hydraulic data and formulae* (Lamont).		

4.3.5.4 Energy loss through structures

Energy loss is expressed as velocity head:

Energy loss $H_e = kV^2/2g$

Where:

k is the entrance loss coefficient and V is velocity.

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 4 5.

4.3.5.5 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 MHs and other nodes, water levels computed at design flow shall not exceed finished ground level while allowing existing and future connections to function satisfactorily.

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 (h1).

This can be represented as:

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

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 4-5 for loss coefficients).

Table 4-5: 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

4.3.6 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.

4.3.7 Water Quality Management

All new commercial or industrial developments, >2000 AADT roads and >10 car carparks must provide onsite stormwater quality treatment to meet the objectives of the QLDC Integrated Three Waters Bylaw 2020: Part C – Stormwater.

A Stormwater Quality Management Plan (SQMP) showing how stormwater discharges will be managed must be prepared by a SQEP and approved by QLDC.

A SQMP must identify and clearly address:

- The stormwater management approach applied;
- Areas of development, including roads and reserves;
- Location of vested infrastructure, including green infrastructure;
- Areas of on-site and public stormwater management;
- Significant site features, hydrology and receiving environments;
- Minimise the generation and discharge of contaminants (including gross Stormwater pollutants such as litter, plastics and other coarse material that may become entrained in stormwater flows) and stormwater flows at source;
- Opportunities to minimise stormwater discharge quality related effects of the development;
- Minimise temperature related effects;
- Enhance freshwater systems including streams and riparian margins;
- Minimise the location of engineered structures in streams;
- Protect the values of Significant Ecological Areas as identified in the District Plan;

4.3.7.1 Water quality design objectives

QLDC requires that a Best Practicable Options (BPO) approach is undertaken when incorporating and designing stormwater quality management devices.

Best Practicable Option is defined in the RMA in relation to stormwater discharges as being the best method for preventing or minimising the adverse effects on the environment having regard, among other things, to

(a) the nature of the discharge or emission and the sensitivity of the receiving environment to adverse effects; and

(b) the financial implications, and the effects on the environment, of that option when compared with other options; and

(c) the current state of technical knowledge and the likelihood that the option can be successfully applied

At Councils discretion and unless it can be shown not possible, Stormwater quality management devices should treat the first 20mm of rainfall from the Post-development catchment and should attempt to direct a minimum 5mm rainfall to ground through soakage.The final design of all stormwater quality management systems/devices to be vested with Council must meet all the design requirements of the LDSCoP and referenced national guidelines. Design exceptions will require prior approval from Council.

The developer must enter into a Stormwater Developer Agreement (DA) with QLDC to ensure the stormwater quality system operates effectively and is maintainable prior to vesting with QLDC.

4.3.7.2 Water quality monitoring

Following the completion of all development works and commencement of full operation of the stormwater quality management device(s), visual discharge and sediment retention inspections will be undertaken and recorded by the developer for a period of no less than 2 years or as set out in the Stormwater DA.

4.3.7.3 Proprietary systems

Unless specified in the LDCSoP approved materials specification, proprietary BPO systems will be accepted by QLDC on the provision of third-party performance verification and prior approval from QLDC Operations and Maintenance.

4.3.7.4 Low impact design

Low impact design 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, minimising site disturbance, and avoiding discharge of contaminants. Stormwater should be managed as close to the point of origin as possible to minimise 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 secondary flow paths, land requirements, and provision for effective operation and maintenance.

C4.3.7

Useful guidance on low impact design practices can be found in the following Auckland Council GD01 "Stormwater Management Devices", and GD04 "Water Sensitive Design for Stormwater".

Additional guides that may be useful are listed in Referenced Documents and Related Documents.

The Council's preferred method of stormwater control is a low impact design solution. The designer shall gain written approval from the Council's Strategy and Asset Planning Team that the proposed maintenance requirements are acceptable prior to submitting a design for acceptance and demonstrate how amenity will be improved by considering how pedestrian infrastructure interacts with the design.

Notwithstanding a treatment train approach, QLDC require centralised end of line LID systems unless topographical constraints or other reasoning acceptable to council preclude this.

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

(a) Reducing peak flow discharges by flow attenuation;

(b) Eliminating or reducing discharges by infiltration or soakage;

(c) Improving water quality by filtration;

(d) Installing detention devices for beneficial reuse.

4.3.7.5 Low impact design process

Key design considerations include:

(a) 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;

(b) 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;

(c) 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. The use of Low Impact Design Considerations shall include a process to provide the most appropriate asset / facility in the long term and its effectiveness shall be demonstrated to the TA. 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;

(d) 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:

(i) Access

(ii) Vegetation

(iii) Mulch

(iv) Sediment

(v) Mechanical components

(vi) Vandalism and safety.

LID systems that are to be vested to Council shall be located in an area where they can be accessed and maintained without a Traffic Managment Plan (TMP) being required unless shown absolutely necessary through P&I O&M acceptance.

4.3.7.6 Low impact design devices

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

(a) Detention system;

(b) Wetlands;

(c) Vegetated swales;

(d) Rain gardens;

(e) Rainwater tanks;

(f) Soakage pits and soak holes;

(g) Filter strips;

(h) Infiltration trenches/basins;

(i) Permeable paving;

(j) Green roofs;

4.3.7.7 (k) Tree pits.Detention ponds

Detention ponds shall only be used with prior approval from the Council.

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' or 'wet' type and can be 'on-line' or 'off-line'. The type of pond required should be discussed with the TA at an early stage.

Specific matters to be considered in pond design include:

(a) Side slope stability;

(b) Shallow ledges or batters for safety;

(c) Ease of access and maintenance including mowing and silt clean out;

(d) Shape and contour for amenity and habitat value;

(e) Effectiveness of inlet and outlet structures;

(f) Overflow design and scour protection;

(g) Fish passage;

(h) Pest control (for example mosquitoes and blue-green algae);

(i) Species to be planted;

(j) Potential effect on downstream aquatic ecology and habitat;

(k) Maintenance requirements.

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

4.3.7.8 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:

(a) Catchment area greater than 1 ha;

(b) Size calculated to achieve water quality volume;

(c) Forebay to capture coarse sediments;

(d) Depth not to exceed 1 m;

(e) Sufficient hydraulic capacity for flood flows;

(f) Sufficient detention time for sediment retention;

(g) Species to be planted.

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

4.3.7.9 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:

(a) Catchment area not greater than 4 ha;

(b) Longitudinal slope 1% – 5%;

(c) Slopes flatter than 1% may require underdrains;

(d) Slopes greater than 5% may require check dams to reduce effective gradient to less than 5%;

(e) Capacity for a 5% AEP event;

(f) Velocity not greater than 1.5 m/s in a 10% AEP event unless erosion protection is provided;

(g) Grass length 50 mm – 100 mm;

(h) Species to be planted.

An option for swales with very flat longitudinal slopes and high water tables is a wetland swale.

Where the swale is adjacent to a road then the safety concerns with regard to check dams shall be taken into consideration.

Typical details that may be used in swale design are shown in figures 3.6(A), 3.6(B), and 3.6(C).

4.3.7.10 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:

(a) Entry and overflow positions to restrict short circuiting;

(b) Geotextile on side walls if required;

(c) An underdrain with a minimum of 50 mm gravel cover;

(d) Pavement design in vicinity of device;

(e) Soil composition;

(f) A ponding area;

(g) Species to be planted;

(h) Access for maintenance.

4.3.7.11 Rainwater tanks

All potable use rainwater tanks are to be approved by the Council.

Rainwater tanks can be designed to harvest water for non-potable uses such as toilet flushing and watering the garden. This can significantly reduce the demand on the potable water supply from the TA. Where required by the TA 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:

(a) Capacity: Typically 2,000 L – 5,000 L for domestic reuse and 6,000 L – 9,000 L for dual reuse and attenuation;

(b) Primary screening to keep out leaves and other coarse debris;

(c) First-flush diverters to collect first 0.4 mm for slow release to ground through a small chamber;

(d) Backflow prevention;

(e) Low level mains top-up valve;

(f) Overflow outlet;

(g) Gravity or pumped;

(h) Tight-fitting cover;

(i) Cool location;

(j) Aesthetics and convenience.

4.3.7.12 Soakage device design

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 where conventional pit and pipe infrastructure is unavailable or unfeasible.

4.3.7.12.1 Applicants design capability

All soakage devices with Consequence level 3 or 4 (as defined in Section 4.3.7.10 must be designed by a SQEP.

4.3.7.12.2 Design storm event

All soakage devices must provide a minimum design capacity (stormwater discharge and storage) for the post development runoff (peak flow and volume) for the 5% AEP critical storm event as determined by Section 4.3.5.1.

All inlet and internal pipework and air vents must provide flow capacity for the 5% AEP storm event peak flow.

4.3.7.12.3 Draindown

All soakage devices must have a draindown period (to empty) of 24 hours from the start of the soakage devices design discharge storm event. This requirement is to ensure that soakage devices have capacity for a back-to-back design storm events.

4.3.7.12.4 Area of soakage

The soakage devices design area of soakage must be calculated as the base area + ½ the side area of the soakage device.

4.3.7.12.5 Secondary Flow paths

Secondary flow paths must be provided for soakage device overflows for storm events greater than the soakage devices design discharge storm event.

Where secondary flow paths cannot be provided, the soakage device must provide capacity (soakage and storage) for all storm events up to the 1% AEP.

Ponding above soakage devices is acceptable with specific design considerations to manage above ground storage. Ponding above soakage devices within road corridors will not be accepted by Council.

4.3.7.12.6 Freeboard

A 300mm freeboard must be provided from the soakage devices design storm event TWL to the lowest invert of the upstream infrastructure outlet.

4.3.7.12.7 Location of soakage devices

Soakage devices should not be located close to buildings, retaining walls or ground slopes in a manner that the ground below the foundations, structure or land is likely to be adversely affected. Soakage devices shall be located so that the zone of influence is clear (45° outwards above the outside lower edges of soak

pit), or 5 m; whichever is greater. Deep-bored soakage devices may require greater distances and specialist advice will be required for installing these types of soakage devices. Exemption from providing specialist advice may be granted by the Council at its sole discretion.

Soakage pits on individual lots must provide an Operation and Maintenance manual with body corporate agreement to maintain the soakage pit in perpetuity

4.3.7.12.8 Geotechnical investigations

Council may require a geotechnical assessment to be carried out by an appropriately qualified geo-professional to determine the suitability of soil and groundwater characteristics for any proposed soakage device prior to soakage testing.

4.3.7.12.9 Pre-treatment

Soakage devices at risk of sediment ingress from the contributing catchment should be provided with pre-treatment devices or the designs Factor of Safety adjusted accordingly.

All soakage devices to be vested with Council must provide design elements compliant with the Appendix B Drawing B4-4. The minimum pre-treatment for any soakage device to be vested with Council must include:

- An inlet side manhole with a minimum 800mm sump level to the soakage devices inlet pipe.
- A removable 160mm draincoil pipe in a filter cloth sleeve.
- A filter cloth or impervious matting over the top and around the sides of the soak-pit.

Additional pre-treatment may be provided through filter strips, vegetated swales, infiltration trenches/basins, catch-pit manholes, Gross Pollutant Traps (GPTs) or other devices using guidance provided in Section 4.3.7.

4.3.7.12.10 Factor of Safety (FoS).

A risk-based design is required by Council for all soakage devices. This ensures design unknowns are considered and factored into the design of all soakage devices so that the intended functionality and design life of the soakage device is achieved.

There are many uncertainties in the design process, not least the assumed unfactored soil infiltration rate. Unfactored soil infiltration rates may change significantly over time and can vary by orders of magnitude. In addition, failure consequences vary depending upon the device's design and location. To account for these issues a factor of safety that reduces observed unfactored soil infiltration rates needs to be introduced into the design process. When choosing an appropriate factor of safety, engineering judgement, depending upon the consequences of failure and subsequent design uncertainties, is needed. Key risks that are addressed with the factor of safety are:

- Insufficient confidence in input data, e.g., soakage testing
- Insufficient pre-treatment of stormwater inflow into the device
- Difficult access to the proposed device for maintenance
- Frequency of maintenance of proposed device is likely to be low.

The observed unfactored soil infiltration rate used in the design process should be divided by the safety factor. The safety factor is generated by multiplying together two partial factors. These are:

- A factor for the consequences of failure, and
- A factor to account for uncertainty in input data.

Equation 1 should be used to calculate the required Factor of Safety ($F_{(total)}$):

Equation 1 $F_{(total)} = F_{(c)} \times F_{(u)}$

Where:

$F_{(total)}$ *= Total combined Factor of Safety to be applied*

$F_{(c)}$ *= Factor of Safety representing the consequences of failure from Table 4-6*

$F_{(u)}$ *= Factor of Safety representing testing uncertainty from Table 4-7*

Equation 2 should be used to calculate the factored soil infiltration rate (K):

Equation 2 $K = k \times F_{(total)}$

Where:

k *= unfactored soil infiltration rate (from Section 4.3.7.12.)*

Table 4-6, which has been adapted and modified from the *CIRIA SuDS Manual C753* (Woods Ballard, et al., 2015), shows suggested safety factors for the consequences of failure. Note that the figures are not based on actual observation of performance loss. Table 4-7 shows suggested safety factors for the uncertainty in input data.

Table 4-6: Suggested partial factor of safety (F_c) for consequences of failure.

Device	**Consequences of failure (see table notes for definitions of Consequence Levels)**			
	Consequence Level 1	**Consequence Level 2**	**Consequence Level 3**	**Consequence Level 4**
Soakpit	1.0	1.5	2.5	5.0
LID device	1.0	1.5	2.5	5.0
Rockbore	1.0	1.5	2.5	5.0

Consequence Level 1: The secondary flow path complies with Section 4.3.7.and all of the following apply:

- Pre-treatment will be present
- Access for maintenance will be easy, frequency of maintenance will be high, and a maintenance plan will be implemented.

Consequence Level 2: The secondary flow path complies with Section 4.3.7 and one or more of the following applies:

- Pre-treatment will be present
- Access for maintenance will be easy, frequency of maintenance will be high, and a maintenance plan will be implemented.

Consequence Level 3: The secondary flow path does not meet Section 4.3.7 but will only cause minor damage to external areas, or non-habitable floor flooding (e.g., surface water on car parking), and one or more of the below points applies:

- Pre-treatment will be present

- Access for maintenance will be easy, frequency of maintenance will be high, and a maintenance plan will be implemented.

Consequence Level 4: Any other scenario, including all situations where the secondary flow path is likely to cause damage to buildings or structures, or major flooding of roads.

Table 4-7: Suggested partial factor of (F_u) for uncertainty in input data.

Testing situation	Testing quality (see table notes for definitions of Quality Levels)			
	Quality Level 1	Quality Level 2	Quality Level 3	Quality Level 4
Falling head test in soil	1.2	1.4	1.8	2.4
Constant head test in soil	1.0	1.2	1.5	2.0
Rockbore test	1.0	1.2	1.5	2.0

Quality Level 1: All of the following apply:

- Test undertaken at the location and depth of the proposed device
- Test undertaken at a time when groundwater is at an annual high. For rock bores, this must be after heavy rain at a time when the rainfall-induced groundwater level peak is likely to be present
- Groundwater monitoring with a duration of over 12 months and measurements taken in winter and summer is available within 100 m of the proposed device. For rock bore tests, this must include monitoring at short intervals (1 hour or less) to identify short-term response to heavy rainfall.
- No groundwater found at the location of proposed soakpit.

Quality Level 2: All of the following apply:

- Test undertaken at the location and depth of the proposed device
- Test undertaken at a time when groundwater is likely to be at an annual high. For rock bores, this must be after heavy rain at a time when the rainfall-induced groundwater level peak is likely to be present.

Quality Level 3: One of the following apply:

- Test undertaken at the location and depth of the proposed device, but at a time of year when the groundwater may be lower than the seasonal high
- Test undertaken at a time when groundwater is likely to be at an annual high, but not at the exact device location. For this to apply, the test must be in a location where the geological and hydrogeological conditions are expected to be the same as the actual proposed device location, and no more than 10 m (horizontally) and 1 m (vertically) from the actual proposed device location.

Quality Level 4: Any other scenario. The designer will still have to demonstrate that the testing is representative of the proposed device location.

4.3.7.12.11 Maintenance requirements

All soakage devices to be vested with council must provide the following maintenance functionality to allow:

- Observation of water level,
- Observation of sediment build-up,
- Removal of sediment build up in the distribution pipework or base of the soakage device.

4.3.7.12.12 Soakage Testing

All unfactored soil infiltration rates in testing and design calculations should be presented in L/hr/m^2 units.

If the unfactored soil infiltration rate is found to be less than 50 l/hr/m^2, testing must be completed by a representative of an IANZ certified laboratory. Where testing shows an unfactored soil infiltration rate of less than 25 l/hr/m^2, soakage is not appropriate and will not be accepted by Council as a stormwater disposal option.

A maximum unfactored soil infiltration rate of 2000 L/hr/m^2 will be accepted by Council.

Soakage tested must be undertaken prior to the design of soakage devices and must be confirmed after earthworks are completed on site.

Results of soakage tests may be affected by seasonal factors. In the winter and spring, the soil moisture and groundwater level will be higher in the summer. Testing under a worst-case basis should be undertaken or an appropriate FoS applied to test results.

The lowest soakage test unfactored soil infiltration rate value of three soakpit test results shall be used for the unfactored soakpit infiltration rate.

Permission from Council should be obtained for use of a fire hydrant. The use of a fire hydrant is only appropriate where the unfactored soil infiltration rate is less than the maximum flow rate provided by the hydrant (usually 20 L/s). Water trucks should be used when it is necessary to prove higher flow rates than available with a hydrant.

4.3.7.12.13 Soakage testing method requirements.

(i) Water levels shall be recorded from a static reference height at all times.

(ii) At least one borehole or soakage test pit is required for every soakage device and the location of the borehole or soakage test pit must be within 10m of the position of a proposed soakage device. Greater distances and multiple soakage devices may be approved for a borehole or soakage test pit by exception by Council provided a Geotechnical report clearly shows consistent ground conditions across all proposed soakage devices.

(iii) Soakage tests shall be performed to the desired depth of the proposed soakage device

(iv) Geological layers and soil types should be recorded in bore logs in accordance with New Zealand Geotechnical Society guidelines.

(v) Water table levels must be recorded, preferably via a piezometer. If no piezometer has been installed, the bore or pit should be left open until the groundwater level has stabilised and recorded.

(vi) Soakage tests positioned within 10 m of each other should be tested simultaneously to ensure that the effect of interference is accounted for.

(vii) Unless otherwise noted in a Council prescribed test methodology, all boreholes or soakage test pits in soil should be pre-soaked prior to testing until a constant infiltration result is achieved to simulate conditions during prolonged wet periods and heavy rainfall.

4.3.7.12.14 Soakage tests in **Coarse grained soils** (Soils whose individual grains are retained on a No. 200 / 0.075 mm sieve).

(i) A soakage test pit should be excavated to the bottom level of the proposed soakage device with a minimum base area of $1m^2$.

(ii) The soakage test pit should be to the same depth anticipated for the full-size soakage device. For run-off from $100m^2$ catchment areas this will typically be 1m to 1.5m below the invert level of the drain discharging to the soakage device. For catchment areas greater than $100m^2$ soakage device depths are typically 1.5m to 2.5m.

(iii) The walls of the soakage test pit should be laid back at a suitable angle to prevent caving in and erosion during the test

(iv) All soakage test pits should be pre-soaked prior to testing until a constant infiltration result is achieved to simulate conditions during prolonged wet periods and heavy rainfall. Testing should be continued until the drop in water level becomes "constant" across three consecutive readings, or until the last drop in level differs by less than 10% of the preceding drop (as per NZS1547 (Standards New Zealand, 2012). This will normally provide adequate time for the soils surrounding the hole to become saturated, and for any soils to swell to ensure that any cavities are filled before the testing begins

(v) Soakage testing of coarse grained soils must be undertaken by excavating a soakage test pit to the same depth as anticipated for the full-size soakage device

(vi) The unfactored soil infiltration rate shall be calculated from the time taken for the water level to fall from 75% to 25% of the effective storage depth in the soakage test pit using Equation 3.

