Infrastructure Committee

13 March 2025

Report for Agenda Item | Rīpoata moto e Rāraki take [6]

Department: Property & Infrastructure

Title | Taitara: Land Development and Subdivision Code of Practice update - Stage 3

Purpose of the Report | Te Take mō te Pūroko

The purpose of this report is to seek endorsement from the Infrastructure Committee on the proposed changes to the Land Development and Subdivision Code of Practice (CoP), this will allow the proposed version to proceed to the final step of approval with is adoption of the new version at the next Full Council meeting.

In order to gain this endorsement this report includes:

- A copy of the proposed CoP (including all appendices) with all proposed changes identified in red text.
- The results from the consultation process in the form of a tracking sheet that includes the details of the submission and the response/action that came from it.

Recommendation | Kā Tūtohuka

That the Infrastructure Committee:

1. **Note** the contents of this report; and

2. **Endorse** the proposed changes to the CoP as recommended in Option 2.

Prepared by:	**Reviewed and Authorised by:**
Name: Richard Powell	**Name:** Tony Avery
Title: Infrastructure Development Engineering Manager	**Title:** General Manager, Property & Infrastructure
17 February 2025	**18 February 2025**

Context | Horopaki

Background

1. Land Development and Subdivision CoP sets out the minimum standards that must be met for civil works and infrastructure constructed within new developments.

2. The CoP is based on the New Zealand Standard 4404:2004 with amendments made over previous iterations to suit the specific needs of our district.

3. Periodic reviews are undertaken to ensure the CoP stays relevant to the changes in the development, civil design, and civil construction industries as well as refining approaches to better protect the environment both natural and developed.

4. Stage 1 and 2 of the current update included minor amendments, removal of contradictions and any amendments that did not involve a cost implication to developers. The changes under Stage 1 and 2 were adopted in 2020 and is the CoP used currently.

5. Stage 3 (current stage) includes significant amendments carried over from Stage 2 and the internal Queenstown Lakes District Council (QLDC) department requests and requests form consultants and developers who use the document. From these requests the 2022 draft CoP was produced and went out for consultation. Due to the scale of changes following that consultation process and the time taken to make those changes a new 2024 draft was produced and went out for further consultation in late 2024.

6. The response to the last round of consultation has informed the 2025 draft CoP which is provided as an appendix to this report seeking endorsement from the Infrastructure Committee prior to providing to full Council for adoption.

Proposal

7. In the proposed update to the CoP there are over 130 changes, this review was done with a particular focus on stormwater management to lessen environmental effects and ensure stormwater systems built today are suitable for the future.

8. This includes updates to the standard drawing set and specific parameters for assessing and designing for stormwater catchments, as well as additional requirements and methodologies for designing and using stormwater treatment and soakage devices.

9. These changes reflect the working knowledge and practical issues encountered in the district, and work to continue aligning the Queenstown Lakes CoP with best practice and to ensure infrastructure meets local conditions and community expectations.

10. In addition to the changes to the Stormwater section the process has endeavored to rectify any apparent issue within the CoP that has been advised/identified by any of its users through either comments and requests over the years or through the specific consultation processes.

Consultation

11. The last consultation process was open for 8 weeks from to the 26 August to the 6 October 2024. At the close of the submissions period, over 200 submission points from 24 individuals or companies were received.

12. In the cases where submissions were technical in nature or if it was unclear what the submission was intending, the submitters were contacted or met with to constructively work through their submission to ensure the intent was understood.

13. All submissions that were received have been considered and addressed, the record of this is found in the submissions tracker amended to this report.

14. For highly technical matters the changes to the CoP were subject to a peer review specifically this included the entire Stormwater section, anything that had geotechnical implications and the Southern Lighting Strategy.

Future of the QLDC Land Development and Subdivision Code of Practice

15. There were a number of points raised from the consultation process that were either out of scope of this review or required a significant amount of work to get to a position where they could be incorporated into the CoP. In these instances, the issues were recorded to be either be considered under the next review or be provided as a separate guidance document, depending on the situation.