Equation 3: $$k = \frac{V_{p75-25}}{a_{s50} \times t_{p75-25}}$$

Where:

k = unfactored soil infiltration rate

V_{p75-25} = the effective storage volume of water in the soakage test pit between 75% and 25% effective storage depth.

a_{s50} = the internal surface area of the soakage test pit up to 50% effective storage depth and including the base area.

t_{p75-25} = the time for the water level to fall from 75% to 25% effective storage depth.

4.3.7.12.15 Soakage tests in **fine grained soils** (50% or more material passing the No. 200 / 0.075 mm sieve) **and rock.**

(i) All soakage testing of fine-grained soils or rock must be undertaken using the Constant Head Test (Talsma-Hallam permeameter) prescribed in Auckland Councils GD07 guideline, Appendix A1.5.

(ii) Boreholes in soil should be between 100 mm to 150 mm in diameter

(iii) Remove all loose materials and smeared clays from the sides of the hole to provide a natural soil interface through which water can infiltrate

(iv) If collapse of a drilled hole seems likely, a perforated PVC pipe should be used to case and hold it open. If scouring of a soakage test pit seems likely, about 50 mm of sand or fine gravel should be added to the pit to protect the bottom from scouring or sediment blinding

(v) If collapse of a drilled hole seems likely, a perforated PVC pipe or equivalent should be used to case and hold it open.

(vi) All boreholes or soakage test pits in soil should be pre-soaked prior to testing until a constant infiltration result is achieved to simulate conditions during prolonged wet periods and heavy rainfall.

(vii) Testing should be continued until the drop in water level becomes "constant" across three consecutive readings, or until the last drop in level differs by less than 10% of the preceding drop (as per NZS1547 (Standards New Zealand, 2012). This will normally provide adequate time for the soils surrounding the hole to become saturated, and for any soils to swell to ensure that any cavities are filled before the testing begins.

(viii) The unfactored soil infiltration rate shall be calculated as the gradient of the last two readings of the recorded water level over time using Equation 4:

Equation 4: $$k = \frac{D \times test\ gradient \times 1000}{4 \times d}$$

Where:

k = unfactored soil infiltration rate

D = auger borehole diameter

d = distance between the midpoint of the last two readings and the base of the borehole

4.3.8 Natural and constructed waterways

Enhancement of watercourses is to be considered as part of a development, where appropriate. Enhancement may include, but is not limited to, the following:

a) Watercourse rehabilitation:

(i) Providing riparian margins and landscaping that takes into account ecological values as well as flood risk issues.

(ii) Protection against scour and erosion of the watercourse

(iii) Removing obstacles for free fish passage

(iv) Restoring ripples and runs to provide habitat and mimic natural conditions

(v) Weed removal.

b) Watercourse day-lighting: In line with the TA's integrated stormwater management principles, where practicable, the TA may prefer the conversion of existing culverted watercourses to its natural pre-development status. Where such opportunities are identified, the developer shall discuss and agree such options and associated details with the TA on a case-by-case basis.

Where waterways are to be incorporated in the stormwater system, they shall be located within a reserve of sufficient width to contain the full design storm flow with a minimum freeboard of 500 mm.

Grass berms in reserves shall have a maximum side slope of 1 in 5 and additionally include a vehicular access berm 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 7.2.4).

All channel infrastructure shall include protection against scour and erosion of the stream banks and stream bed.

If the watercourse is to be in private property and be maintained by the TA it shall be protected by an easement.

4.3.9 Pipelines and culverts

4.3.9.1 Location and alignment of public mains

The preferred location of public mains shall be within the road reserve or within other public land.

In greenfield developments, the stormwater pipes shall always be located below the water pipes and above the wastewater pipes. For infill developments, a stormwater line may only be permitted to cross under a wastewater pipe if no other suitable option is available. In this instance, no sewer PVC joins are permitted within 1m of the stormwater pipe, and the sewer PVC shall be encased in PE at least 200mm beyond each join.

Where required by the TA 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 5.3.7.6 and 5.3.7.7 for further guidance on curved alignments for stormwater pipelines.

4.3.9.2 Materials

All pipes shall be PE100, PVC (minimum class SN8) or rubber ring joint reinforced concrete and meet the relevant standards as listed in Table A1 of NZS4404:2010. Unless otherwise agreed in writing by the Council. Acceptance of design documentation without separate written approval shall not constitute acceptance of an alternative material.

For materials for which there is no New Zealand or Australian Standard the specific approval of the TA is required.

4.3.9.3 Minimum pipe sizes

Minimum pipe sizes for public mains and sump leads unless otherwise specified shall be:

Single sump with single outlet	– 200 mm internal diameter
Public mains	– 200 mm internal diameter where only taking house leads – 300 mm internal diameter for all other mains and double sump leads with single outlets.

4.3.9.4 Minimum cover

Where the TA does not have specific requirements, the minimum covers as described in AS/NZS 2566.2 (for buried flexible pipelines) or AS/NZS 3725 (for buried concrete pipes) may be used.

Within carriageways, trafficable footpaths, and crossings, stormwater mains are to have a minimum of 1.0 m cover unless structural calculations to the appropriate standards have been provided and approved by Council. Laterals and sump leads can have the cover reduced to 0.6 m within these areas. Cover outside of the carriageway, footpaths, crossings or other trafficable areas shall be no less than 0.6m.

Where cover is reduced from requirements above, pipe loading capacity shall first be checked as per AS/NZS 2566.1 requirements to determine if concrete capping or encasing is required. If pipe loading capacity is acceptable, justification is to be submitted to QLDC for approval of reduced cover. If pipe loading capacity is exceeded, concrete capping or encasing is required as per Appendix B Drawing B4-2.

4.3.9.5 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 0.6 m/s at a flow of half the 50% AEP design flow. For velocities greater than 3.0 m/s see 5.3.5.6.

4.3.9.6 Culverts

In designing culverts the effects of inlet and tailwater controls shall be considered.

Culverts under fills shall be of suitable capacity to cope with the 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.

The culverts to be marked and recorded are those which transport stormwater or natural water from a "normal water course" from one side of the road to the other. They do not include the urban drainage system, such as pipes leading from sumps to collector systems. Culverts shall have green culvert edge marker posts located on either end of the culvert where the culvert crosses a road.

Culverts shall be numbered consecutively within a road . Additional culverts placed later shall be decimalised, e.g. 6.1, 6.2, etc. These numbers should be included against the appropriate assets on the asbuilts and RAMM update sheet submitted to Council.

Refer to the NZTA *Bridge manual* for waterway design at bridges and culverts.

For roads with speeds greater than 60 km/hr and where the culvert diameter is 300mm or greater, the clear zone requirements defined in Austroads Guide to Road Design - Part 06 apply, and if these cannot be achieved, then a mountable or traversable culvert may be necessary and the final decision is at the discretion of Council.

Cross drainage structures require traversable grates and parallel (to the road) drainage structures require mountable grates. Examples of mountable and traversable grates for culverts are shown in Appendix B Drawing B5-15 and B5-16.

Screens or grates are not permitted on any culvert outlet (with the exception of traversable culverts), any culvert outlet that is greater than 300 mm dia. shall have a "Danger Do Not Enter" sign installed at the outlet.

4.3.9.7 Inlets and outlets

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 2m/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.

Direct discharge to a waterway or the sea may require a discharge consent from the regional council unless authorised by a comprehensive consent held by the TA, or is a permitted activity in a regional plan.

4.3.9.8 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:

(a) Determine the time of concentration and set the design rainfall event for the smaller system;

(b) Determine the peak flow for the design event;

(c) Determine receiving waterway peak water level for the design rainfall event in (a);

(d) Starting with the level from (c) determine the smaller system profile at a flow of 75% of the flow from (b);

(e) Determine the receiving waterway mean annual flood water level;

(f) Starting with the level from (e) determine the smaller system water profile at the flow from (b);

(g) 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.

4.3.9.9 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 NZTA specification F/2 and NZTA F/2 notes. It is good practice to provide regular inspection points.

Bedding and backfill material around a subsoil drain pipe 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.

Connection of subsoil drains to collection sumps are to be positioned such that the invert of the subsoil drain is above the soffit of the sump's outlet pipe.

In the absence of any other more appropriate criterion the design flow for subsoil systems shall be based on a standard of 1 mm/h (2.78 L/s/ha).

Refer to manufacturer's literature for information on pipe materials, filter fabrics, bedding, and filter design.

4.3.9.10 Bulkheads for pipes on steep grades

Bulkheads, or anti-scour blocks, shall be detailed on the design drawings. Spacing of bulkheads shall be:

Table 4-8: Spacing of bulkheads for pipes on steep grades

Grade (%)	Requirement	Spacing (S) (m)
15 – 35	Concrete bulkhead	S = 100/Grade (%)
>35	Special design	Refer to TA
NOTE – On grades flatter than above where scour is a problem, sand bags may be used to stabilise the trench backfill.		

4.3.9.11 Trenchless technology

See 5.3.6.8 and 5.3.6.9 for guidance on the use of trenchless technology.

4.3.10 Manholes

4.3.10.1 Standard manholes

Access chambers or 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 100 m unless approved otherwise. They shall be easily accessible and located clear of any boundary. All public mains shall terminate with a MH at the upstream end.

See 5.3.8.2 and 5.3.8.3 of this Code of Practice 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 the TA.

Appendix B drawings B1-5, B1-6, B1-7, and B1-8 for manholes may be adopted for stormwater systems.

Materials used for the construction of manholes to be agreed by with the TA.

4.3.10.2 Manhole materials

MH material selection shall be in accordance with the Approved Materials List for 3 Waters. MH materials selected shall be suitable for the level of aggressiveness of the surrounding groundwater.

4.3.10.3 Size of manholes

The standard internal diameter of circular MHs is 1050 mm and preferred nominal internal diameters are 1050 mm, 1200 mm, and 1500 mm.

When considering the appropriate MH 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 the TA on the layout of the chamber is recommended. Any MH with 3 or more inlets is required to be a minimum of 1200mm diameter, and comply with requirements as per Appendix B Drawing B1-5.

The base layout of MHs shall comply with 5.3.8.4.2 of this Code of Practice.

4.3.10.4 Shallow manholes (or mini manholes)

The minimum internal diameter of a manhole shall be 600 mm.

4.3.10.5 Deep manholes

The use of deep manholes should be avoided through design where practical. Where manholes deeper than 4m depth are unavoidable specific design and Council approval will be required. Generally landing platforms are to be fitted for manholes greater than 6m in depth, unless appropriate maintenance provisions can be otherwise demonstrated. Where platforms are necessary the manhole diameter shall be a minimum of 1500mm diameter to allow for the minimum clearance for safe access.

Landing platforms are to be constructed from corrosion resistant materials (stainless steel grade 316 or approved alternative), and are to be positioned to optimise maintenance access for internal manhole features such as internal drop structures. Platforms should be located mid-depth where possible, and are not to be located within 2m of the top or bottom of the manhole to preserve appropriate working heights in these zones. The platform shall include a hinged hatch to allow access to the lower section of the manhole, and the platform opening must align with the external manhole opening.

4.3.10.6 Hydraulic flow in manholes

In addition to the normal pipeline gradient all MHs on pipelines less than 1000 mm diameter shall have a minimum drop of 30 mm within the MH to compensate for the energy loss due to the flow through the MH. See 5.3.8.4.4 and 5.3.8.4.5 for further guidance.

4.3.10.7 Manhole connections

Open cascade is permitted into MHs over 2.0 m in depth and for pipes up to and including 300 mm diameter providing the steps are clear of any cascade. Other situations may be considered and require TA 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 mortar 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 90° to the main pipeline direction of inflow.

Minor pipelines connecting at above design water level may do so at any angle.

The connection of PVC pipes to concrete structures, such as manholes will be with a purpose made PVC starter and finisher with a 'gritted' external surface.

4.3.10.8 Flotation

In areas of high-water table, all MHs shall be designed to provide a factor of safety against flotation of 1.25.

4.3.10.9 Cover for manholes and chambers, surface boxes for housing meters and valves

In trafficable areas, where strength, performance and stability are required, cover for manholes and chambers, surface boxes for housing meters and valves, should be in accordance with the council approved material lists.

4.3.11 Connection to the public system

Where the connection of individual lots and developments are to the public system they shall meet the following requirements:

(a) Connection shall be by gravity flow via laterals to public mains or waterways

(b) All new urban lots shall be provided with individual service laterals, unless on-site disposal is approved by the TA; Connection to kerb adaptors in kerb and channel will not be allowed in new developments.

(c) 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 the TA);

(d) The minimum internal diameter of connections shall be:

(v) 100 mm for residential lots

(vi) 150 mm for commercial and industrial lots and connections serving two dwellings or residential lots

(vii) 200 mm for connections serving three or more dwellings or residential lots (unless otherwise approved by the TA);

(e) The connection shall be of a type capable of taking the spigot end of an approved pipe;

(f) Where the stormwater pipeline is outside the lot to be served, a connection 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 green;

(g) Connection to stormwater systems such as vegetated swales, soakpits, or soakage basins is acceptable provided the system is approved by the TA;

(h) All connections to pipelines or MHs shall be sealed by removable caps until such time as they are required;

(i) Connections shall be indicated accurately on as-built plans. Location relative to boundaries, depth to invert and ground level shall be given as a minimum.

4.3.12 Connection of lateral pipelines to public mains

Factory made fittings shall be used for all connections to public mains up to 300 mm diameter. Connections to larger mains up to 750 mm diameter shall use properly manufactured saddles. Concrete bondage to the exterior of the main pipe is required.

A hole may be made in a 900 mm diameter and larger main to affect a connection. The connection shall be properly dressed and plastered 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 at a MH.

4.3.12.1 Permanent disconnection of stormwater lateral

Where existing property connections are to be disconnected, they shall be disconnected and capped off at least 200mm outside the property boundary. The location of the capped end shall be fixed as per as built specifications and included in the as-built data.

4.3.13 Building over Council Infrastructure

No building shall be constructed over any stormwater drain, nor shall any structure foundation be located within a line extending at 45º from 150mm below the pipe invert to the ground surface, or within 1.5m either side of the pipe, without the specific approval of the Council.

The Council will only give approval to construct a building over a stormwater drain if;

I. It is impractical to construct a new main clear of the zone of influence; and

II. A manhole is installed within 10m of both sides of the building; and

III. The pipe runs in a straight line both vertically and horizontally between manholes;

And

I. There are no connections under the building; and

II. The condition of the pipe is checked by closed circuit television survey prior to construction at the applicant's cost and the pipe condition is approved as acceptable by Council;

And

I. Structures straddling or founded within the above zone are designed by a Chartered Professional Engineer such that there is no loading from the building applied to the stormwater pipe;

And

I. Easement to be revised at the applicants expense and in accordance with the conditions of any specific approval.

4.3.14 Sumps

(a) Sumps shall be placed at a maximum of 90 metre intervals

(b) No back entry is permitted for mountable kerbs

(c) Double sumps comprises, two single sumps connected via a single minimum 300mm lead, with one of the sumps discharging via a 300mm lead to the outfall.

(d) Double sumps (or duplicate sumps and leads) shall be provided:

I. Where a single sump has insufficient intake capacity,

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

III. Where two sub-catchments meet.

(e) Specific design requirements are required where design exceeds 12%

4.3.15 Wash bays

A vehicle, machinery or equipment wash bay should be designed to exclude rainwater, and to retain, collect, treat and reuse, or dispose of all wastewater to sewer. Installation of appropriate facilities during the design and construction phase will ensure protection of the stormwater system from contaminated wastewater.

Pre-treatment devices must comply with NZBC G14 Industrial Liquid Waste.

4.3.16 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. Specially designed flexible joints shall be provided at all junctions between pipes and rigid structures.

In developments where liquefaction has been identified, provisions to create resilient services must be considered and implemented where practicable. Relevant information can be found in the document *Underground Utilities – Seismic Assessment and Design Guidelines* Edition 1 March 2017.

4.3.17 Pipe Decommisioning

Pipe decommissioning to be undertaken as according to Appendix N.

4.4 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 section 1 of this Code of Practice.

4.4.1 Approval process

Stormwater infrastructure requires approval from the TA and unless the TA holds a comprehensive, or network consent for the catchment, consents from the regional council to discharge, divert, or dam water may also be required.

In these circumstances it is good practice:

(a) To consult with LAs prior to consent application;

(b) To lodge applications with LAs at the same time so that land use and water-related resource consents can, if required, be dealt with at a joint hearing under s. 102 of the RMA.

4.4.2 Information to be provided

Specific information to be provided on any concept plans or scheme plans for development or subdivision incorporating stormwater infrastructure shall include:

(a) The location of any natural waterways or wetlands 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;

(b) Typical pre-existing and post development cross sections through any natural waterways or wetlands;

(c) The proposed proximity of buildings to the water's edge or the shoulder of the banks, or both;

(d) 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; and

(e) The level datum.

TAs may require some of the information following, particularly (h) and (i), in order to assess possible effects of a proposed development.

Applications for design approval shall include the information outlined in 1.8 of this Code of Practice. In addition the following information shall be provided:

(f) A plan showing the proposed location of existing and proposed stormwater infrastructure and flow paths;

(g) Detailed long sections showing the levels and grades of proposed stormwater infrastructure in terms of datum;

(h) 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 4.3.5.2;

(i) Details and calculations prepared which clearly indicate any impact on adjacent area or catchment that the proposed infrastructure may have; and

(j) Operations and maintenance guidelines for any water quantity and or quality control structures/facilities shall be submitted to the TA for design approval along with other documents. The guidelines should describe the design objectives of the structure/facility, 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.

4.5 CONSTRUCTION

4.5.1 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 Parts 1 and 2 (all buried flexible pipelines), or AS/NZS 3725 (concrete pipes).

4.5.2 Trenching

Guidance is provided in Appendix B Drawings B7-1 and B7-2.

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 the TA to provide an adequate foundation, and side support if required, for the pipeline.

4.5.3 Reinstatement

Areas where construction has taken place shall be reinstated to the condition required by the TA.

4.5.4 Inspection and acceptance

Pipe systems of 1200 mm diameter or less shall be inspected using closed circuit television (CCTV) prior to acceptance by the TA.

CCTV inspections and deliverables shall be in accordance with the New Zealand Gravity Pipe Inspection Manual (4th Edition) or subsequent amendments, unless prior approval is gained from the TA.

The TA may, at its discretion, also require a water test to be carried out. Testing shall be carried out as specified in Appendix C.

Inspection to reference assets as per provided as builts, and shall reference the Resource Consent Number.

Acceptance will only be for pipe of Grade 1.

4.5.5 Location and marking of laterals

A green painted push on cap shall be installed at the end of the stormwater laterals. The stormwater lateral shall be located on the right hand side of foul sewer lateral (viewed from the road reserve looking into the property).

5 WASTEWATER

5.1 SCOPE

Where community specific guidelines are available these shall be taken into consideration throughout the design and construction of subdivisions and development. Where community specific considerations cannot be met, written acceptance of an alternative method shall be obtained from the Council.

This section sets out requirements for the design and construction of wastewater systems for land development and subdivision. Section 5 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 WSA 04.

5.2 GENERAL

5.2.1 Objectives

The designer shall agree the approach to be taken for wastewater with the Council prior to commencing any work.

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

In principle the wastewater system shall provide:

(a) A single gravity connection for each property;

(b) A level of service to the TA's customers in accordance with the authority's policies;

(c) Minimal adverse environmental and community impact;

(d) Compliance with environmental requirements;

(e) Compliance with statutory OSH requirements;

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

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

(h) Zero level of pipeline infiltration on commissioning of pipes;

(i) Low level of pipeline infiltration/exfiltration over the life of the system;

(j) Resistance to entry of tree roots;

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

(l) Structural strength to resist applied loads; and

(m) 'Whole of life' costs that are acceptable to the TA.

5.2.2 Referenced documents and relevant guidelines

Wastewater designs shall incorporate all the special requirements of the TA and shall be in accordance with the most appropriate Standards, codes, policies, and guidelines including those set out in Referenced Documents. Related Documents lists additional material that may be useful. The QLDC Pressure Sewer Policy, 2024 should be adhered to.

See Appendix B Drawings B3-3 to B3-6 for relevant pressure sewer details.

5.3 DESIGN

5.3.1 Design life

All wastewater systems shall be designed and constructed for an asset life of at least 100 years. Some components such as pumps, valves, and control equipment may require earlier renovation or replacement. Refer to WSA 02 for the classification of life expectancy for various components in conventional gravity systems.

5.3.2 Structure plan

The TA 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 the TA. Where a structure plan is not provided, the designer shall determine this information by investigation using this Code of Practice and engineering principles.

5.3.3 Future development

Unless agreed in writing by the Council where further subdivision or development is allowed for within the current district plan upstream of the one under consideration the council shall require infrastructure to be constructed to the upper limits of the subdivision/development to allow for future connections.

The assessment of required capacity shall be on the basis of full development to the extent defined in the current district plan. Where infrastructure may service adjacent land then the full development to the extent defined in the current district plan of all the land that may be serviced by the infrastructure shall be included in the capacity calculations.

Where the new infrastructure being installed is required by Council to service future development then that infrastructure will be designed and constructed on the basis of full development to the extent defined in the current district plan.

Before commencing development a developer shall liaise with the Council's Strategy and Asset Planning Team as to whether infrastructure should be upsized to service adjacent future development. If such upgrades are required, agreement shall be reached with QLDC for Council to cover the costs of upgrades.

5.3.4 System design

5.3.4.1 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 unsubdivided land. This design shall use safety factors defined by the TA for hypothetical subdivision and service for layouts to determine the necessary depth and diameter for an extension.

The designer shall be responsible for checking with the Council that the downstream network is adequate to accommodate the proposed subdivision/development.

5.3.4.2 Extent of infrastructure

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

5.3.4.3 Topographical considerations

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

5.3.4.4 Geotechnical investigations

The designer shall take into account any geotechnical requirements determined under section 2 of this Code of Practice.

5.3.5 Design criteria

5.3.5.1 Design flow

The design flow comprises domestic wastewater, industrial wastewater, infiltration, and direct ingress of stormwater.

The design flow shall be calculated by the method nominated by the TA. In the absence of information from the TA the following design parameters are recommended:

(a) Residential flows

(i) Average dry weather flow of 250 litres per day per person

(ii) Dry weather diurnal PF of 2.5

(iii) Dilution/infiltration factor of 2 for wet weather

(iv) Number of people per dwelling 3;

C5.3.5.1(a)

For small contributing catchments, PFs can be significantly higher but, due to the requirement for a minimum pipe size of DN 150, such flows will not govern the design.

(b) Commercial and industrial flows

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 the TA has no design guide, Table 5-1 is recommended as a design basis. These flows include both sanitary wastewater and trade wastes and include peaking factors.

All trading businesses must ensure that they comply with the current bylaw(s) relative to the infrastructure network.

Refer to Appendix B Drawing B3-7 for trade waste sampling point detail.

5.3.5.2 Hydraulic design of pipelines

The hydraulic design of wastewater pipes should be based on either the Colebrook-White formula or the Manning formula. The coefficients to be applied to the various materials are shown in Table 5-2.

5.3.5.3 Minimum pipe sizes

Irrespective of other requirements, the minimum sizes of property connection and reticulation pipes shall be not less than those shown in Table 5-3.

Table 5-1: Commercial and industrial flows

Industry type (Water usage)	**Design flow** (Litre/second/hectare)
Light	0.4
Medium	0.7
Heavy	1.3

Table 5-2: Guide to roughness coefficients for gravity sewer lines

Material	**Colebrook-White coefficient k** (mm)	**Manning roughness coefficient** (n)
VC	1.0	0.012
PVC	0.6	0.011
PE	0.6	0.009 – 0.011
GRP	0.6	0.011
Concrete machine made to AS/NZS 4058	1.5	0.012
PE or epoxy lining	0.6	0.011
PP	0.6	0.009 – 0.011

NOTE –

(1) These values take into account possible effects of rubber ring joints, slime, and debris.

(2) The n and k values apply for pipes up to DN 300.

(3) For further guidance refer to WSA 02:1999 table 2.4; AS 2200 table 2; *Plastics pipes for water supply and sewage disposal* (Janson), Metrication: *Hydraulic data and formulae* (Lamont), or the *Handbook of PVC pipe* (Uni-Bell).

Table 5-3: Minimum pipe sizes for wastewater reticulation and property connections

Pipe	**Minimum size** **DN** (mm)
Connection servicing 1 dwelling unit	100
Connection servicing more than 1 dwelling unit	150
Connection servicing commercial 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 5-4 and Table 5-5 will be adequate without specific hydraulic design.	

5.3.5.4 Limitation on pipe size reduction

In no circumstances shall the pipe size be reduced on any downstream section.

5.3.5.5 Minimum grades for self-cleaning

Notice should be taken of the requirement for new sewers to maintain self-cleansing velocities during subdivision staging. The design shall allow for interim measures for self-cleansing where these cannot be achieved during the initial stages of the development.

Self-cleansing velocities can be demonstrated by:

- Adopting the minimum pipe grades in Table 5-4 and Table 5-5; and
- Calculating the expected PDWF for the proposed pipe section and ensuring flow velocity exceeds the minimum requirement of 0.75 m/s.

Table 5-4: Minimum grades for wastewater pipes

Pipe size DN	**Absolute minimum grade** (%)
150	0.7
225	0.45
300	0.30

Table 5-5: 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 persons	1.00

5.3.5.6 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 greater than 3.0 m/s is unavoidable or where a pipe of grade >7 % drains to a manhole, the following precautions shall be taken:

(a) Depth of a manhole to exceed 1.5m to invert for 150mmØ and 225mmØ pipes.

(b) Depth of a manhole is to exceed 2.0m deep for 300mmØ pipes.

(c) Change of direction at the manhole is not to exceed 45º.

(d) No drop junctions or verticals shall be incorporated in a manhole.

(e) Inside radius of channel inside a manhole is to be greater than 2 times the pipe diameter and benching is to extend 150mm above the top of the inlet pipe.

5.3.5.7 To avoid excessively deep channels within manholes, steep grades (>7 %) shall be "graded-out" at the design phase where practicable. The design of pipelines on gradients over 7% must be agreed with Council.Gravity wastewater applications

See Appendix A for appropriate gravity pipe Standards for wastewater.

The pipe shall be designed to:

(a) Have adequate capacity, grades, and diameters;

(b) Have adequate grade for self-cleaning;

(c) Be deep enough to provide gravity service to all lots;

(d) Comply with minimum depth requirements to ensure mechanical protection and safety from excavation;

(e) Avoid all underground services, while maintaining all the necessary clearances; and

(f) Allow for various drops and losses through MHs.

5.3.5.8 Pressure and vacuum wastewater applications

The introduction of pressure or vacuum systems into a network requires approval from the TA. See Appendix A for appropriate pressure pipe and fittings Standards for wastewater. See also 5.3.12.

Design of pressure and vacuum wastewater applications shall consider the following:

(a) 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;

(b) Sump and pump design;

(c) Maintenance requirements;

(d) Access for servicing and maintenance.

5.3.6 Structural design

5.3.6.1 General

The design shall be in accordance with AS/NZS 2566.1, or AS/NZS 3725, including the structural design commentary AS/NZS 2566.1 Supplement 1. Details of the final design requirements shall be shown on the drawings.

5.3.6.2 Seismic design

All pipes and structures shall be designed with adequate flexibility and special provisions to minimise risk of damage during earthquake. Historical experience in New Zealand earthquake events suggests that suitable pipe options, in seismically active areas, may include rubber ring joint PVC or PE pipes. Specially designed flexible joints shall be provided at all junctions between pipes and rigid structures.

In developments where liquefaction has been identified, provisions to create resilient services must be considered and implemented where practicable. Relevant information can be found in the document *Underground Utilities – Seismic Assessment and Design Guidelines* Edition 1 March 2017.

5.3.6.3 Structural consideration

Pipelines shall be designed to withstand all the forces and load combinations to which they may be exposed including internal forces, external forces, temperature effects, settlement, and combined stresses.

5.3.6.4 Internal forces

Pipelines shall be designed for the range of expected pressures, including dynamic stresses, transient conditions (surge and fatigue) and maximum static head conditions. In the case of transient conditions, the amplitude and frequency shall be estimated. Mains subject to negative pressure shall be designed to withstand a transient pressure of at least 50 kPa below atmospheric pressure. Design for dynamic stresses in pressure wastewater pipelines shall be in accordance with PIPA POP010A, (PE pressure pipes) PIPA POP010B (fusion fittings for PE pressure pipes) and POP101 (PVC pressure pipes).

5.3.6.5 External forces

The external forces to be taken into account shall include:

(a) Trench fill loadings (vertical and horizontal forces due to earth loadings);

(b) Surcharge;

(c) Groundwater;

(d) Dead weight of the pipe and the contained water;

(e) Other forces arising during installation;

(f) Traffic loads;

(g) Temperature (expansion/contraction).

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

5.3.6.6 Geotechnical investigations

The designer should take into account any geotechnical requirements determined under section 2 of this Code of Practice. Where required, standard special foundation conditions shall be referenced on the drawings.

5.3.6.7 Pipe selection for special conditions

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

(a) Structural adequacy for the ground conditions and water temperature;

(b) Water quality considering the lining material;

(c) Compatibility with aggressive or contaminated ground;

(d) Suitability for the geotechnical conditions;

(e) Compliance with the TA's requirements.

5.3.6.8 Trenchless technology

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

(a) Environmentally sensitive areas;

(b) Built-up or congested areas to minimise disruption and reinstatement;

(c) Railway and major road crossings;

(d) Significant vegetation;

(e) Vehicle crossings;

Wastewater pipes used for trenchless installation shall have suitable mechanically restrained joints, specifically designed for trenchless application, which may include integral restraint, seal systems, or heat fusion welded joints.

Trenchless installation methods may include:

For new pipes:

(f) Horizontal directional drilling (HDD) (PVC with restraint joint/fusion welded PE)

(g) Uncased auger boring/pilot bore microtunnelling/guided boring (PVC with restraint joint/fusion welded PE)

(h) Pipe jacking (GRP/reinforced concrete)

For pipe rehabilitation/renovation:

(i) Slip lining/grouting (PVC with restraint joint/fusion welded PE)

(j) Closefit slip lining (PVC with restraint joint/fusion welded PE)

(k) Static pipe bursting (PVC with restraint joint/fusion welded PE)

(l) Reaming/pipe eating/inline removal (PVC with restraint joint/fusion welded PE)

(m) Soil displacement/impact moling (fusion welded PE)

(n) 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 manufacturer's and installer's recommendations.

The following details including location of access pits and exit points shall be submitted to the TA for approval:

(o) Clearances from services and obstructions;

(p) The depth at which the pipeline is to be laid to ensure minimum cover is maintained;

(q) The pipe support and ground compaction;

(r) How pipes will be protected from damage during construction;

(s) Any assessed risk to abutting surface and underground structures.

C5.3.6.8

Further information on trenchless technologies may be found in 'Trenchless technology for installation of cables and pipelines' (Stein), 'Trenchless technology – Pipeline and utility design, construction, and renewal' (Najafi), 'Guidelines for horizontal directional drilling, pipe bursting, microtunnelling and pipe jacking' (Australasian Society for Trenchless Technology), and and AS/NZS 2033:2024, Section 6.4 - Installation of buried pipes using trenchless technology.

5.3.6.9 Marking tape or pipe detection tape

Appropriate marking tape or detection tape shall be installed at the top of the embedment zone, or tied to the pipe during HDD, to aid future location of the pipe. Refer to AS/NZS 2032 section 5.3.15 and figure 5.1.

5.3.7 System layout

5.3.7.1 Pipe location

The preferred layout/location of pipes within roads, public reserves, and private property may vary and shall be to the requirements of each TA. QLDC's preference is for all infrastructure to be located within public land. Where this is impractical and that is agreed with Council, access shall be legally secured and it shall be demonstrated how the infrastructure can be readily accessed for routine or emergency maintenance.

Pipes should be positioned as follows:

(a) Within the street according to the locally applicable utilities allocation code. In the absence of a code, a location clear of carriageways is preferred;

(b) Within public land with the permission of the controlling authority;

(c) Within reserves outside the 1% AEP flood area;

(d) Within private property parallel to front, rear, or side boundaries.

5.3.7.2 Materials

All pipes shall be PE100, PVC (minimum class SN8) or rubber ring joint reinforced concrete and meet the relevant standards as listed in Table A1 of NZS4404:2010. Acceptance of design documentation without separate written approval shall not constitute acceptance of an alternative material.

5.3.7.3 Electrofusion (EF) Couplers

Use of electrofusion (EF) couplers should be limited to where butt welding is impractical or unsafe, to be agreed by QLDC prior to installation. EF couplers shall be installed by an appropriately QLDC approved contractor.

5.3.7.4 Pipes in reserves and public open space

Pipes in reserves and public open space shall be located in accordance with the TA's requirements.

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

5.3.7.5 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. If this is not possible, protection of the pipe and associated structures shall be specified for evaluation and approval by the TA.

Where pipes to be vested to the TA are designed to traverse private properties, they should be protected by legal easements of the TA.

Pipes shall be centrally located within an easement. An easement shall be 3 m wide or to the full extent of the zone of influence, whichever is greater, or unless otherwise agreed by Council.

5.3.7.6 Minimum cover

Pipelines shall have minimum cover in accordance with the TA or utility owner's requirements. Where the TA does not have specific requirements, the minimum covers as described in AS/NZS 2566.2 may be used.

Within carriageways, trafficable footpaths, and crossings, wastewater mains are to have a minimum of 1.0 m cover unless structural calculations to the appropriate standards have been provided and approved by Council. Laterals can have the cover reduced to 0.6 m within these areas. Cover outside of the carriageway, footpaths, crossings or other trafficable areas shall be no less than 0.6m.

Where cover is reduced from requirements above, pipe loading capacity shall first be checked as per AS/NZS 2566.1 requirements to determine if concrete capping or encasing is required. If pipe loading capacity is acceptable, justification is to be submitted to QLDC for approval of reduced cover. If pipe loading capacity is exceeded, concrete capping or encasing is required as per Appendix B Drawing B4-2.

5.3.7.7 Horizontal curves

Horizontal curves shall only be used where authorised by the TA.

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 savings 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.

5.3.7.8 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 5.3.7.6.

5.3.7.9 Underground services

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

5.3.7.10 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 the TA has its own specific requirements.

In greenfield developments, the wastewater pipes shall always be located below both water and stormwater pipes. For infill developments, a wastewater line may only be permitted to cross a stormwater pipe if no other suitable option is available. In this instance, no sewer PVC joins are permitted within 1m of the stormwater pipe, and the sewer PVC shall be encased in PE at least 200mm beyond each join.

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 Table 5-6. Written agreement on reduced clearances and clearances for shared trenching shall be obtained from the TA and the relevant service owner.

Table 5-6: Clearances between wastewater pipes and other underground services

Utility (Existing service)	**Minimum horizontal clearance for new pipe size ≤DN 300** (mm)	**Minimum vertical clearance**[1] (mm)
Gas mains	300[2]	150
Telecommunication conduits and cables	300[2]	150
Electricity conduits and cables	500	225
Wastewater pipes and drains	300[2]	150
Water mains	1000[3]/600	500
Public stormwater mains	300	150

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 possible, stormwater pipes should be located above wastewater pipes to prevent possible contamination if the wastewater pipe were to fail. Any instance where this is not planned needs to be specifically raised and agreed to by QLDC.

5.3.7.11 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:

(a) Protection of the pipeline;

(b) Long term maintenance access for the pipeline; and

(c) Protection of the existing structure or building.

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

5.3.7.12 Bulkheads for pipes on steep grades

For bulkheads, or anti-scour blocks, see 4.3.9.10 and Appendix B

5.3.8 Maintenance structures

5.3.8.1 General

This describes the requirements for structures which permit access to the wastewater system for maintenance.

The minimum internal diameter of a manhole shall be 1050 mm.

Maintenance structures include:

(a) Manholes (or maintenance holes) (MHs);

(b) Maintenance shafts (MSs); and

(c) Terminal maintenance shafts (TMSs).

5.3.8.2 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. The TA may determine other specific requirements subject to the individual site characteristics.

The design shall include maintenance structures at the following locations:

(a) Intersection of pipes except for junctions between mains and property connections;

(b) Changes of pipe size;

(c) Changes of pipe direction, except where horizontal curves are used;

(d) Changes of pipe grade, except where vertical curves are used;

(e) Combined changes of pipe direction and grade, except where compound curves are used;

(f) Changes of pipe invert level;

(g) Changes of pipe material, except for repair/maintenance locations;

(h) Permanent or temporary ends of a pipe;

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

Table 5-7 summarises maintenance structure options for wastewater reticulation.

Table 5-7: Acceptable MH, MS, and TMS options for wastewater reticulation

Application	Acceptable options[1]		
	MH	MS	TMS
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 MH with internal/external drops	NO	NO
Change in pipe size	YES MH is the only option	NO	NO
Change in horizontal direction	YES within permissible deflection at MH	YES MS prefabricated units or MS used with horizontal bends of max 33° deflection	YES for DN 150 pipe only
Change of pipe material	YES	NO	NO
Permanent end of a pipe[3]	YES	YES	YES
Pressure main discharge point	YES MH is the only option and shall include a vent	NO	NO

NOTE –

(1) Where person entry is required down to the level of the pipe, a MH is the only option.

(2) This table refers to reticulation mains. DN 100 and DN 150 lot connections can be made to any maintenance structure or, using a proprietary junction, at any point along the main.

(3) Some TAs permit the use of London Junction or Rodding Eye at the end of the pipe, but it is recommended that TMSs are used.

5.3.8.3 Maintenance structure spacing

For reticulation pipes, the maximum distance between any two consecutive maintenance structures shall be 100 m.

At the permanent end of a wastewater main, the distance from the end maintenance structure to the nearest downstream MH shall not exceed 240 m (see figure 5.1).

Where a combination of MHs and MSs is used along the same pipe, the maximum spacing between any two consecutive MHs shall not exceed 400 m irrespective of how many MSs are used between the two MHs (see figure 5.2).

5.3.8.4 Manholes

5.3.8.4.1 Manhole materials

MHs may be manufactured in concrete, or from suitable plastics materials, including GRP, polyethylene, PVC or polypropylene, or from concrete/plastic lined composites.

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

The connection of PVC pipes to concrete structures, such as manholes will be with a purpose made PVC starter and finisher with a 'gritted' external surface.

5.3.8.4.2 Base layout

Each MH base shall have:

(a) One minimum standing area of 350 mm x 350 mm or of 350 mm diameter (where the ladder or step irons are located), and a second minimum width standing area of 250 mm x 250 mm or of 250 mm in diameter, as shown in Appendix B Drawing B1-5 and Drawing B1-6;

(b) A minimum working space of 750 mm clear of drop pipes, ladders, and step irons; and

(c) Channels with a minimum inside channel wall radius of 300 mm (in plan).