16. While this update has had a focus on Stormwater it has become evident that there is a real demand for the roading and transport section to be updated therefore a further update to the CoP is planned for 2026 to revise the Roading and Transportation sections of the CoP, at this time the outstanding items that were not able to be closed out in this round would also be considered.

17. The Local Government (Water Services) Bill (Introduced December 2024) provides the Water Services Authority – Teumata Arowai powers to develop a mandatory set of National Engineering Design Standards (NEDS) for water services. No timeline has been set out for when the NEDS will need to be adopted however the Bill is likely to be enacted mid 2025 following that the NEDS will be finalised through a consultation process. The Department of Internal Affairs intend to provide further information once the Bill is enacted.

18. Having an up-to-date CoP will put QLDC in a good position to make submissions to the NEDS with our position already considered and documented. The NEDS is also limited to 3 waters reticulated infrastructure therefore sections of the code that relate to roading, transport and trunk infrastructure will still be relevant and required.

Analysis and Advice | Tatāritaka me kā Tohutohu

19. This report identifies and assesses the following reasonably practicable options for assessing the matter as required by section 77 of the *Local Government Act 2002* (LGA).

20. Option 1 – Do nothing, decline the option to endorse the proposed 2025 version of the CoP and continue to use the current version of the Land Development and Subdivision CoP (2020).

    Advantages:

    - Developers, Designers and internal QLDC officers who use this document are familiar with the current version will not need to learn a revised version of the CoP.
    - Council can wait for the central government roll out a nationally standardised Land Development and Subdivision CoP.

    Disadvantages:

    - Relying on the existing 2020 CoP will mean that any shortfalls in that version, which have been remedied with the proposed update, will remain to be acceptable through the consenting process until a national standard is available and enforceable.
    - There is currently no confirmed timeframe for when a national standard will be provided, therefore the current 2020 CoP could be continued to be used for some time.

21. Option 2 – Accept all proposed changes to the CoP and provide endorsement for it to be adopted at the next full Council meeting.

    Advantages:

    - This will allow the 2025 CoP version to proceed to the final step of being considered for approval (adoption at Full Council meeting) which will then allow it to be implemented and complied with providing a standard that better suits the district and remedies issues within the current version of the CoP.

    Disadvantages:

    - The revised 2025 QLDC COP and the changes from the current version will need to be learnt by Developers, Designers and internal QLDC Staff who use this document.
    - The new 2025 QLDC COP may be redundant if or when central government rolls out a nationally standardised Land Development and Subdivision CoP and require all Councils to adopt it.

22. This report recommends Option 2 for addressing the matter because this will allow the 2025 version of the CoP to proceed to the final step of approval (adoption at Full Council meeting) as a full document that has had the input and consideration from:
    - Resource Management, Capital Delivery and Operations and Maintenance Departments within QLDC.
    - Consultants, Designers and Developers from both within and outside of the District.
    - Expert peer reviews of the technical content.

Consultation Process | Hātepe Matapaki

Significance and Engagement | Te Whakamahi I kā Whakaaro Hiraka

23. This matter is of high significance, as determined by reference to the Council's Significance and Engagement Policy 2024 because the proposed updated to the CoP have a high community interest, is amending a currently adopted and used document (2020 CoP). The updates to the CoP do not involve any strategic assets.

24. The persons who are affected by or interested in this matter are developers, designers, consultants, internal QLDC staff.

25. The Council has contacted all developers and consultants that actively work with the CoP to request submissions on the updates, a specific request was also sent out to all relevant QLDC staff and publicised the submission period to the general public.

Māori Consultation | Iwi Rūnaka

26. The Council has not specifically consulted with Iwi Rūnaka over the proposed changes however opportunity to make a submission on the changes through the public consultation process was available.

Risk and Mitigations | Kā Raru Tūpono me kā Whakamaurutaka

27. This matter relates to the Environmental risk category. It is associated with RISK10027 Inadequate construction management causing failure of infrastructure service or property damage within the QLDC Risk Register. This risk has been assessed as having a moderate residual risk rating.