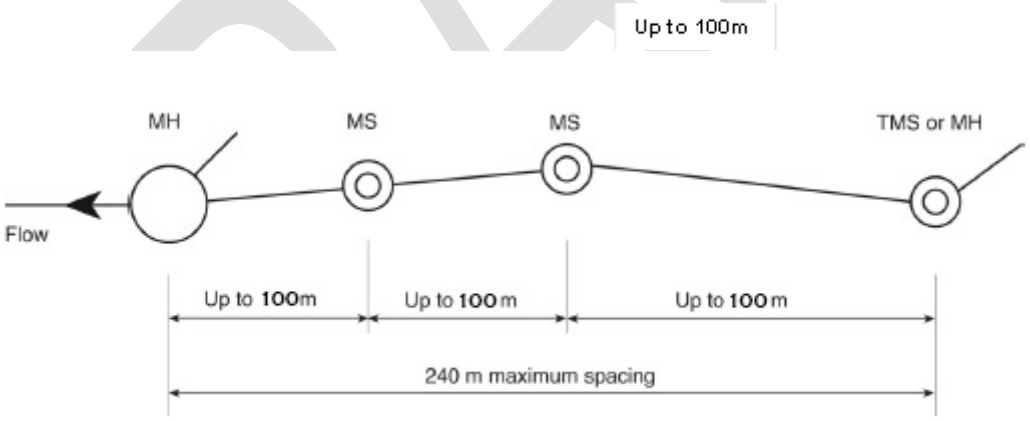


Figure 5.1 – Multiple MSs between MH and 'last' MH/TMS

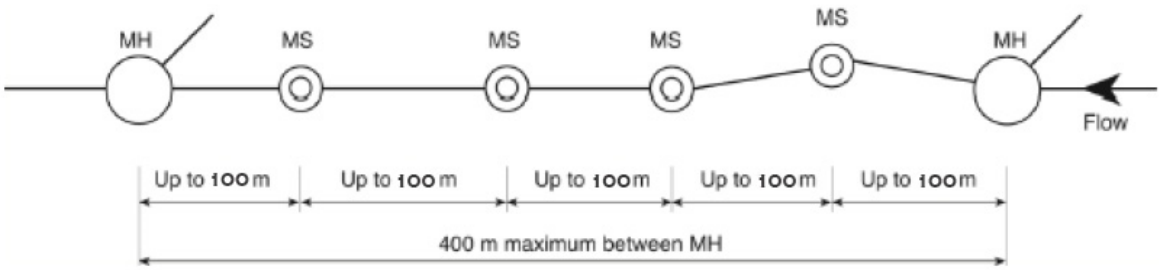


Figure 5.2 – Multiple MSs between consecutive MHs

5.3.8.4.3 Allowable deflection through MHs

A maximum allowable deflection through a MH shall comply with Table 5-8.

Table 5-8: Maximum allowable deflections through MHs

Pipe size DN	**Maximum deflection** Degrees (°)
150 – 300	Up to 120° for internal fall along MH channel – see Table 5-9
150 – 300	Up to 150° where there is a large fall at MH using an internal or external drop structure

5.3.8.4.4 Internal falls through MHs

The minimum internal fall through a MH shall comply with Table 5-9.

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

On pipes where the internal fall across the base of the MH is not achievable due to a large difference between the levels of incoming and outgoing pipes (see Appendix B Drawing B1-5 and Drawing B1-6;), then internal or external drops shall be provided (see Drawing B1-7).

Table 5-9: Minimum internal fall through MH joining pipes of same diameter

Deflection angle at MH Degrees (°)	**Minimum internal fall** (mm)
0 to 30	30
>30 to 60	50
>60 to 120	80

5.3.8.4.5 Effect of steep grades on MHs

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

(a) No change of grade is permitted at inlet to a MH;

(b) Depth of MH is to exceed 1.5 m to invert for DN 150, DN 200, and DN 225 pipes;

(c) Depth of MH is to exceed 2.0 m deep for DN 300 pipes;

(d) Change of direction at the MH is not to exceed 45°;

(e) No drop junctions or verticals are to be incorporated in the MH;

(f) Inside radius of channel inside the MH is to be greater than 2 times the pipe diameter; and

(g) 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.

C5.3.8.4.5

For further guidance on handling steep grades, refer to WSA 02.

5.3.8.4.6 Flotation

In areas of high water table, all MHs shall be designed to provide a factor of safety against flotation of 1.25.

5.3.8.4.7 Covers

Watertight MH covers with a minimum clear opening of 600 mm in diameter, complying with AS 3996, shall be used, unless the TA has an alternative standard. AS 3996 gives direction for the class of cover for particular locations and applications.

5.3.8.4.8 Bolt-down covers

Where required by the TA, bolt-down metal access covers (watertight type) shall be specified on MHs:

(a) In systems where the possibility of surcharge exists; and

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

Sealed entry holes with restricted access 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% AEP flood level. Where this is not practicable, bolt-down access covers may be specified by the TA. It will also be necessary to specify the tying together of MH components where bolt-down covers are specified and precast components are used.

5.3.8.4.9 Size of manholes

The standard internal diameter of circular MHs is 1050 mm and preferred nominal internal diameters are 1050 mm, 1200 mm, and 1500 mm.

When considering the appropriate MH diameter, consideration shall be given by the designer to the base layout to ensure hydraulic efficiency and adequate working space in the chamber (as detailed in 5.3.8.4.2). Where the effective working space is reduced by internal drop pipes, a larger diameter may be required. Where there are several inlets, consultation with the TA on the layout of the chamber is recommended.

Any MH with 3 or more inlets is required to be a minimum of 1200mm diameter, and comply with requirements as per Appendix B Drawing B1-5.

The base layout of MHs shall comply with Drawing B1-5

5.3.8.4.10 Deep manholes

The use of deep manholes should be avoided through design where practical. Where manholes deeper than 4m depth are unavoidable specific design and Council approval will be required. Generally landing platforms are to be fitted for manholes greater than 6m in depth, unless appropriate maintenance provisions can be otherwise demonstrated. Where platforms are necessary the manhole diameter shall be a minimum of 1500mm diameter to allow for the minimum clearance for safe access.

Landing platforms are to be constructed from corrosion resistant materials (stainless steel grade 316 or approved alternative) and are to be positioned to optimise maintenance access for internal manhole features such as internal drop structures. Platforms should be located mid-depth where possible, and are not to be located within 2m of the top or bottom of the manhole to preserve appropriate working heights in these zones. The platform shall include a hinged hatch to allow access to the lower section of the manhole, and the platform opening must align with the external manhole opening.

5.3.8.4.11 Cover for manholes and chambers, surface boxes for housing meters and valves

In trafficable areas, where strength, performance, and stability are required, cover for manholes and chambers, surface boxes for housing meters and valves, should be in accordance with the council approved material lists.

5.3.8.5 Maintenance shafts

Where maintenance shafts (MSs) have been approved by the TA, and where it is expected that human access below ground will not be required, MSs can be used on DN 150, DN 200, and DN 225 pipes as an alternative to MHs, providing 5.3.8.5.1 and 5.3.8.5.2 are satisfied. See Appendix B SNZ Drawings B7-10, B7-11, and B7-12.

Typical MS configurations are:

(a) Straight through MSs; and Appendix B Drawing B7-10 to B7-12.

(b) Angled MSs – see 5.3.8.5.2(a).

MSs can also be used in conjunction with a TMS (see 5.3.8.6).

5.3.8.5.1 Limiting conditions

The following conditions apply to the use of MSs:

(a) MSs shall only be used on DN 150, DN 200, and DN 225 pipes;

(b) MSs shall not be used instead of MHs at junctions;

(c) Depth of MSs shall:

(i) Be within the allowable depth limit for the particular pipeline system

(ii) Not exceed the MS manufacturer's stated allowable depth limit, and

(iii) Be within the depth limit imposed by the TA;

(d) MSs shall be restricted to pipeline gradients and depths where the deviation from vertical of the MS 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;

(e) MSs shall not be used at discharge points of pumping mains.

5.3.8.5.2 Design parameters

MSs shall only be used at the design locations detailed in figures 5.1 and 5.2. The following requirements shall apply:

(a) Directional and gradient changes at MSs shall be achieved by using either:

(i) Close-coupled horizontal or vertical manufactured bends immediately adjacent to the MS (maximum horizontal deviation of 33°), or

(ii) MS units specially manufactured with internal horizontal or vertical angles to suit design requirements (maximum horizontal deviation of 90°);

(b) MSs 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;

(c) Straight through type and angled MSs can incorporate up to two higher level property connections discharging directly into the riser shaft.

For construction details see Appendix B and Drawing B7-11 and B7-12.

5.3.8.6 Terminal maintenance shafts

Where terminal maintenance shafts (TMSs) have been authorised by the TA and where it is expected that human access below ground will not be required, TMSs may be used on DN 150, DN 200, and DN 225 pipes as an alternative to MHs, providing the conditions detailed in this Code of Practice are satisfied.

5.3.8.6.1 Design parameters

A TMS may only be used as a terminating structure under the following conditions:

(a) At the permanent end of a wastewater pipe;

(b) On DN 150, DN 200, and DN 225 pipes;

(c) After the last MH (with no intermediate MS) provided it is spaced no further than 120 m from that MH, as shown in figure 5.1;

(d) After an intermediate MS, as shown in figure 5.2;

(e) Subject to the limiting conditions detailed in 5.3.8.5.1.

5.3.8.6.2 Property connections into a permanent end

TMSs may incorporate a maximum of two higher level property connection branches discharging directly into the riser shaft. 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 MS may be used instead of a TMS to accommodate the straight through connection. In such a case, a nominal internal diameter 100mm connection will require a reducer immediately adjacent to the MS.

5.3.8.6.3 Dead ends

Pipes need not terminate at a MH, MS, or TMS if the pipe is to be extended in the future.

5.3.9 Venting

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

(a) At pumping stations;

(b) At MHs where pumping stations discharge to a gravity pipe; and

(c) At entrances and exits to inverted siphons.

In such situations vent shafts shall be installed as per the requirements of WSA 02 and WSA 04.

5.3.10 Connections

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

5.3.10.1 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 building area of the property (unless specific approval is obtained from the TA).

5.3.10.2 Requirements of design

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

(a) Plan location and lot contours;

(b) Invert level at property boundary or junction with the main as applicable.

5.3.10.3 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 the TA.

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 TA 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 the TA, developers have the option of providing wastewater facilities to the individual titles or tenements in new developments by:

(a) Constructing individual connections which shall be owned and maintained by the body corporate, tenants in common or the company; or

(b) Extending the public line into the lot and providing a separate connection to each unit.

5.3.10.4 Location of connection

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

(a) Be clear of obstructions, such as trees, tree roots, paved areas;

(b) Be easily accessible for future maintenance;

(c) Be clear of any known future developments, such as swimming pools or driveways;

(d) Avoid unnecessarily deep excavation >1.5 m where practicable;

(e) Be within or on the property boundary.

5.3.10.5 Connection depth

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

(a) Surface level at plumbing fixtures of buildings (existing or proposed);

(b) Depth to invert of pipe at plumbing fixture or intermediate points;

(c) Minimum depth of cover over connection for mechanical protection;

(d) Invert of public main at junction point;

(e) Allowance for crossing other services (for clearances seeTable 5-6);

(f) Provision for basements;

(g) Allowance for head loss in traps and fittings;

(h) Allowance for any soffit depth set by the TA.

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

Where an approved connection to Council's reticulation is from a private sewer pressure main, Council requires an approved boundary kit for each connection to be located within the road reserve at the property boundary.

5.3.10.6 Location and marking of laterals

A red painted glued cap shall be installed at the end of the foul sewer laterals. The foul sewer lateral shall be located on the left hand side of the stormwater lateral (viewed from the road reserve looking into the property).

5.3.10.7 Permanent disconnection of wastewater lateral

Where existing property connections are to be disconnected, they shall be disconnected and capped off at least 200mm outside the property boundary. The location of the capped end shall be fixed as per as built specifications and included in the as-built data.

5.3.10.8 Flow Metering

Any proposed water supply connections off a Council Trunk Main for subdivisions must provide a bulk flow meter with connection to QLDC Telemetry unless otherwise agreed with P&I or approved by the Chief Engineer.

5.3.11 Pumping stations and pressure mains

Pressure mains shall be designed and installed in accordance with the standards of the TA. If the TA has no applicable standards, then they shall be designed in accordance with Sewage Pumping Station Standard WSA 04.

Wastewater and public toilets with pump stations or septic tanks shall be designed in accordance with Appendix G – Sewer Pump Station. Design of electrical systems shall be in accordance with the QLDC Electrical & SCADA Standard Network Flowmeters Standard (2010).

Surge analysis and protection against surge pressures will be also required for wastewater pump/ pumping main system. Deviations from the CoP may be considered at the Council's discretion.

All products and components including pumps shall be approved by the Council prior to submitting a design for acceptance.

All pressure main pipework shall be PE100.

Tracer wire shall be included on all pressure mains. Refer to section 6.5.3.4 for detail of form of wire and testing. For pressure wastewater mains, the tracer wire shall run continuously between valves. At each valve the wire shall be ducted to the surface level through a length of polyethylene pipe ending immediately below the lid. The tracer wire shall be long enough to extend 600mm minimum above ground level when uncoiled. The excess length shall be neatly coiled in the valve box.

5.3.12 Pressure sewers and vacuum sewers

Pressure sewers shall be designed and installed in accordance with the standards of the standards of the QLDC Low Pressure Sewer Designs Standards, Technical Specifications and Pressure Sewer Policy.

Vacuum sewers are not covered under the aforementioned standards, specification or policies and require specific council Approval for their use. In such circumstances they shall be designed and installed in accordance with the then current standards of the TA. If the TA has no applicable standards, then they shall be designed in accordance with WSA 06 Sunject to Council's approval.

5.3.13 On-site wastewater treatment and disposal

On-site wastewater treatment and disposal shall be designed and installed in accordance with the standards of the TA. If the TA has no applicable standards, then they shall be designed in accordance with AS/NZS 1546.1 and AS/NZS 1547.

5.3.14 Building over Council Infrastructure

No building shall be constructed over any wastewater drain, nor shall any structure foundation be located within a line extending at 45º from 150mm below the pipe invert to the ground surface, or within 1.5m either side of the pipe, without the specific approval of the Council.

The Council will only give approval to construct a building over a wastewater drain if;

i. It is impractical to construct a new main clear of the zone of influence;

and

ii. A manhole is installed within 10m of both sides of the building;

and

iii. The pipe runs in a straight line both vertically and horizontally between manholes;

and

iv. There are no connections under the building;

and

v. The condition of the pipe is checked by closed circuit television survey prior to construction at the applicant's cost and the pipe condition is approved as acceptable by Council;

and

vi. Structures straddling or founded within the above zone are designed by a Chartered Professional Engineer such that there is no loading from the building applied to the wastewater pipe;

and

vii. Easement to be revised at the applicants expense and in accordance with the conditions of any specific approval.

5.4 APPROVAL OF PROPOSED INFRASTRUCTURE

5.4.1 Approval process

Wastewater infrastructure requires approval from the TA.

5.4.2 Information to be provided

Applications for design approval shall include the information outlined in 1.8 of this Code of Practice. In addition, the following information shall be provided:

(a) A plan showing the proposed location of existing and proposed wastewater infrastructure;

(b) Detailed long sections showing the levels and grades of proposed wastewater pipelines in terms of datum;

(c) Long sections shall include full details of pipe and manhole materials and sizes;

(d) Details and calculations prepared which demonstrate that agreed levels of service will be maintained;

(e) Details and calculations prepared which clearly indicate any impact on adjacent area or catchment that the proposed infrastructure may have; and

(f) Appropriate operating manuals, pump information, and instructions for pump stations and pressure systems if proposed.

5.5 CONSTRUCTION

5.5.1 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).

5.5.2 Trenching

See Appendix B Drawing B1-1 to Drawing B1-4 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 the TA to provide an adequate foundation and side support if required for the pipeline.

5.5.3 Reinstatement

Areas where construction has taken place shall be reinstated to a condition as required by the TA.

5.5.4 Inspection and acceptance

Pipeline inspection and recording by closed circuit television (CCTV) shall be carried out prior to acceptance by the TA.

CCTV inspections and deliverables shall be in accordance with *New Zealand pipe inspection manual* and the requirements of the TA.

Inspection to reference assets as per provided as builts, and shall reference the Resource Consent Number.

Acceptance will only be for pipe of Grade 1.

5.5.5 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 Appendix C.

5.5.6 Leakage testing of pressurised sewers

Requirements for field testing of pressurised sewers are given in Appendix C.

5.5.7 Connection to existing systems

Connection to existing wastewater mains will only be undertaken by Queenstown Lakes District Council, or its authorised agents, at the cost of the applicant.

6 WATER SUPPLY

6.1 SCOPE

Where community specific guidelines are available these shall be taken into consideration throughout the design and construction of subdivisions and development.

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 localised reticulation system and the larger distribution network.

Water reticulation design is generally described in 'performance based' terms combined with 'deemed to comply' solutions. Individual TAs may specify additional or varying requirements. The designer is responsible for all aspects of the water system design, excepting those aspects nominated and provided to the designer by the TA.

If the scope of the development is large and includes its own water source, treatment or reservoirs, reference should be made to WSA 03.

Detailed plans and design calculations (where appropriate) shall be submitted to the TA. In addition, the requirements outlined in section 1 of this Code of Practice shall be met.

6.2 GENERAL REQUIREMENTS

The designer shall agree the approach to be taken for water supply with the Council prior to commencing any work.

6.2.1 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 the TA's designated water supply area, and the TA's requirements are satisfied.

The design shall ensure an acceptable water supply for each property including fire flows, depending on TA policies by providing either:

(a) A water main allowing an appropriate point of supply to each property;

and

(b) A service connection from the main for each property.

The designer shall consider:

(c) The TA's policies, customer charters, and contracts;

(d) The hydraulic adequacy of the system;

(e) The ability of the water system to maintain acceptable water quality;

(f) The structural strength of water system components to resist applied loads;

(g) The requirements of SNZ PAS 4509;

(h) Environmental requirements;

(i) The environmental and community impact of the works;

(j) The 'fit-for-purpose' service life for the system;

(k) Optimising the 'whole-of-life' cost; and

(l) Each component's resistance to internal and external corrosion or degradation.

6.2.2 Referenced documents and relevant guidelines

Relevant legislation is listed in the Referenced Documents section of this Code of Practice.

Water designs shall incorporate all the special requirements of the TA and shall be in accordance with the most appropriate Standards, codes, and guidelines including those set out in Referenced Documents, the Civil Defence Emergency Management Act 2002, and *Drinking-water standards for New Zealand 2005* (Revised 2008). Related Documents lists additional material that may be useful.

6.3 DESIGN

6.3.1 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.

6.3.2 Structure plan

The TA 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 the TA. Where a structure plan is not provided, the designer shall determine this information by investigation using this Code of Practice and engineering principles.

6.3.3 Future development

Unless agreed in writing by the Council, where further subdivision or development is allowed for within the current district plan adjacent to the one under consideration the council shall require infrastructure to be constructed to the extents of the subdivision/development to allow for future connections.

The assessment of required capacity shall be on the basis of full development to the extent defined in the current district plan. Where infrastructure may service adjacent land then the full development to the extent defined in the current district plan of all the land that may be serviced by the infrastructure shall be included in the capacity calculations.

Where the new infrastructure being installed is required by Council to service future development then that infrastructure will be designed and constructed on the basis of full development to the extent defined in the current district plan.

The cost of increased infrastructure to service adjacent future development will be agreed in writing with the Council's Strategy and Asset Planning Team prior to commencing work.

6.3.4 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.

The designer shall be responsible for checking with Council that the network is adequate to accommodate the proposed subdivision/development.

The water demand allowance in the subdivision design shall include provision for:

(a) Population targets;

(b) The area to be serviced; or

(c) Individual properties proposed by the developer.

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

6.3.5 Design criteria

6.3.5.1 Hydraulic design

The diameter, material type(s), and class of the water main shall be selected to ensure that:

(a) The main has sufficient capacity to meet peak demands while maintaining minimum pressure;

(b) All consumers connected to the main receive at all times an adequate water supply and pressure; and

(c) The appropriate firefighting flows and pressures can be achieved.

6.3.5.2 Network analysis

Where required by the TA, 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.

6.3.5.3 Peak flows

Clause deleted

6.3.5.4 Head losses

The head loss through pipe and fittings at the design flow rate shall be less than:

(a) 5 m/km for nominal internal diameter of main <200;

(b) 3 m/km for nominal internal diameter of main ≥200.

Head loss can be calculated using one of a number of standard hydraulic formulae. Some TAs have a preferred procedure and, where appropriate, this procedure should be used.

6.3.5.4.1 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 the TA 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 6-1). If the designer uses the Manning formula the coefficients in Table 6-1 are recommended.

Table 6-1: Hydraulic roughness values

Material	**Colebrook-White Coefficient k** (mm)	**Manning roughness Coefficient** (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 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.		

6.3.5.5 Minimum flows

The minimum flow shall be the greater of:

(a) 25 L/min for normal residential sites;

(b) Fire flows as specified in SNZ PAS 4509.

6.3.5.6 Minimum water demand

Following receipt of validated modelling data, the daily consumption has been amended to

(a) Daily consumption of 700 L/person/day (occupancy per residence = 3 people);

(b) Peak hour factor of up to 4.0 (Queenstown), 6.6 (Rest of District);

(c) Firefighting demands as specified in SNZ PAS 4509;

(d) The network should be designed to maintain appropriate nominated pressures for both peak demand (average daily demand in L/s x peak hour 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 3.3.

When supported by alternative modelling/metering data that has been approved by Council the following minimum water demand figures may be used at the sole discretion of the Council.

(a) Daily consumption of 250 L/p/day;

(b) Peak hour factor of up to 4.0 (Queenstown), 6.6 (Rest of District);

(c) Firefighting demands as specified in SNZ PAS 4509;

(d) The network should be designed to maintain appropriate nominated pressures for both peak demand (average daily demand in L/s x peak hour 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 3.3.

6.3.5.7 Sizing of mains

Table 6-2 and Table 6-3 may be used as a guide for sizing mains.

Table 6-2: Empirical guide for principal main sizing

Nominal internal diameter of main (mm)	Capacity of main (single direction feed only)			
	Residential (lots)	**Rural Residential** (lots)	**General/light Industrial** (ha)	**High usage Industrial** (ha)
100	40	10	–	–
150	160	125	23	–
200	400	290	52	10
225	550	370	66	18
250	650	470	84	24
300	1000	670	120	35
375	1600	1070	195	55

Table 6-3: Empirical guide for sizing rider mains

Nominal internal diameter 50mm rider mains		
Pressure	**Maximum number of dwelling units**	
	One end supply	**Two end supply**
High > 600 kPa	20	40
Medium 400 – 600 kPa	15	30
Low < 400 kPa	7	15

6.3.5.8 Pressure zones

TAs may have maximum acceptable pressure requirements in any pressure zone. 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 the TA to confirm pressure requirements.

6.3.5.9 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:

(a) Static head of supply;

(b) 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:

(c) Size of mains;

(d) Maximum and minimum design pressure;

(e) The pressure class/rating of pipeline system components;

(f) Surge analysis results;

(g) Hydraulic loss functions;

(h) Specification of the maximum allowable operating pressure;

(i) Flow and pressure compliance with peak demand and firefighting demand scenarios.

6.3.5.10 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 the TA or some higher pressure selected to control (minimise) the range of pressures experienced over the normal diurnal variation in the system.

The design pressure shall be between 300 kPa and 750 kPa (30 m to 75 m).

A minimum pressure rating of each pipeline component is to be provided to the TA with the as-built details.

C6.3.5.10

A design pressure of 300 kPa to 750 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.

6.3.5.10.1 Operating pressure/working pressure

The maximum allowable operating pressure in mains of 100mm dia and greater shall not exceed 750kPa without the specific approval of Council's Chief Engineer.

The maximum allowable operating pressure of ridermains and service connections shall not exceed 750kPa.

6.3.5.11 District Metered Area infrastructure

In the event a development crosses or incorporates a District Metered Area or areas, then the appropriate infrastructure is required to be installed. This would include water meters, valving, housing and associated communication requirements.

6.3.6 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 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 s. 69ZZZ and this shall be adhered to.

6.3.6.1 Materials

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.

All pipes shall be HD PE100, except for lateral connections up to 50 mm ID which shall be MD PE80B. Unless otherwise agreed in writing by the Council. Acceptance of design documentation without separate written approval shall not constitute acceptance of an alternative material.

Refer to clause 3.1.8 - Council Approved Materials List.

6.3.6.2 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.

Refer to *QLDC Backflow Policy 2022* document to determine the level of risk and appropriate backflow preventer (BFP) configuration.

- For Very Low Risk ID <25mm, a non-testable dual check-valve is required to be installed in road reserve.
- For Low & Medium-risk ID <25mm, a testable double check valve must be installed in the road reserve.
- For Low & Medium-risk ID >25mm, a testable double check valve must be installed inside the boundary. This can be installed above ground (either in a building or in a frost protected enclosure).
- For High risk, a testable RPZ backflow device must be installed inside the boundary. This must be installed above ground (either in a building or in a frost protected enclosure).

Refer to Appendix B Drawings B2-6 to B2-10.

6.3.6.3 Electrofusion (EF) Couplers

Use of electrofusion (EF) couplers should be limited to where butt welding is impractical or unsafe, to be agreed with QLDC prior to installation. EF couplers shall be installed by an appropriately qualified welder, in accordance with AS/NZS 2033:2024.

6.3.6.4 Water age

Drinking water supply systems shall be designed to minimise water age to ensure no unacceptable deterioration of water quality. This shall include:

(a) 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;

(b) Mains for short runs shall be reduced in size or looped, for example no-exit roads (see figure 6.5);

(c) 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 the TA on staging, as multiple mains may not be desirable and larger mains with a scouring programme may be preferred instead.

6.3.7 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:

(a) Stagnation;

(b) Turbidity (large fluctuations in flow rates can dislodge the biological slime or stir up settled solids in pipelines);

(c) Pressure;

(d) Surge;

(e) Pumping facilities;

(f) Pressure reducing devices;

(g) Pipe lining materials.

6.3.7.1 Surge analysis

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.

6.3.8 System layout

6.3.8.1 General

Locating infrastructure to be vested on private land will not be acceptable unless specifically agreed with the TA. Water mains are usually located in the road. The location shall be specified by the TA, within the road or space allocation nominated by the road controlling authority. Where approved by the TA water mains may be located in private property or public reserve, and in this case easements shall be required.

Water mains should:

(a) Be aligned parallel to property boundaries;

(b) Should not traverse steep gradients; and

(c) Should be located to maintain adequate clearance from structures and other infrastructure.

(d) Where practicable water mains shall be laid in the road berm outside of the carriageway and any associated drainage features.

(e) All water mains shall be laid within legal public road reserves where practicable. Easements shall be provided for all water supply systems that are to be vested in Council or the system owner where they cross any private land. Pipes shall be generally centrally located within an easement. An easement shall be 3 m wide or to the full extent of the zone of influence, whichever is greater, or unless otherwise agreed by Council.

6.3.8.2 Reticulation layout

A principal water main of not less than nominal internal diameter 100mm, fitted with fire hydrants, shall be laid on one side of all public roads and no-exit roads in every residential development. A nominal internal diameter 50mm rider main shall be laid along the road frontage of all lots not fronted by the principal main. A nominal internal diameter 50mm rider main shall also be provided for service connections where the principal main is nominal internal diameter 250mm or larger. The principal mains serving commercial and industrial areas shall be at least nominal internal diameter 150mm laid on both sides of the road. This requirement may be relaxed in short no-exit roads as long as adequate firefighting coverage is available.

6.3.8.3 Mains layout

In determining the general layout of mains, the following factors shall be considered:

(a) Main location to allow easy access for repairs and maintenance;

(b) Whether system security, maintenance of water quality, and ability to clean mains meet operational requirements;

(c) Location of valves for shut-off areas and zone boundaries (see 6.3.14);

(d) Avoidance of dead ends by use of looped mains or rider mains;

(e) Provision of dual or alternate feeds to minimise service risk.

6.3.8.4 Water mains in private property

Water mains located within private property will require an appropriately sized and registered easement in accordance with the TA's requirements.

C6.3.8.4

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 the TA may approve water mains in easements is a fire main in a right of way.

6.3.8.5 Types of system configuration

Network layouts shall be established in accordance with TA practice. Interconnected ring systems should be provided when feasible. Refer to WSA 03 for further information.

6.3.8.6 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 growth.

6.3.8.7 Shared trenching

Where shared trenching is approved by the TA and utility service owners, a detailed design shall be submitted for approval by those parties and shall include:

(a) Relative location of services (horizontal and vertical) in the trench;

(b) Clearances from other services;

(c) Pipe support and trench fill material specifications;

(d) Embedment and trench fill compactions;

(e) Trench markings;

(f) Services' location from property boundaries;

(g) Any limitations on future maintenance; and

(h) Special anchoring requirements, such as for bends and tees.

Where approved by the TA and utility service owners, shared trenching may also be used for property service connections.

6.3.8.8 Rider mains and duplicate mains

A rider main shall be laid along the road frontage of all lots not fronted by a principal main.

Duplicate mains are required to provide adequate fire protection in the following cases:

(a) Arterial roads or roads with a central dividing island;

(b) Roads with split elevation;

(c) Roads with rail or tram lines;

(d) Urban centres;

(e) Parallel to large distribution mains that are not available for service connections;

(f) Commercial and industrial areas nominated by the TA;

(g) Where required by SNZ PAS 4509.

6.3.8.9 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 crossing restoration. The TA may require extra mechanical protection for the pipes or different pipe materials to minimise the need for future maintenance.

6.3.8.10 Crossings of waterways or reserves

All crossings of waterways or reserves shall be specific designs to suit the TA's requirement.

Crossings shall, as far as practicable, be at right angles to the waterway or reserve. Reference should be made to the TA 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.

6.3.8.11 Location marking of valves and hydrants

The location marking of stop valves, service valves, and fire hydrants shall be to SNZ PAS 4509.

6.3.9 Clearances

6.3.9.1 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 8.2.2, unless the TA 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 6-4. Written agreement on reduced clearances and clearances for shared trenching shall be obtained from the TA and the relevant service owner prior to the commencement of construction.

Table 6-4: Clearances between water mains and underground services

Utility (Existing service)	**Minimum horizontal clearance** (mm)		**Minimum vertical clearance**[1] (mm)
	New main size		
	Nominal internal diameter **≤200mm**	Nominal internal diameter **>200mm**	
Water mains nominal internal diameter >375mm	600	600	500
Water mains nominal internal diameter ≤375mm	300[2]	600	150
Gas mains	300[2]	600	150
Telecommunications conduits and cables	300[2]	600	150
Electricity conduits and cables	500	1000	225
Public stormwater mains	300[2]	600	150[3]
Wastewater pipes	1000/600[4]	1000/600[4]	500[3]
Kerbs	150	600[5]	150 (where possible)

NOTE –

(1) 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.

(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) Water mains should always cross over wastewater and stormwater drains.

(4) 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.

(5) Clearance from kerb and channel shall be measured from the nearest edge of the concrete. For water mains ≤375mm nominal internal diameter, clearances can be progressively reduced until the minimum of 150 mm is reached for mains nominal internal diameter ≤200mm.

(6) Where a main crosses other services, it shall cross at an angle as near as possible to 90°.

6.3.9.2 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:

(a) Protection of the pipeline;

(b) Long term maintenance access for the pipeline; and

(c) Protection of the existing structure or building.

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

Sufficient clearance for laying and access for maintenance is also required. Table 6-5 may be used as a guide for minimum clearances for mains laid in public streets.

Table 6-5: Minimum clearance from structures

Pipe diameter Nominal internal diameter (mm)	**Clearance to wall or building** (mm)
<100	600
100 – 150	1000
200 – 300	1500
375	2000
NOTE – These clearances should be increased for mains in private property (even with easements) as access is often more difficult and damage risk greater.	

6.3.9.3 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.

6.3.9.4 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. 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.

6.3.10 Pipe selection

The selection of the appropriate pipe material, sizes, and classes shall be based on system demands.

6.3.10.1 Standard pipe sizes

The principal main shall be as per manufacturers standard sizes that are readily available in New Zealand, and specifically the Otago region.

6.3.10.2 Minimum pipe sizes

The minimum pipe and fittings PN to be used for water reticulation mains shall be PN 12.5 (see clause 3.1.8 - Council Approved Materials List).

(a) 50 mm nominal internal diameter for rider mains in residential zones;

(b) 100 mm nominal internal diameter for residential zones;

(c) 150 mm nominal internal diameter for industrial or commercial zones.

The TA may also specify minimum pipe diameters for other identified areas such as CBDs.

6.3.10.3 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 the TA.

6.3.10.3.1 Design pressure

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) (see 6.3.7.1)

– Lowest Ground Level (GL) of the proposed main, (m above datum).

The design pressure (m head) shall be used for:

(a) Selection of pipe materials and classes;

(b) Selection of pipe fitting types and classes.

6.3.10.3.2 Minimum pipe PN

The minimum pipe and fittings PN to be used for water reticulation mains shall be PN 12.5 (see clause 3.1.8 - Council Approved Materials List). Designers shall verify the TA's minimum requirement before specifying the required pipe PN.

6.3.10.3.3 Nominated pipe PN

Some TAs may nominate a pipe PN (such as PN 12) for pressure pipes and fittings to standardise on a limited number of pipe PNs, or to allow future operational flexibility within their system. Where this is the case, the design pressure used as the basis for system design, anchorage, and pressure testing shall not exceed the TA's specified operating pressure limit associated with the pipe PN.

6.3.10.3.4 Pumped mains

For water mains in pumped systems, a detailed surge analysis shall be conducted unless otherwise directed by the TA to ensure:

(a) The appropriate surge pressure is included in the calculated design head;

(b) 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.

6.3.10.4 Pipe materials

For acceptable pipe materials and Standards see Appendix A.

6.3.11 Fire flow

The water reticulation system shall be designed to comply with SNZ PAS 4509.

6.3.11.1 Fire protection services

Many commercial and industrial developments require installation of special fire protection services. While it is the responsibility of the site owner to provide these fire services, the developer shall design the water reticulation system to meet the required demands, where these are known in advance.

6.3.12 Structural design

6.3.12.1 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.

6.3.12.2 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 suggest 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 or as agreed with TA.

In developments where liquefaction has been identified, provisions to create resilient services must be considered and implemented where practicable. Relevant information can be found in the document Underground Utilities – Seismic Assessment and Design Guidelines Edition 1 March 2017, and in AS/NZS 2033:2024 Appendix B - Guidelines for PE pipe installation in earthquake zones.

6.3.12.3 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.

6.3.12.4 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.

6.3.12.5 External forces

The external forces to be taken into account shall include:

(a) Trench fill loadings (vertical and horizontal forces due to earth loadings);

(b) Surcharge;

(c) Groundwater;

(d) Dead weight of the pipe and the contained water;

(e) Other forces arising during installation;

(f) Traffic loads;

(g) Temperature (expansion/contraction).

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

6.3.12.6 Geotechnical investigations

The designer should take into account any geotechnical requirements determined under section 2 of this Code of Practice.

Where required, standard special foundation conditions shall be referenced on the drawings.

6.3.12.7 Pipe selection for special conditions

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

(a) Structural adequacy considering ground conditions and water temperature;

(b) Water quality considering lining material;

(c) Compatibility with aggressive or contaminated ground;

(d) Suitability for the geotechnical conditions;

(e) Compliance with the TA's requirements.

6.3.12.8 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, freezing of water mains, and temperature derating.

In such situations the pipe materials, support, and restraint for the pipes and fittings shall be detailed on the drawings.

6.3.12.9 Trenchless technology

Trenchless technology may be used as appropriate for alignments passing through or under:

(a) Environmentally sensitive areas;

(b) Built-up or congested areas to minimise disruption and reinstatement;

(c) Railway and major road crossings;

(d) Significant vegetation;

(e) Vehicle crossings.

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. Any pipes installed using trenchless technology under roads shall be sleeved.

For information on trenchless installation methods see 5.3.6.8.

C6.3.12.9

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, microtunnelling and pipe jacking' (Australasian Society for Trenchless Technology).

6.3.12.10 Embedment

6.3.12.10.1 Minimum pipe cover

Pipelines shall have minimum cover in accordance with the TA or utility owner's requirements. Where the TA does not have specific requirements, the minimum covers as described in AS/NZS 2566.2 may be used.

Within carriageways, trafficable footpaths, and crossings, water mains are to have a minimum of 1.0 m cover unless structural calculations to the appropriate standards have been provided and approved by Council. Laterals can have the cover reduced to 0.6 m within these areas. Cover outside of the carriageway, footpaths, crossings or other trafficable areas shall be no less than 0.6m.

Where cover is reduced from requirements above, pipe loading capacity shall first be checked as per AS/NZS 2566.1 requirements to determine if concrete capping or encasing is required. If pipe loading capacity is acceptable, justification is to be submitted to QLDC for approval of reduced cover. If pipe loading capacity is exceeded, concrete capping or encasing is required as per Appendix B Drawing B4-2.

6.3.12.10.2 Minimum trench width

Pipe trench width design considerations shall be based on the minimum side clearances detailed in Appendix B Drawing B7-1.

6.3.12.11 Pipeline restraint

Anchorage shall be provided at bends, tees, reducers, valves, and dead ends where necessary.

> ***C6.3.12.11***
>
> *In-line valves, especially those nominal internal diameter 100mm or larger, should be anchored to ensure stability under operational conditions. See Appendix B2 drawings.*

6.3.12.11.1 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 the TA.

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 Appendix B Drawing B2-5 and Drawing B7-7.

Thrust blocks for temporary infrastructure shall be designed to the requirements for permanent thrust blocks.

6.3.12.11.2 Anchor blocks

Anchor blocks are designed to prevent movement of pipe bends in a vertical direction. They consist of sufficient mass concrete to prevent pipe movement (Appendix B Drawing B2-5 and Drawing B7-7). Anchor blocks are to be installed as required by the designer.

6.3.12.11.3 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 the TA. However many TAs will still require the use of thrust and anchor blocks.

6.3.13 Reservoirs and pumping stations

Where reservoirs or pumping stations are required, reference shall be made to the TA for its specific requirements.

WSA 03 contains design criteria for pumping stations and reservoirs.

6.3.14 Valves

6.3.14.1 General

All valve types, materials and manufactures shall be approved by the Council's Strategy and Asset Planning Team prior to a design being submitted for acceptance.

Valves are used to:

(a) Isolate reticulation mains from distribution mains;

(b) Isolate smaller reticulation mains from larger reticulation mains;

(c) Isolate planning zone boundaries, for example, industrial, residential, or commercial.

Valves shall be provided:

(d) Each side of freeways, arterial roads, and railway and tram crossings;

(e) Adjacent to street intersections (for ease of location);

(f) In the footway, clear of roadway, where possible.

(g) A valve shall be located on all legs of a junction and positioned no further than 20m from the junction unless otherwise agreed with the Council.

Subject to these considerations, valve numbers shall be minimised.

The TA 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.

6.3.14.2 Siting of valves

The siting of valves shall take a holistic view of the existing infrastructure and proposed additions. General principles to be considered shall include:

(a) Valves shall be sited to provide the control (such as flow, pressure, isolation, and diversion) required by the TA;

(b) Ready access to valves to enable their safe operation. Account shall be taken of traffic and other site peculiarities;

(c) Minimisation of inconvenience to the public by avoiding clustering of surface fittings in the footpath at intersections;

(d) Optimisation of the number and location of valves to meet the TA's operation and maintenance requirements, safe working, and to minimise the effect of a shutdown on the TA's customers.

6.3.14.3 Gate valves

Valves shall have anti-clockwise rotation of the input spindle for closure, unless otherwise specified by the TA. Gate valves nominal internal diameter ≤50mm (commonly called peet valves) shall be clockwise closing unless otherwise specified by the TA.

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 nominal internal diameter ≥80mm shall be gate valves. In-line valves shall be the same diameter as the reticulation main.

6.3.14.3.1 Gate valve spacing criteria

The number of property service connections in a shut-off area shall be in accordance with Table 6-6. 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 6-6.

Table 6-6: Valve spacing criteria

Water main size Nominal internal diameter	**Number of property service connections (nominal)**	**Maximum spacing** (m)
≤150	40	300*
200-300	100	750
375	150	1000
* In rural areas, the maximum spacing is 500 m.		

6.3.14.3.2 Branch mains

Stop valves shall be located on branch mains adjacent to the through water main. The type of joint to be used (Soc-Soc, Fl-Soc or Fl-Fl) shall be based on the required security of the water mains. For transfer mains or reticulation mains (≥ 300mm nominal internal diameter) a tee with a flanged branch, and a flanged valve shall be used (see figure 6.1 and Appendix B B7-4 and B7-5.

Where a road crossing is necessary immediately after the tee branch and there is no space available adjacent to the tee, a stop valve shall be installed on the opposite side of the road (see figure 6.1 and Appendix B B7-4 and B7-5).

6.3.14.3.3 Pressure zone dividing valves

Pressure zone dividing valves and hydrants shall be installed in one of the following arrangements (see figure 6.2):

(a) 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;

(b) A valve with a standard fire hydrant on each side.