28. The approval of the recommended option will allow Council to implement additional controls for this risk. This will be achieved by adopting the changes that more stringently require the proper management of stormwater.

Financial Implications | Kā Riteka ā-Pūtea

29. No further expense will be incurred or additional resource required for any of the options described above. This is excluding a small amount of internal resource that would be required to

prepare and present the CoP updates to the Full Council for adoption if option 2 or 3 were to be chosen.

Council Effects and Views | Kā Whakaaweawe me kā Tirohaka a te Kaunihera

30. The following Council policies, strategies and bylaws were considered:
    - Vision Beyond 2050: Our Vision and Mission - QLDC
        - Disaster-Defying Resilience – Through resilient infrastructure
        - Deafening Dawn Chorus – By protecting waterways and other ecosystems;
    - Pressure Sewer Policy – Confirming any changes to the CoP aligns with this policy;
    - Policy for the Provision of New Water Supply and Sanitary Sewer Connections - Confirming any changes to the CoP aligns with this policy;
    - QLDC Disability Policy has also been considered, further consideration will be given when roading and transport sections of the CoP are updated to ensure alignment with the policy.

Local Government Act 2002 Purpose Provisions | Te Whakatureture 2002 o te Kāwanataka ā-Kīaka

31. Section 10 of the LGA states the purpose of local government is (a) to enable democratic local decision-making and action by, and on behalf of, communities; and (b) to promote the social, economic, environmental, and cultural well-being of communities in the present and for the future. The underlying purpose of the updates to the CoP is to ensure what Council require of subdivisions and developments enhances the build environment and protects the natural environment, the addition requirements, specifically around Stormwater, are intended to ensure the appropriate design and management of stormwater is implemented.

32. The recommended option:
    - Can be implemented through current funding under the Long Term Plan and Annual Plan;
    - Is consistent with the Council's plans and policies; and
    - Would not significantly alter the intended level of service provision for any significant activity undertaken by or on behalf of the Council or transfer the ownership or control of a strategic asset to or from the Council.

Attachments | Kā Tāpirihaka

A	QLDC Land Development and Subdivision Code of Practice 2025 (Proposed)
B	QLDC Land Development and Subdivision Code of Practice 2025 Appendices (Proposed) – **Please note this attachment is a standalone document**.
C	Submissions Tracker

Attachment A: QLDC Land Development and Subdivision Code of Practice 2025 (Proposed)

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.

2025 amendments from the 2020 Code of Practice 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	07/10/15	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	23/09/20	Asha Schaefer – Civil Engineer	Ulrich Glasner – Chief Engineer David Wallace - Principal RME
13	Amendments as per 2021/22 Submissions – Draft for public consultation	09/06/22	Asha Schaefer – Civil Engineer	Richard Powell – Infrastructure Engineer, Chief Engineering

14	Amendments as per 2024 Public Consultation document and as per 2024 Submissions	20/02/25	Nisha Dahal –Infrastructure Development Engineer Sam Metcalfe – Infrastructure Development Engineer	Simon Leary – Infrastructure Delivery & Engineering Manager Richard Powell – Infrastructure Development Engineering Manager

CONTENTS

DISCLAIMER

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

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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

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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 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

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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

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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)

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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 and loading 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, territorial reinforcement, and quality environments of the built environment. These CPTED principles lead to a reduction in the incidence and fear of crime as well as an improvement in the quality of life

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) with a practice field in Geotechnical Engineering or a chartered engineering geologist (PEngGeol) 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 self contained household unit, whether of one or more persons, and includes accessory buildings. Where more than one 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 deemed 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/m^3	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
m^3/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
SQEP	Suitably Qualified and Experienced Person
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 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. For small scale civil design work Council will generally accept Chartered Professional Engineer (CPEng) and Survey and Spatial New Zealand Certified Professional Land Development Engineer qualifications. Large scale civil design, complex civil design or civil design related to the specific situations referenced below will need to be completed by a CPEng. 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, alongside the requirement to practice within scope of competency and experience

a. Traffic and transportation assessment, barrier design, Safe System audits, and Safe System audits exemptions – Suitably Qualified and Experienced Person shall be a CPEng with a practice field in Transportation with a recognised design competence in Traffic Engineering or Traffic Safety;
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 a CPEng with a practice field in Civil or Transportation with a recognised Pavement Design competence;
c. Stormwater engineering incorporating flood mitigation, catchment analysis or stormwater system design - Suitably Qualified and Experienced Person is required to sign off design and that person shall be a CPEng with a practice field in Civil or Water with recognised Stormwater discipline competence. 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.