6.3.14.3.4 Secure service connections

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 6.3 illustrates typical arrangements to facilitate partial isolation of the main while maintaining supply to the customer.

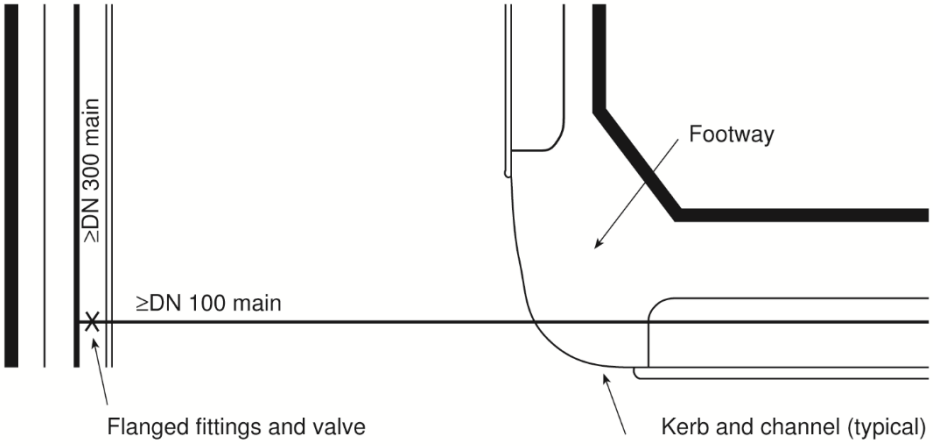


Figure 6.1 – Branch valve adjacent to main

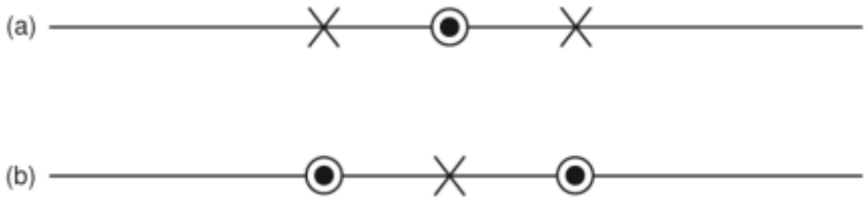


Figure 6.2 – Valve and hydrant combinations for pressure zone dividing valves

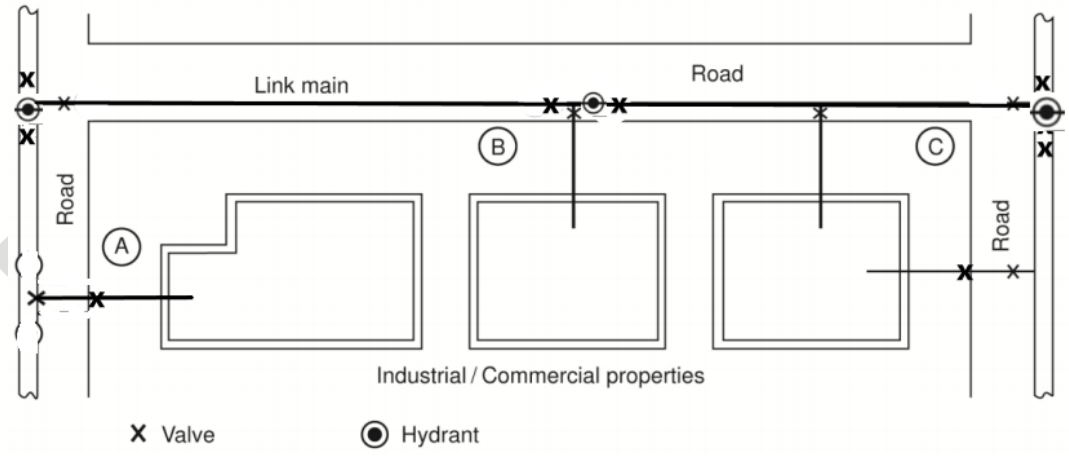


Figure 6.3 – Secure connection

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.

6.3.14.4 Butterfly valves

Butterfly valves shall only be used with the approval of the TA.

C6.3.14.4

Butterfly valves are not normally used in reticulation mains as they hinder swabbing operations, and the quick closing action can induce high surge pressures.

6.3.14.5 Pressure reducing valves

Pressure reducing valves (PRV) are outside the scope of this Code of Practice. Refer to WSA 03.

C6.3.14.5

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.

6.3.14.6 Air valves

6.3.14.6.1 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 nominal internal diameter 80mm for installation on mains. This size has an exhaust capacity of approximately 0.3 m^3/s.

C6.3.14.6.1

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.

6.3.14.6.2 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:

(a) At summits (high points);

(b) At intervals of not more than 800 m on long horizontal, ascending, and descending sectors;

(c) At every increase in downward slope;

(d) At every reduction in upward slope;

(e) On the downstream side of PRVs;

(f) On the downhill side of major isolating valves;

(g) 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.

6.3.14.7 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 <300mm nominal internal diameter.

C6.3.14.7

On mains ≥300mm nominal internal diameter, 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:

(a) Drain the water main by gravity or have provision for pump-out within a period of 1 hour, or both;

(b) Have a diffuser fitted at the discharge point if there is a likelihood of environmental or asset damage; and

(c) Not be subject to inundation.

6.3.14.7.1 Scour sizes

Scours shall be sized in accordance with Table 6-7.

Table 6-7: Minimum scour size

Main size Nominal internal diameter (mm)	**Scour size** Nominal internal diameter (mm)
Nominal internal diameter ≤200	80
Nominal internal diameter >200 –≤300	100
Nominal internal diameter >300 –≤375	150

6.3.14.7.2 Scour locations

Scours shall be located at:

(a) Low points at the ends of water mains; and

(b) 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:

(c) An approved pit that is to be pumped out each time the scour is operated (called a pump scour);
(d) A kerb and channel;
(e) An open-grated street drainage sump;
(f) A natural water course (with energy dissipater).

Scours shall not:

(g) Cause damage when operated;
(h) Discharge to closed stormwater structures;
(i) Discharge across roadways;
(j) Discharge directly to waterways, unless in compliance with the appropriate consent requirements.

6.3.14.8 Flushing points

Flushing points shall be installed at the end of nominal internal diameter 50mm rider mains (see Appendix B Drawing B7-5).

6.3.15 Hydrants

6.3.15.1 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.

6.3.15.2 Hydrants for firefighting

The spacing of hydrants for firefighting shall be in accordance with SNZ PAS 4509.

6.3.15.3 Hydrant installation

Fire hydrants shall not be fitted to reticulation mains with nominal internal diameter < 100mm or to distribution or transfer mains without the prior written approval of the TA.

6.3.15.4 Hydrants for reticulation system operational requirements

Additional to firefighting requirements, hydrants shall be provided at:

(a) 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;

(b) 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.

C6.3.15.4

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.

6.3.15.5 Hydrants at ends of mains

If a scour is not provided, a hydrant shall be installed as close as possible to the end of every main of nominal internal diameter ≥100mm.

C6.3.15.5

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.

Fire hydrants are to be flow tested in accordance with Appendix G of the New Zealand Fire Service Firefighting Water Supplies Code of Practice. The number of hydrants to be flow tested shall be selected to demonstrate that suitable firefighting provisions have been allowed for. The number and location of the hydrants to be flow tested shall be proposed by the developer to Council for review. Council reserves the right to require any and all hydrants to be tested at their discretion.

Any hydrants installed as part of the development that are not to be flow tested shall be inspected in accordance with Appendix G of the Firefighting Water Supplies Code of Practice Comprehensive records of all hydrant flow tests and hydrant inspections shall be provided to Council.

6.3.16 Connections

6.3.16.1 Connection of new mains to existing mains

In specifying connection detail the designer shall consider:

(a) Pipe materials, especially potential for corrosion;

(b) Relative depth of mains;

(c) Standard fittings;

(d) Pipe restraint and anchorage;

(e) Limitations on shutting down major mains to enable connections; and

(f) 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 the TA.

Individual property connections to existing water supply mains with a nominal diameter of 150 mm or greater are not permitted unless specific and prior approval from the TA is received. Any connections to mains greater than 300 mm in diameter must be a three valve configuration (one valve on each leg of the connection) unless specific and prior approval from the TA is received. This configuration should be applied to smaller diameter pipes where appropriate isolation is not available in the existing network.

6.3.16.2 Property service connections

Each Residential Unit shall be provided with a 20mm (ID) dia connection. The connection to each Residential Unit shall include a 20mm (ID) dia Acuflo Manifold including internal backflow prevention located within an Acuflo manifold box on the property boundary within the road reserve.

For Multi-unit developments and multiple rears lots that exceed 5 lots or units then a suitably designed rider main can be installed with the toby valves located within the ROW adjacent to the individual properties or units.

Where it is not practical to install all the meters within the road reserve (i.e. multiple dwellings of three levels or greater), QLDC may at its sole discretion, consent to remote water meters being installed within

the property, where they are readily accessible for reading, maintenance or replacement. In addition to separate meters within the property, multi-unit developments must also have a single property meter located on QLDC's side of the point of supply.

The Acuflo manifold box shall be extended and the Acuflo manifolds shall be located with 550-650mm cover to ground level for all 20mm connections. The toby valve for all other service connections shall be located with 550-650mm cover to ground level within a standard valve box.

Valves shall be located clear of vehicle manoeuvring areas, where practicable. Where this cannot be achieved, the valve shall be protected within a pre-approved trafficable valve box.

Where the District Plan permits two or more Residential Units to be constructed on a single Lot, individual 20mm (ID) dia service connections shall be provided to each Residential Unit or one 25mm (ID) dia service connection for a maximum of two Residential Units. Each service connection shall be connected to the nearest trunk water main or rider water main. 25mm dia water connections shall be divided and reduced to a 20mm dia water connection to each Residential Unit served.

Tapping saddle fittings used with polyethylene pipe must comply with AS/NZS 4129. All other tapping bands should be in accordance with AS/NZS 4793. Mechanical saddles are acceptable for pipe sizes between nominal internal diameter 50mm and nominal internal diameter 150mm. Electrofusion saddles are acceptable for pipe sizes between nominal internal diameter 50mm to nominal internal diameter 300mm. A Tee shall be installed on pipe sizes over nominal internal diameter 300mm. Gunmetal tapping bands on polyethylene pipe is not permitted.

6.3.16.3 Permanent disconnection of water lateral

Permanent disconnection will disable the connection to the extent it will not be possible to restore service through the pipe.

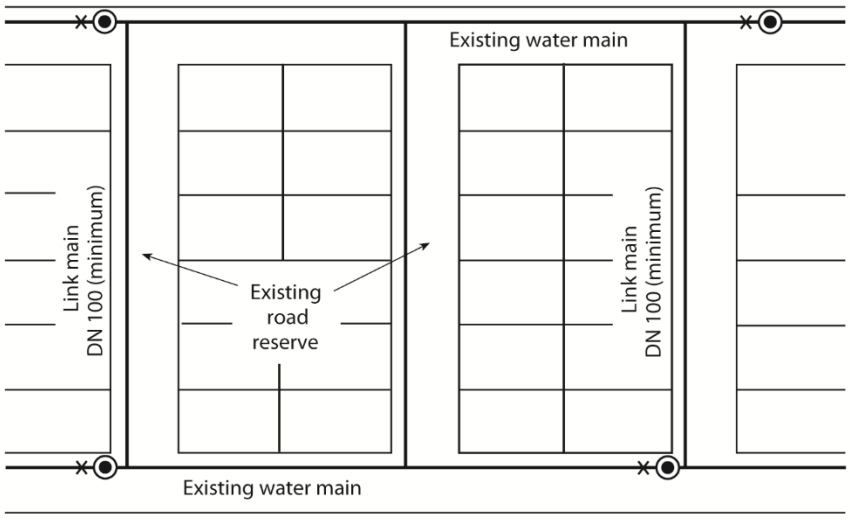
This will require the water connection to the main (whether in the verge or road carriageway) being disconnected and capped off at the main.

6.3.16.4 Live Tapping for Pressure Water & Trunk Mains

Live tapping only up to 50mm ID will be allowed unless approved by the TA. PVC and AC live tapping is only allowed from the side of the main only, unless self-tapping Talbots are used.

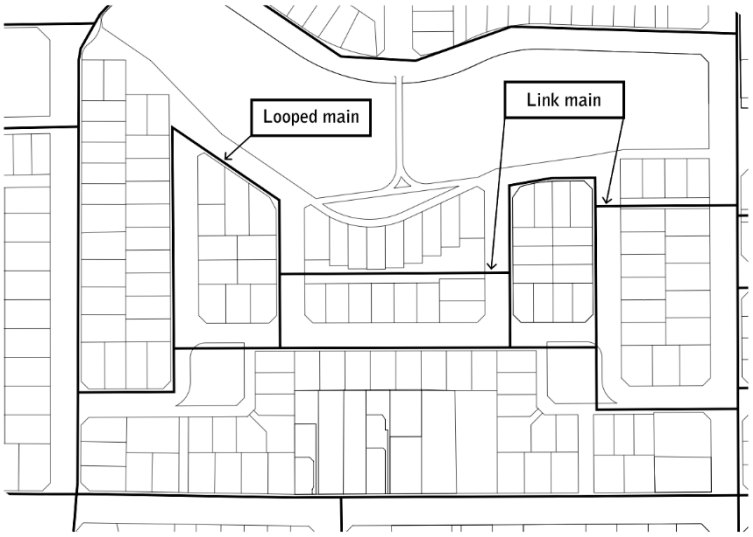
6.3.17 Termination points

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 nominal internal diameter 100mm, particularly in no-exit roads, should be considered (see figures 6.4 and 6.5).



NOTE – Rider mains are not shown.

Figure 6.4 – Elimination of termination points



Note - Rider mains are not shown

Figure 6.5 – Looped and link principal mains

6.3.17.1 Permanent ends of water mains

Rider mains, nominal internal diameter <100mm, may be used to supply the furthest properties beyond the water main. The nominal internal diameter 100mm (or greater) 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 rider main and water main, which shall be suitably anchored (see Appendix B Drawing B7-5).

6.3.17.2 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.

6.3.18 Water Meters and Backflow Prevention

Water meters shall be installed by the developer at all points of supply on the property boundary and must be accessible to pedestrians. Once installed and following 224c certification the meters are owned and maintained by QLDC.

All meters shall be in accordance with QLDC's water metering policy or as agreed in writing by QLDC's Asset Planning and Strategy and Asset Planning teams.

Surface boxes for housing meters and valves, should be in accordance with the council approved material lists.

6.3.19 Building over Council Infrastructure

No building shall be constructed over any water supply pipe, nor shall any structure foundation be located within a line extending at 45º from 150mm below the pipe invert to the ground surface, without the specific approval of the Council.

The Council will only give approval to construct a building/structure over a water main if;

i. It is impractical to construct a new main clear of the zone of influence;

and

ii. A valve is installed within 10m of both sides of the building;

and

iii. The pipe runs in a straight line both vertically and horizontally between valves and shall be PE100;

iv. There are no connections under the building;

and

v. The condition of the pipe is checked pot holes every 10m prior to construction at the applicant's cost and the pipe condition is approved as acceptable by Council;

and

vi. Structures straddling or founded within the above zone are designed by a Chartered Professional Engineer such that there is no loading from the building applied to the water main;

and

vii. Easement to be revised at the applicant's expense and in accordance with the conditions of any specific approval.

6.4 APPROVAL OF PROPOSED INFRASTRUCTURE

6.4.1 Approval process

Water supply infrastructure requires approval from the TA.

6.4.2 Information to be provided

Design drawings compatible with the TA's concept plan and the design parameters included in this Code of Practice shall be provided to the TA for approval. Designers shall ensure the following aspects have been considered and where appropriate included in the design:

(a) The size (or sizes) of pipework throughout the proposed reticulation system;

(b) Selection of appropriate pipeline material type/s and class;

(c) Mains layouts and alignments including:
- (i) Route selection
- (ii) Topographical and environmental aspects
- (iii) Easements
- (iv) Foundation and geotechnical aspects
- (v) Clearances, shared trenching requirements
- (vi) Provision for future extensions;

(d) Hydraulic adequacy including:
- (i) Compliance with the required maximum and minimum operating (working) pressure
- (ii) Acceptable flow velocities, and
- (iii) Compliance with the estimated water demand, including firefighting;

(e) Property service connection locations and sizes;

(f) Types and locations of appurtenances, including:
- (i) Stop valves
- (ii) Pressure reducing valves (PRVs)
- (iii) Hydrants and fire services
- (iv) Scours and pump-out branches and
- (v) Termination details;

(g) Locations and details of thrust blocks and anchors, see Appendix B Drawing B7-7.

(h) Preparation of final design drawings, plans (and specifications if applicable).

6.5 CONSTRUCTION

6.5.1 Excavation

Excavation of existing carriageways shall conform to the TA's road opening procedures where these exist. Excavation in existing carriageways shall be carried out in a safe manner with the minimum disruption to traffic and pedestrians.

6.5.2 Embedment

Pipes and fitting shall be surrounded with a suitable bedding material in accordance with Appendix B Drawing B1-2 to DrawingB1-4).

6.5.3 Backfilling and reinstatement

6.5.3.1 Carriageways

Backfilling shall be in accordance with the requirements of the TA.

Pipe trenches within a carriageway shall be backfilled using an approved hardfill placed immediately above the pipe embedment and compacted in layers not exceeding 200 mm in loose depth, as per Appendix Drawing B1-2 and Drawing B1-3.

In existing sealed roads, the top section of the trench shall be backfilled as specified by 3.4.2.3. The depth of base course and type of finishing coat seal shall conform to the standard of the existing road construction.

6.5.3.2 Berms

Pipe trenches under grass berms and footpaths shall be backfilled in accordance with the requirements of Appendix B Drawing B1-4.

6.5.3.3 Detector tape

Open trenching – backfill shall be placed to 100 mm below existing ground level. At this point, where required by the TA, the contractor shall provide and lay metallic 'detector' tape coloured blue, stipulating 'Danger – Water Main Below' (or similar). See Appendix B Drawing B1-1.

6.5.3.4 Tracer wire

Tracer wire in the form of a continuous 4 mm^2 multi strand (minimum 4) polythene sleeved copper cable, shall be installed with all non-metallic pipes to allow detection. The wire shall be strapped to the pipe wall by means of a minimum of two complete wraps of heavy duty adhesive tape, at a maximum of 3.0 m intervals. The wire shall have some slack to allow for bends in laying and for future installation of tapping saddles.

The tracer wire shall run continuously between valves and hydrants. At each valve or hydrant the wire shall be ducted to surface level through a length of polyethylene pipe ending immediately below the lid, The tracer wire shall be long enough to extend 600 mm minimum above ground level when uncoiled. The excess length shall be neatly coiled in the valve or hydrant box.

The tracer wire shall be tested for continuity between surface boxes using an electronically generated tone and detector probe or alternative approved method.

NOTE tracer wire is not required on water laterals.

6.5.4 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 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 Appendix C for the appropriate testing procedure.

6.5.5 Disinfection of water mains

Disinfection of the water mains shall be carried out following successful pressure testing and backfilling as specified in Appendix D. The disinfection solution shall be collected and disposed of in an appropriate manner.

6.5.6 Discharge of testing water

Discharge of testing or chlorinated water from pipelines may require a resource consent from the regional council.

6.5.7 Water sampling

The TA may require water samples to be taken for water quality compliance purposes. The water sampling points to be installed at the end of the water networks, especially where large subdivsions are expanding the network boundary. Access to the water sampling point to be considered in the design.

7 LANDSCAPE

7.1 SCOPE

Where community specific guidelines are available these shall be taken into consideration throughout the design and construction of subdivisions and development.

This section sets out requirements for the design and construction of landscape and planting for land development and subdivision. Section 7 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.

Design and construction shall be undertaken in accordance with the requirements of Part 7, Landscape of NZS 4404:2010 except as amended and extended for Queenstown Lakes District Council requirements in the clauses below, and any Queenstown Lakes District Council guidelines and specifications relating to landscape and reserves Developments shall comply with Section 7 Landscape of NZS 4404:2010 except as modified by this document.

Throughout the section where the QLDC or Council Operations [Parks] Department is referred to, this should be taken as the QLDC or Council Parks and Open Space Planning team.

7.2 GENERAL

Consultation with Queenstown Lakes District Council's Operations [Parks] department is required on all landscape matters in potential reserves prior to the design phase and development plan approvals. This includes consulting on the potential to create new reserve land and/or improve existing reserves. Public land for reserves shall only be created and vested in Council where there is an identified need in consultation with Council's Operations [Parks] department.

All landscaping and built assets in reserves and road reserves to be vested to Council shall be maintained by the developer for a minimum period of 3 years from the time of receiving 224c certification. A developer's agreement shall be provided to Parks and Open Space Planning team outlining how the reserves will be maintained within this period and the condition they shall be in at the end of this period".

7.2.1 Approval

Consultation with the Council on landscape design and construction at an early stage, and prior to submission of any engineering designs for acceptance, is required. New planting plans are to be signed off by the Parks and Open Spaces Planning Manager prior to planting or establishment of planting areas.

Each TA may have specific landscape guidelines which will be detailed in district plans or codes of practice and some areas may be subject to special landscape requirements which will need assessment through a resource consent process. These may be subject to specific design consideration and approval by the TA. Stormwater systems including secondary flow paths shall be considered when landscape designs are determined, so as to avoid conflict or failure of these systems.

7.2.2 Environmentally-responsive 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.

7.2.3 Reserves and land protection covenants

Queenstown Lakes District Council's requirements for new reserve provisions should be determined prior to the initial design stage through consultation with the Operations [Parks] department.

When assessing reserve provision and development proposals the Council will consider:

- Filling existing gaps in reserve provisions
- Encouraging improvement of existing reserves
- Development designs that are sympathetic to the existing landscape character of the area
- Development designs that will provide recreational benefit to the community and/or District
- Preserving existing lookout and observation points
- Protecting heritage features and sites
- Protecting and enhancing sites of ecological importance
- Securing reserve land at the subdivision stage(s) of development.

Council may request recreation, landscape, heritage or ecological assessments for consideration.

If new reserve land is considered appropriate, layout plans showing proposed location of reserves are required to be approved by Queenstown Lakes District Council's Operations [Parks] department prior to an application for an outline development plan, a plan change, a resource or building consent or a connection to Council services being lodged.

All reserve provision and development proposals should be approved in principle by Queenstown Lakes District Council's Operations [Parks] department prior to any public consultation.

Detailed development plans for all future reserves shall be submitted with applications for subdivision consent, and no work is to be carried out on site before approval of the development plans from Council's Operations [Parks] department. No work is to be carried out until development contributions have been calculated and agreed with Council. Council agreements relating to individual stages of development will allow work to commence on those stages.

All reserve development shall be completed in accordance with the plans acceptable to Queenstown Lakes District Council's Operations [Parks] department. 'As-built' plans shall be provided for all reserves. Development may include earthworks, drainage, irrigation, planting, paths, structures (such as seating, tables, lighting, rubbish bins, fencing, barriers, signs, and play equipment) and facilities (such as toilets and changing sheds) as agreed with Council's Operations [Parks] department.

Unless a license to occupy is agreed by QLDC, gardens in road reserves shall only be provided in areas that are adjacent to commercial or community uses i.e. shops, hospitality, parks, schools or community facilities. In all residential areas, the expected level of service for road reserves is trees and lawn unless a license to occupy the road reserve that ensures maintenance of the garden(s) by the licensee is agreed by QLDC.

7.2.4 Ecological, functional, and aesthetic opportunities

Planting provides a range of ecological, functional, and aesthetic opportunities for environmental enhancement:

(a) Ecological:

(i) Provides, protects, and maintains terrestrial biodiversity and habitat

(ii) Reduces the amount of sediment and pollutants entering waterways

(iii) Maintains and enhances water quality and habitat

(iv) Reduces surface water flooding

(v) Increases stability and contributes to erosion control

(vi) Supports carbon sequestration

(vii) Supports ecosystem functioning including nutrient recycling, water retention, purification, and sediment control

(viii) Provides wildlife habitat value;

(b) Functional:

(i) Defines space

(ii) Provides shade, shelter, and privacy

(iii) Screens unsightly outlooks and provides visual barriers

(iv) Ameliorates sound and reduces pollution

(v) Assists driver recognition of road link and place context

(vi) Reduces glare and reflection and provides urban cooling

(vii) Assists in the control of erosion

(viii) Creates physical barriers

(ix) Provides recreation and amenity value

(x) Provides edible species

(xi) Provides opportunities for enhancing health, and should not be detrimental to it;

(c) Aesthetic:

(i) Frames views

(ii) Emphasises landform and landscape features

(iii) Provides visual unity in the environment

(iv) Reduces the visual impact of the roadway

(v) Softens hard surfaces and bleak areas

(vi) Provides colour, form, and texture

(vii) Provides visual lineage within and between regions

(viii) Provides identity and environment.

7.2.5 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.

7.3 DESIGN

Planting and other landscaping shall be appropriate to and compatible with the local environment. The design layout and plant species selection shall be based on the consideration of the following:

(i) Ability of plants to thrive on the site

(ii) Height of plants at time of maturity and future shading impacts

(iii) Size of planting areas, including road berms, to be compatible with plant species

(iv) To be sympathetic to the existing landscape character of the area

(v) Provide for long-term sustainable management.

Planting and other landscaping features shall be easily maintainable and minimise overall life cycle costs inclusive of establishment, irrigation, maintenance and replacement.

7.3.1 Location

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. Refer to the Queenstown Lakes District Council Street Tree Planting Guidelines.

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.

Detailed development plans showing distances of trees from paths, structures and underground services shall be provided for the approval of Queenstown Lakes District Council's Operations [Parks] department so as to reduce the potential for future conflicts between trees and infrastructure. All trees and vegetation planted near high voltage transmission lines must comply (including when maturity is reached) with the Electrical (Hazards from Trees) Regulations 2003.

All new trees in reserves and road reserves require the approval of the QLDC Arborist unless tress are approved species from QLDC Street Tree Planting Guidelines Appendix I. If a license to occupy has not been granted, and garden assets are proposed to lie within the road corridor in areas of 50 km/hr and above, approval by QLDC's Parks and Opens Spaces Manager is required. This will be assessed based on appropriate levels of service and traffic management requirements in addition to the above criteria.

7.3.2 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 TA'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 CPTED principles.

7.3.3 Existing vegetation and trees

Where there is existing vegetation and/or trees in an area proposed as reserve, Queenstown Lakes District Council's Operations [Parks] department shall decide whether they are to be removed or retained prior to development and Arboricultural and/or Ecological assessments shall be provided on Council's request to inform this decision. Vegetation and/or trees to be removed or retained shall be identified on the development plans.

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 the TA including:

(a) Position and design of temporary protective fencing or other methods of protection;

(b) Arboricultural maintenance required;

(c) Methods of protection of the tree and root zone where construction is to occur near the root zone and tree canopy;

(d) Maintenance required for long term health and stability of the tree or vegetation.

7.3.4 New trees and road geometry

Separation and sight distances should be considered when planting on roads. Alternative location and design proposals shall also be considered, such as provision of trees in a dedicated area or 'non-services' berm in the road reserve. Tree planting in groups can help accentuate road perception (see 3.3.5). Strategically placed, grouped plantings of trees are often of greater benefit and impact than individual trees placed linearly in a roadside berm.

7.3.5 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.

7.3.6 Species selection

In selecting species for planting, take into account the overall composition, low maintenance, and longevity, as well as the need to comply with the TA's planting policies. All new trees in reserves and road reserves require the approval of the QLDC Arborist unless tress are approved species from QLDC Street Tree Planting Guidelines Appendix I. Refer Appendix I for QLDC Street Tree Planting Guidelines.

Fruit trees and native tree species suitable to the environment shall be promoted in reserves, where appropriate.

The spacing of trees and plants should ensure a coherent design. The following matters shall be considered:

(a) Suitability of eco-sourced native plants for revegetation planting of the ecological region to protect the local biodiversity;

(b) Suitability to environmental conditions, for example climate, ground moisture, wind, and shade;

(c) Tolerance to high foot traffic use where appropriate;

(d) Pest and disease resistance, invasive or recognised as a pest plant under the National Pest Plant Accord (refer to http://www.biosecurity.govt.nz/nppa);

(e) Non-suckering habit;

(f) Final height, form, and longevity;

(g) Maintenance requirements;

(h) Safety such as toxicity of leaves, flowers, seeds, and bark in areas likely to be used by young children, and impairments to pedestrians;

Plant species on the road should be selected to avoid interfering with sight lines inconsistent with the target operating speed. The mature size of any tree or garden planting is to be assessed for each planting location and relative to the surrounding street environment.

7.3.7 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. Biodegradable plant protectors/guards are only to be used (no plastic).

7.3.8 Landscaping structures

7.3.8.1 Landscaping structures include (but are not limited to) sculptures, walls, fences, screens, bollards, tree cages, 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:

(a) Inappropriately limit safe sight lines;

(b) Be a hazard to pedestrians, people with disabilities, cyclists, or vehicle traffic.

7.3.8.2 Entranceway wall structures shall be located fully on private land unless TA approval is obtained. Any other immovable landscape structure (for example boulders) shall be located to prevent obstructing access to underground services.

7.3.8.3 Structures shall be designed to safely withstand appropriate loadings. Structures not exempt under the Building Act shall only be constructed on receipt of a building consent.

Design for access and mobility of buildings and associated facilities shall comply with NZS 4121.

All retaining walls including those not requiring a building consent should be constructed to resist lateral earth pressures and those from any surcharge loading that may be present.

7.3.9 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 TA's fencing policy at the time. The TA may specify that one or both of the following options apply:

(a) A fencing covenant is registered on all titles of properties with a common boundary to reserve land, indemnifying the TA against all costs of erection and maintenance of fences on common boundaries;

(b) There is a specific fencing design for the reserve or boundary type.

7.3.10 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.

Depending on the location and season of planting, Queenstown Lakes District Council's Operations [Parks] department may require provision for temporary irrigation of native gardens, grass areas or revegetation planting. Provision for watering during the establishment of plants or lawn may be required for these areas if not otherwise irrigated. Grass areas in reserves in CBDs or shopping precincts, sports field turf and all specimen trees and exotic gardens shall be permanently irrigated and irrigation plans shall be supplied for approval by Council's Operations [Parks] department.

All other reserves, including berms in the road reserve, shall not be irrigated unless with the written agreement of QLDC Parks and Open Space Planning team.

Irrigation shall be designed in accordance with the design standards and specifications included in Appendix F.

7.3.11 Trails and Tracks

All new trails and tracks shall be developed in accordance with the QLDC 2018 Trail Design Standards & Specifications Appendix J.

7.3.12 Playgrounds

New playground designs are to be signed off by the Parks and Open Spaces Planning Manager before resource consent is issued. As-builts for all new assets are to be received by Council before 224c is approved. New playground design and equipment shall comply with NZS 5828 and SNZ HB 5828.1.

7.3.13 Sports field facility development

New playground designs are to be signed off by the Parks and Open Spaces Planning Manager. It is strongly advised this is done before resource consent is issued. Design shall be in accordance with the *Guidance Document for Sports Field Development, 2019.*

7.3.14 Public toilets

New public toilet design shall comply with NZS 4241. All public toilets with pump stations or septic tanks shall be designed in accordance with Appendix G – Sewer Pump Station.

7.4 CONSTRUCTION AND MAINTENANCE

7.4.1 Introduction

There are minimum construction and maintenance standards and recommended procedures to be followed to ensure that all landscaping is to an acceptable standard prior to final inspection and release of the bond, if a bond is required.

It is the developer's responsibility to ensure that the landscaping meets the required standards at the termination of the maintenance period. 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 time of acceptance of as-built landscape plans by the TA or issue of a s. 224 completion certificate under the Resource Management Act.

Sign-off for practical completion shall be obtained from the Queenstown Lakes District Council's Operations [Parks] department at the end of the maintenance period. Maintenance and plant replacement shall be undertaken until sign-off. Prior to sign-off, grass and planting areas shall have a fully established sward of grass or planting coverage without any visible gaps. There should be no weeds present in the planting areas, and weed species should consist of no more than 5% of grass areas. All trees should be in good health, structure, form and be free of disease.

7.4.2 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. 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.

7.4.3 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.

7.4.4 Planting grass areas

7.4.4.1 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 compositions 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.

7.4.4.2 Stormwater reserve grassed areas that are to be mown shall have a high endophyte certified seed. A Fescue/Browntop blend is suggested with a composition of 50% Winter Active Rygrass, 15% Chewing Fescue, 15% Creeping Red Fescue, 18% Tall Fescue, and 2% Browntop.

7.4.4.3 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 decompact 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.

7.4.4.4 All grass areas within a road corridor that has a speed limit in excess of 50km/h are to be planted with high fescue grass on screened soil.

7.4.4.5 Rural berms shall be topsoiled to the same standards as urban berms unless they make use of already grassed undisturbed ground.

7.4.4.6 The area for grass seeding shall be free of all weed species. Grass seed mix shall be in accordance with the Queenstown Lakes District Council Turf Reinstatement Specifications, January 2007.

7.4.4.7 A sward coverage of not less than 90% shall be achieved within 1 month of sowing, and before completion documentation shall be provided for processing by the TA. All established grass shall be mown to a range specified by the TA. 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.

7.4.5 Mulch

7.4.5.1 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 for planting beds shall be a uniform 100 mm in final depth.

Where deemed required, robust timber edging to be included on gardens and mulched areas in order to prevent mulch/soil loss/creep onto walkways etc. Mulched areas timber edging to be maintained at 100 mm minimum. Assessment to be made by Parks Planner or Parks Officer.

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.

7.4.5.2 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.

7.4.5.3 Mulch shall be evenly spread at the base of the trunk and shall not be stacked into a volcano shape.

7.4.5.4 Mulch should be free of all contamination including non-organic debris, pest plants, noxious (as specified under the Otago Regional Council Regional Pest Management plan 2019), contaminants, stumps, branches, and construction debris

7.4.6 Specimen tree planting

7.4.6.1 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 the TA.

Those contractors involved in specimen tree planting and maintenance should be competent horticultural/ arboricultural practitioners and therefore follow accepted industry standard procedures for tree planting. Establishment and initial maintenance are critical to the long-term viability of the specimen tree.

7.4.6.2 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 the TA.

7.4.6.3 Given the generally modified nature of soil in subdivisions it is essential that a suitable tree planting pit be prepared. The approach shall be to have:

(a) Ground free from debris and rubbish;

(b) 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;

(c) Sides of planting holes crumbled and not smooth;

(d) Topsoil incorporated into the upper level of planting holes;

(e) Each tree fertilised with an appropriate amount of slow release fertiliser, as per the manufacturer's recommendations;

(f) Final planted depth consistent with finished ground level;

(g) Each tree adequately staked to withstand movement in natural wind conditions and to meet TA standards;

(h) Trees secured with expandable ties at approximately 1/3 of their height or as high as required to support the tree (to be checked every 6 months) or anchored below ground with a root ball anchor;

(i) Soil firmed sufficiently to force any air pockets from planting holes;

(j) Trees watered immediately following planting;

(k) Trees radially mulched to a distance of 500 mm or to drip line, whichever is the greater area and a depth of 100 mm; and

(l) Staking uniformly low and visually consistent throughout the subdivision stage. 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.

(m) Unless specifically agreed otherwise by Council, new verges that incorporate street tree planting shall be no less than 1.8m in width in order to provide the new trees with a suitable rooting environment and increase their likelihood of becoming successfully established without disrupting the surrounding infrastructure. Appropriate alternative methods should be used in cases where less room is available and street trees would provide amenity.

7.4.6.4 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.

7.4.6.5 Newly planted trees, where appropriate, shall incorporate a suitable and sustainable form of physical support. This support can consist of below ground anchor systems (preferred when planting large grade trees in very high profile situations) or wooden stakes. If wooden stakes are employed, the local climatic conditions shall be assessed and this will determine the dimensions of the supports, though as a guide tree stakes should not exceed 1/3rd of the height of the tree being planted. Options for tree staking include a single stake positioned on the windward side of the tree (only to be used in relatively sheltered areas) two opposing stakes or three stakes in a triangle formation (to be used on large grade trees).

The newly planted tree shall be attached to the wooden stakes using a suitable tie which shall be at least 50mm in width and of a semi-permanent webbing construction made from a biodegradable product such as hessian or an acceptable equivalent. Each tie should be taut, but should not pull the tree towards the stake. The intention is to keep the tree in place while permitting the top to move freely, such crown movement will encourage increases in stem diameter and root development.

7.4.6.6 Providing a suitable rooting environment is crucial to successful tree establishment. Ensuring a newly-planted tree has sufficient good quality, uncompacted soil increases the trees likelihood of becoming successfully established without disrupting the surrounding infrastructure. Certain specialist design features may reduce the soil volumes required within the pit itself, such as interconnected pits, or incorporation of root paths to nearby uncompacted soil.

Achieving sufficient soil volume on sites where the planting area is subjected to loading such as car parking, footpaths, roads above tree roots requires a system of below ground support. Two of the most commonly used methods are structural soils and below-ground, pre-engineered cells. Structural soils are appropriate where other, non-structural soil is also readily available to the tree. For example, trees planted within a parking area adjacent to a soft landscape area, where tree roots can grow freely beneath the hard surfacing, but have access to adjacent uncompacted soil. Pre-engineered cells filled with suitable soil may be necessary in more urban areas where tree roots have fewer opportunities to access soil beyond the tree pit. The use of either approach requires specialist knowledge and advice should be sought from the manufacturer/supplier before being included in the tree pit design.

7.4.7 General amenity planting

Before topsoil is added all stripped and graded ground intended for planting should be cultivated to a depth appropriate to the plant species including a sufficient depth to break up any compaction. There should be friable topsoil for shrubs and ground cover appropriate to the depth of the root ball.

7.4.8 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 the TA or appropriate to form the desired canopy density. 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.

7.4.9 Swales, rain gardens, wetlands, and riparian margins planting

Swales, rain gardens, wetlands, and riparian margins should have site specific planting plans prepared by a suitably qualified person and submitted to the TA for approval of designs. Access shall be provided if future removal and maintenance is required.

7.4.10 Pruning

7.4.10.1 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 to recognised arboricultural practices. Pruning of amenity trees shall comply with AS 4373.

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 users. However there are situations where planting should be used to restrict visibility and slow traffic or frame views.

7.4.10.2 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:

(a) Tips to be pinched or purged as appropriate for species to give desired shape and size;

(b) Form pruning of young plants to ensure compact form and shape;

(c) Undercutting of groundcovers at edges generally;

(d) Plants are to be pruned so that they do not smother neighbouring plants.

7.4.11 Maintenance

7.4.11.1 Planting period and irrigation

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 type of planting and should be covered in specifications and as required by the TA.

The developer shall:

(a) 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;

(b) Clean all paths and surrounding areas;

(c) Remove all plant labels;

(d) Clear and weed all channels;

(e) Ensure that all damaged, vandalised, stolen, or dead plants are replaced to maintain numbers and unity of display;

(f) 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 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:

(g) The land is to be free of noxious weeds (Old Man's beard, Broom, Hemlock, Gorse, all Contoneaster species, all Buddleia species, Briar Rose, Darwin's Barberry, Blackberry, Grey Willow, Cracked Willow, Contorta Pine, Ragword, all Thistle species, Spanish Heath, Tree Lupin, Hawthorn, Sycamore, Silver Birch and all other plants as listed and updated on the Otago Regional Councils website for Pest Plant control), tree stumps (above ground) and other specified vegetation identified.

(h) All previous fences, farm utilities, building remains, and rubbish are to be removed or disposed of to the satisfaction of the TA;

(i) Land to be mown shall be accessible to suitable mowing equipment, and is to have an established turf type seed grass cover;

(j) Drainage reserves, ponds, lakes, channels, and streams requiring maintenance shall have suitable access for machinery;

(k) All boundaries are to be surveyed and clearly pegged or fenced where required;

(l) Any rights of way or easements are to be formalised at no cost to the TA;

(m) Any proposed landscape planting or furniture/structures shall be completed.