d. Civil Structures Design - Suitably Qualified and Experienced Person is required to sign off design and that person shall be either a CPEng with a practice field in Structural Engineering or Civil with recognised Civil Structures discipline competence.

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 sub-base and 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 10 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)

Copyright waived

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

……………………………………………………………………………………………………

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QUEENSTOWN LAKES DISTRICT COUNCIL

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. Include Warranties for luminaires, warranties for poles, street light location plan with marked up pole numbers.
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
Approved Materials – 4 Transport

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 1.2.2 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 (e.g. 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.

Any retaining wall should be checked against the Building Code to confirm if a Building Consent is required. Satisfying the requirements of this code does not exempt the retaining structure from requiring a building consent.

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;
- Where a load is to be applied to the head of the slope;
- 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)

Copyright waived

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.

Where a development may affect the state highway network or require a connection to the state highway, NZTA's agreement and/or written approval may be required. The types of proposals typically requiring NZTA approval include:

- *Creating, upgrading, moving or otherwise changing an accessway onto a state highway.*
- *Changes to intensification of existing land use activities on properties accessed from the*
- *State highway (i.e. from residential to commercial or increased residential density).*
- *Subdivisions or new activities (including building new structures or undertaking works) in land designated by Waka Kotahi – our land use designations may be for state highways, cycleways or shared paths.*
- *Subdivisions or new businesses requiring access to the state highway.*
- *Subdivisions or new businesses not requiring access to the state highway but generating potential traffic impacts on the state highway network.*

Note: Stormwater connections from surrounding development directly to the State Highway stormwater networks are not generally supported by NZTA. This is to ensure the operation of the state highway stormwater network is not compromised through third party use.

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 who are 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 an 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. Additional Safe System audits may be required at later design and implementation stages at Council's discretion.

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 Section 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 are made by employees (typically	Individual or small clusters of activities located outside the urban limits, such as school campuses and research facilities.	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 concentrated	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 population of

LAND USE	AREA TYPE			
	RURAL	SUBURBAN	URBAN	CENTRE
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.*	*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.*	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.*	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 carriageway 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. Carriageways 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 carriageway *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 Property and Infrastructure Department 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 superelevation 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 carriageways 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 carriageway 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 (8.8m) 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, sealed	Shared (in movement lane)	2.50	Lane (this would normally be a private road or private way)		E1
	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

PLACE CONTEXT			DESIGN ENVIRONMENT				LINK CONTEXT					TYPICAL PLAN AND CROSS SECTION	
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**	**TYPICAL PLAN AND CROSS SECTION** **SEE APPENDIX E FOR LARGER VERSION OF FIGURES**	**FIGURE NUMBER**
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 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**
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**

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	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
	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

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)	**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**
	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**

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	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
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

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)		**E11**
	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**

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**	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**
	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**

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	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**
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**

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	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
	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
Urban	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
Urban	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, NZ guide to pavement evaluation and treatment design (with a design life of 25 years), and Austroads Guide to Pavement Technology Part 2: Pavement Structural Design.

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. The curvature function is to be checked and submitted as part of design for Arterial Roads (GT4) with asphalt surfacing and is to meet the requirements in the NZTA guide to pavement evaluation and treatment design.
>
> For other roads, mechanistic or empirical 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.