7.4.11.2 Maintenance period

Generally, the maintenance period for new reserves shall be minimum three years from receiving section 224c certification, but to be approved by Parks and Open Spaces Planning Manager. The maintenance required during this period shall be outlined in a Maintenance Agreement between the developer and QLDC Parks and Open Space Manager that shall be established prior to obtaining section 224c certification. The Maintenance Agreement shall ensure that all new reserve and road reserve areas are managed in accordance with QLDC maintenance standards. At a minimum, the maintenance period shall include the following requirements:

(a) all new assets, including irrigation, shall be kept in good working order and be free of defects or disrepair.

(b) turf, specimen trees and vegetation shall be maintained to an acceptable standard as specified by QLDC Parks and Open Space Planning team.

(c) the reserves shall be kept in a tidy condition and to not have any loose litter or collections of refuse.

(d) health and safety plans shall be provided for all contractors undertaking maintenance in the reserves or road reserves.

7.4.12 Asset register and plans

At practical completion and prior to section 224c certification, all new reserve and road reserves asset information should be submitted electronically with spatial attributes as outlined in Schedule 1D.

8 NETWORK UTILITY SERVICES

8.1 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.

NOTE – Network utility services in roads are subject to the Utilities Access Act 2010 and the Infrastructure (Amendments Relating to Utilities Access) Act 2010.

8.2 GENERAL

8.2.1 Legislation

Referenced legislation and documents are listed in the Referenced Documents section of this Code of Practice.

8.2.2 Definitions

For the purpose of section 8 the following definitions shall apply:

Code	Means the national Code of Practice approved in accordance with the Utilities Access Act 2010
Corridor manager	Has the same meaning given to it by the Utilities Access Act 2010

8.2.3 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 and gas reticulation.

The developer shall provide satisfactory evidence to the TA 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. The following applies to each utility:

(a) 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 the TA corridor manager and the water supply authority for water pipes, or the TA for wastewater pipes and stormwater systems;

(b) Electric power. The supply of electric power 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 the TA corridor manager. Where the developer is intending to provide electric power other than by underground system, the developer shall provide alternative supply arrangements for approval of the TA;

(c) 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 supplied to the subdividing developer at the time of road construction for installation in the carriageway formation to the requirements of the telecommunications supplier and the TA corridor manager;

(d) Gas. Where an existing gas supply is available or likely to be available to serve a subdivision, the developer may make appropriate arrangements with the gas supply authority and the TA corridor manager, and at the time of road construction, install such ducts/pipes as may be required.

The developer shall follow the requirements of the Code to the extent that they apply to the utility installation for the development.

8.3 DESIGN

8.3.1 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.

> ***C8.3.1***
>
> *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.*

8.3.1.1 In preparing the engineering plans consideration shall be given to the requirements of the network utility operators and the TA corridor manager for:

(a) Minimum cover to cables and pipes;

(b) The network utility operator's desired position for the cable and piping within the road berm as agreed with the TA corridor manager;

(c) The minimum separation distances between power or telecommunication cables, and gas or water mains;

(d) The width of berm which shall be clear of other services and obstructions to enable efficient cable-laying operations.

> ***C8.3.1.1***
>
> *Reference should be made to each network utility operator and the TA corridor manager for their specific requirements. Refer to the Code for further information.*

8.3.2 Utilities above ground

Utilities should preferably be sited within the road berm or on land which will legally become part of the road but which is set back outside the normal road line. Alternatively separate lots (public utility reserves) or easements over private property may be used. If there are any concerns raised about the safety of above ground structures, the risk should be assessed in accordance with the requirements of the Code and any significant risks mitigated.

8.4 CONSTRUCTION

8.4.1 Underground cabling

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 the TA corridor manager.

> ***C8.4.1***
>
> *The trenchless method is preferred in existing urban areas for underground cabling. Refer to the Code for further information.*

8.4.2 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.*

8.4.3 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 the TA.

8.4.4 Commercial and industrial subdivisions

The servicing requirements for commercial and industrial areas are often indeterminate. 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.

8.4.5 Location of services

8.4.5.1 Position in the road

Position and depth shall be agreed with the appropriate network utility operator and the TA corridor manager in accordance with the provisions of the Code.

8.4.5.2 Recording of underground services

TAs shall maintain a procedure for recording the location of their underground services on plans which are readily available to the public at the TA office. It is unlikely that the TA 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 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.

8.4.5.3 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.

8.4.6 Trenches

8.4.6.1 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 the TA corridor manager.

8.4.6.2 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 the TA corridor manager.

C8.4.6

TAs are recommended to prepare standard specifications for the opening of trenches and the restoration of surfaces. Network utility operators are in turn recommended to comply with the requirements of such specifications.

Refer to the Code for further guidance.

8.4.7 Completion of Work

Following completion of the works and prior to issuing a 224c certificate the developer shall provide written confirmation from the Network Utility Service providers that the installation has been completed to their standards and that they are satisfied with access provisions allowing for maintenance and future upgrading of their network.

9 TRAFFIC SIGNALS

9.1 SCOPE

The purpose of this section is to give an understanding of the QLDC requirements when undertaking the design of traffic signal installations in the Queenstown Lakes District, whether they are completely new installations or existing sites that are being upgraded.

For more specialist details in their content and specific design parameters on areas like software, modelling, drawing details and requirements the applicant must read in conjunction with this document Appendix M – Traffic Signal Guidelines.

Signal designs are to be developed in consultation with QLDC and WTOC. Some elements, such as provision of SCATS communication lines, mains power and software preparation require significant time to implement, so early liaison with these parties is critical. Similar lead in times may be required for changes to the operation of existing intersections or for temporary signal installations for traffic management purposes. Therefore, this aspect of signal planning requires special attention.

9.2 GENERAL

The stages of traffic signal design requiring approvals are shown in Table 9-1. From submission to QLDC from the applicant, it is advised to include any deadlines or contract requirements so QLDC can prioritise accordingly. For further technical details and requirements read Appendix M – Traffic Signal Guidelines.

Table 9-1: Traffic signal design stages requiring approvals

Process	Comments
Traffic Signal Feasibility Report	Brief traffic signal report, includes modelling, practical assessments, buildability, costs, future proof, services the users.
Traffic Signal Detailed Design	In depth detail resulting in no surprises during construction, design report showing judgement and considerations evaluated. Drawings and documents at a high standard, minimising risk and unexpected construction costs.

All documents are to be supplied in electronic format including original files from various software applications. For example; SIDRA .sip, AutoCAD .dwg files. This is to ensure that the plans are clear and concise for reviewers, safety auditors and contractors.

Modelling forms part of the traffic signal feasibility report, generally SIDRA is an industry known standard for modelling traffic signals however, other software may be considered. Refer to Appendix M Section 2.

It is expected that the applicant project team members have the experience and knowledge to provide the relevant details, especially in the production of software, CIS and traffic signal design. It is not the job of QLDC or WTOC to provide training or resources for designers who are new to the industry as there are suitable courses and consultants who can provide this level of expertise.

9.3 DESIGN

9.3.1 Technical Criteria

The design of the traffic signals must be carried out in accordance with the standards and guidelines listed below and their revised / subsequent replacements:

- Waka Kotahi P43 Specification for Traffic Signals.

- QLDC Land Development & Subdivision Code of Practice – 2022.
- QLDC CoP Appendix M – Traffic Signal Guidelines.
- AUSTROADS Traffic Management Guides.
- NZTA Road Traffic Standards (RTS) 14.
- NZTA Pedestrian Network Guidance.
- NZTA Safe System audit (SSA) Procedures for transport projects
- NZS1158 Public Lighting Standards
- QLDC Southern Light Strategy

9.3.2 Drawings

The applicant shall provide construction drawings to QLDC for peer review and acceptance. The drawings shall conform to the standards required by QLDC. The signal layout drawing is to comply with the Appendix M – Traffic Signal Guidelines.

9.3.3 Specific signal audits68

In addition to any general project safety audits that include signalised intersections, the applicant shall allow for two specific signal audits. The primary objective of a specific signal audits is to help ensure a project achieves an outcome consistent with Safer Journeys and the Safe System approach. That is, minimisation of death and serious injury.

These audits are:

- A signal design (and safety) peer review
- A post construction installation (and safety) audit with the RCA Traffic Signals Engineer providing the Safety Engineer response as outlined in the Waka Kotahi Safe System audits Procedures for Projects Guidelines

Copies of both safety audits to be retained by QLDC.

The audits are required for temporary and permanent installations. The audits are considered 'hold points' in the construction programme and the applicant shall make provisions in their programme for:

- Undertaking the audits
- Response to the audits, and
- RCA representatives to close off the audits

The applicant is responsible for addressing all issues raised by the auditors or RCA, and for rectifying any defects identified.

As recommended in the Waka Kotahi Safe System audits Procedures, the safety audit team must consist of members that have specific experience in the project subject. The minimum criteria for the team members is as follows:

- Member of the IPENZ SNUG user group
- At least 3 years traffic signal design experience
- Traffic signal performance modelling experience

9.3.4 Traffic Signal Installation Specification

The applicant shall use the Waka Kotahi P43 Specification for Traffic Signals and the QLDC CoP Traffic Signals section as the installation specification. The applicant shall provide details of any deviations from the content of this specification for acceptance by QLDC.

9.3.5 Software Development Procedure

Table 9-2 outlines the process for the development of software. The applicant manages the software development process and will provide the software including independent testing. The times in Table 9-2 are guidelines.

During software / .SFT testing process, the time frames may be extended if software requires reworking due to a fault during testing. The applicant must consider this and plan the process accordingly.

Table 9-2: CIS and SFT Development Flow Chart

Process	Days	Actioned By	Approved By
Create CIS	5 working days	Applicant	N/A
Peer review CIS	5 working days	Applicant	QLDC Traffic Signals Engineer
WTOC approval of CIS	5 working days	N/A	WTOC
.SFT Generation	5 working days	Applicant	N/A
.SFT test Report (Win Traff)	5 working days	Applicant	QLDC Traffic Signals Engineer
.SFT test in SCATS and Test Rig	5 working days	Contractor	WTOC
Total	**6 weeks**		

9.4 APPROVAL OF PROPOSED INFRASTRUCTURE

The approval process for land development and subdivision design and construction and documents and supporting information on traffic signal infrastructure to be provided at each stage of the process shall be in accordance with Section 1 and Section 9 of this Code of Practice.

9.4.1 Information to be provided

1. Traffic Signal Feasibility Report
2. Traffic Signal Detailed Design
3. Pre-Construction Safe System audits
4. Post-Construction Safe System audits
5. CIS
6. SFT Wintraff Test Report

9.4.2 Commissioning

Commissioning shall be as per Waka Kotahi P43 Specification for Traffic Signals.

Waka Kotahi P43 Site Acceptance Test (SAT) process and New Intersection Commissioning Form ensure all documentation and processes are understood before the traffic signals are switched on.

The installation contractor as part of their pre-commissioning and final testing, using the P43 Site Acceptance Test, shall audit the hardware and operations of the signals prior to switching on the traffic signals live on street. The traffic signals must be run on site without the lanterns on for at least 24 hours prior to switching on to validate operations in SCATS.

Fully completed and approved P43 Sight Acceptance Test Chart document (pre commissioning version) needs to be submitted three days prior to the proposed traffic signal commissioning switch on date. If this document is not submitted QLDC reserves the right to extend the commissioning / switch on date until the pre commissioning document is received and approved.

9.4.3 Site Acceptance Testing (SAT)

Prior to commissioning, the applicant is to contact QLDC and WTOC with a minimum of three working days' notice, to propose switch on and commissioning.

The applicant is responsible for liaising with QLDC and WTOC to ensure that all parties are kept up-to-date with proposed commissioning dates and times for each new or modified signal installation.

Commissioning is to be timed to occur:

- At least 2 hours outside any recognised peak traffic periods
- Only during weekdays, and
- Not Friday, Saturday, Sunday or public holidays, unless there is agreement from QLDC and WTOC.

The applicant and the construction signal contractor are required to attend the commissioning and to continue to monitor the site throughout the first am and pm peak period and any time required thereafter to ensure the integrity of the software and hardware and to identify and rectify any operational problems.

Correct operation under isolated control is to be verified prior to connecting the Telecom line for SCATS operation. The site must be connected to the SCATS system 24 hours prior to the switch on of the installation as this allows time for setting up the SCATS data and graphics and means the site can be monitored when it is switched on.

All comments to be recorded in the P43 Site Acceptance Test (SAT). Once switched on and the signed original P43 Site Acceptance Test (SAT) has been completed by all required parties, QLDC will take over operations and the applicant can progress practical completion.

9.5 CONSTRUCTION

Traffic signal installation shall be governed by the Waka Kotahi P43 Specification for Traffic Signals with the following special conditions relevant to traffic signals within the Queenstown Lakes District:

9.5.1 Cabinet Heater

A heater unit shall be included in every traffic signal cabinet in order to suppress condensation and protect the electronic equipment to run within the temperature range specified by the manufacturer.

9.5.2 Sawcutting Loops

Where inductive loops are sawcut into existing pavement the cut shall be a minimum of 40mm deep to mitigate freeze/thaw effects.

9.5.3 Overhead Detection

Overhead detection for vehicles, pedestrians or bikes must use radars or thermal cameras. Normal video detection is not desired and must be approved by QLDC with justification.

9.5.4 Controllers

All controllers shall be VC6 compliant. The traffic signal controller connection shall include a dual port moxa.

9.5.5 Closed Circuit Television (CCTV)

CCTV shall be supplied at every new signal installation. At minimum one CCTV camera dedicated to WTOC traffic observation shall be installed. The applicant must also coordinate with QLDC for additional monitoring equipment desired (if any).

Traffic observation camera visibility is to be verified with WTOC before final installation. The specific equipment shall be the standard used by WTOC. At the time of this publication the preferred cameras are:

- For Dome cameras Axis Q-6055-e
- For Pedestal cameras Pelco Esprit 6230

It is desirable to have CCTV in place and running at the commencement of a major project to aid monitoring of the site during the various phases of construction. This is of particular importance if temporary traffic arrangements are to be implemented during construction.

9.5.6 Street Lighting

Engagement with the QLDC Property & Infrastructure chief engineer is required to ensure lighting meets QLDC requirements, please refer to the QLDC Southern Light Strategy documents. Where JUSP poles are used, street light cabling must be isolated from traffic signal cabling and have its own electrical protection.

9.5.7 Power supply

The Electrical Supply Authority (ESA) power supply termination and High Rupturing Capacity (HRC) fuse should be positioned within close proximity of the controller cabinet. Preferably within 10m and shown in traffic signals as built drawings. Original Electrical Certificate of Compliance to be submitted as part of the commissioning process.

The traffic signal contractor shall:

- Arrange for local power connection using a smart meter from the local electrical supplier
- Submit the appropriate forms and documentation, and
- Consult with QLDC for the site address and account billing information before the application is submitted.

All costs associated with planning are to be paid by the applicant including installation costs for the smart meter box, reader units, cabling and ducting, as required.

The traffic signal contractor shall record the mains power supply location and direction of source and this detail is to be shown in the traffic signal as-built drawings.

9.5.8 Generator Socket

Any new controller, UPS or standalone CCTV/communications cabinet shall be fitted with a Generator Socket unless otherwise specified.

9.5.9 Uninterrupted Power Supply (UPS)

When traffic signals at an intersection are blacked out due to loss of power supply, police are notified to perform point duty. At complex intersections emergency power must be provided for.

Portable generators can be used to provide emergency power via a Generator Socket. However, an uninterrupted power supply must also be installed where one or more of the following conditions apply:

- Conflicting, opposing and parallel through approaches cannot be seen from any approach stop line.
- More than one Police officer is required to work the point.
- Sites with significant number of Heavy Goods Vehicles (HGV)
- UPS is required at the direction of QLDC due to complex geometric design and inadequate sight distance factors.

Where a UPS is required the applicant shall be responsible for all additional costs. To house the UPS an additional cabinet may be required. The UPS must meet the requirements of Waka Kotahi P43 Specification for Traffic Signals.

9.5.10 Communication System

Communications at traffic signals are a vital part of their operations and are required to be operational for commissioning / switching on traffic signals. Minimum telecommunications connectivity shall be the highest available spec VDSL connection and shall be confirmed to the RCA Traffic Signals Engineer prior to installation.

If a permanent communications line is not able to be provided prior to commissioning then a temporary 3G or higher connection may be provisioned only if prior approval from QLDC is obtained. The applicant shall be responsible for all costs in relation to communications, until commissioning is complete and the permanent communication line is operational.

Contact WTOC for information on communication providers. The application for connection can be submitted once the traffic signal controller location has been approved.

9.6 MAINTENANCE AND UPGRADES

The applicant will remain responsible for maintenance and any faults throughout the construction period. For upgrades works the site history and asset information of the intersection can be requested from QLDC to assist in evaluating costs when tendering. QLDC will invite their maintenance contractor and all parties shall inspect, following successful Site Acceptance Test, refer to P43, QLDC will take over maintenance of the traffic signals following the audit.

Equipment warranty and guarantees shall remain as detailed in Waka Kotahi P43 Specification for Traffic Signals.

Where upgrade works are required on an existing traffic signal intersection the traffic signal installation contractor (unless otherwise detailed in the contract conditions) shall be responsible for the operations and maintenance of the traffic signal installation.

9.6.1 Response Times

QLDC will inform the applicant / traffic signal installer to any reported faults under the priority requirements as defined below. The RCA Traffic Signals Engineer may add conditions to the priority as required for each fault. Maximum permitted response of priority is measured from the time the fault was reported.

All requests for Emergency Maintenance, Accidental or Vandal Damage, and Minor Repairs shall be attended to promptly, emphasis should be placed on resolution time in preference to response times.

If any of the priorities below cannot be met, QLDC shall arrange for their maintenance contractor to attend the fault. Any costs incurred shall be claimed from the applicant by QLDC.

9.6.1.1 Priority 1 Faults (on a 24hrs per day, 7 days per week basis)

The target of maximum Response Time for the Contractor to arrive at the location of the fault and commence remedial work is 60 minutes from the time that the fault was first reported to the Contractor. Faults shall be attended as soon as practicable within the 60-minute period however, it is expected and understood that due to distance, some call outs may not be able to meet these response requirements.

Priority 1 Faults are defined as:

- Failures affecting the safe operation of the signals or safe display of signals, eg: Conflicting signals, no display on one or more approaches, non appearance of any phase when demanded, etc
- All lights out, BO or FY conditions,
- Other conditions may be added at the Engineer's discretion.
- Damage caused by accident or vandalism affecting the safe operation of the signals or safe display of signals, eg.
    - Cabinet damaged that has the potential to cause the controller to not functioning correctly, or
    - be protected from the elements,
    - Signal pole no longer being within 10° of vertical or protruding into the carriageway,

- Signals misaligned so that conflicting signals are visible and/or signals are no longer visible to approaching traffic, and
- Wiring or terminals exposed to the elements (eg. Lantern doors open, finial cap off etc).

9.6.1.2 Priority 2 Faults (on a 06:00 to 23:00, 7 days a week basis)

The maximum permitted Response Time for the Contractor to arrive at the location of the fault and to commence remedial work is 4 hours from the time that the fault was first reported to the Contractor.

Priority 2 Faults are defined as:

- Failures affecting local Controllers ability to communicate with SCATS system:
- Eg SCATS alarms, and faults with push buttons and also tactile/vibrating indicators for blind pedestrians.

The Response Time for Priority 2 faults, as defined above, which are outside the hours above shall be prioritised for response by 10:00 am next day.

9.6.1.3 Priority 3 Faults (on a 7 days a week basis)

Maximum 24-hour response

- Failures or damage not affecting safe operation or display.

The maximum permitted Response Time for the Contractor to arrive at the location of the fault and to commence remedial work is 24 hours from the time that the fault was first reported to the Contractor.

Priority 3 Faults are defined as:

- Failures or damage not affecting safe operation or display:

Depending on weather and TMP requirements, display replacement on mast arms may be extended to a maximum of 5 days for priority 3 faults only.

Note: The logging in the Dispatch in RAMM of the Time Arrived on site and the Time Completed is the responsibility of the Contractor.