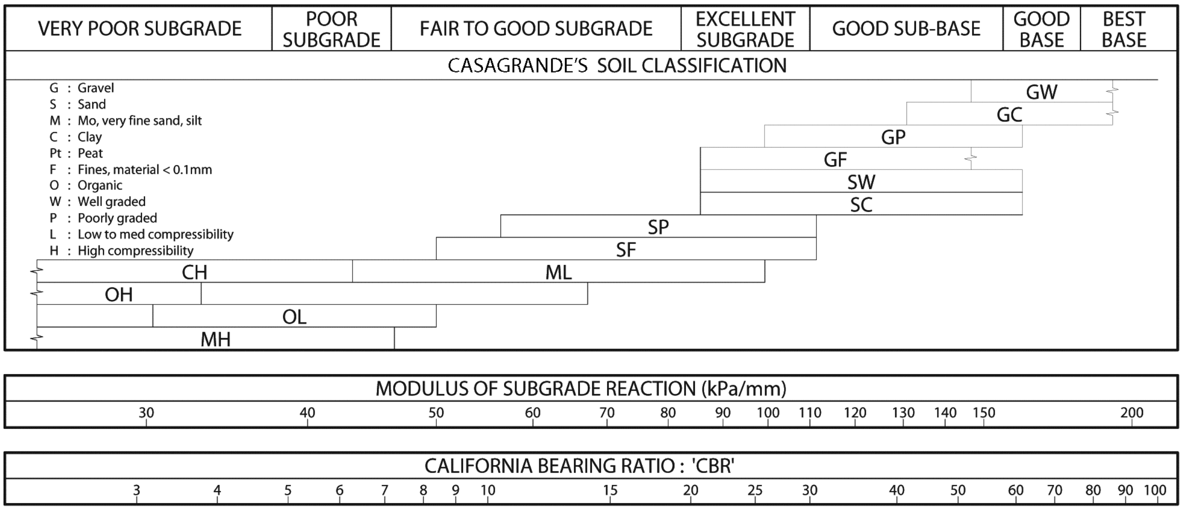
Where CBR values are required for aggregates, these shall be based on laboratory tests prepared on the fraction passing the 19 mm sieve but a CBR of more than 30 shall never be used. The use of CBR on metal layers shall only be in conjunction with consideration of the CBR and stiffness of lower layers.

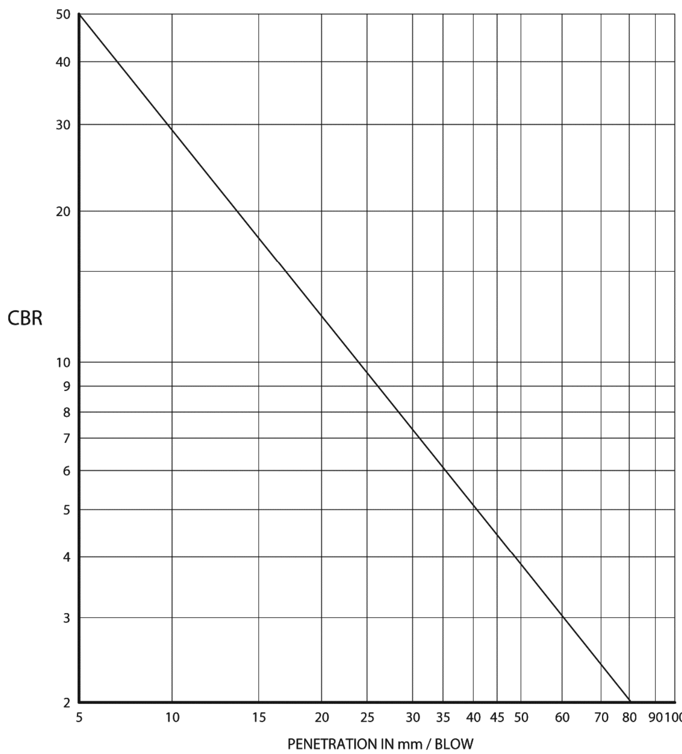
The use of Scala Penetrometer to determine the CBR value on local roads with clay and colluvial materials shall be approved by the Council at its sole discretion.

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 to support the assumed deflections in Section 3.4.11. Any assumptions in the design 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.*

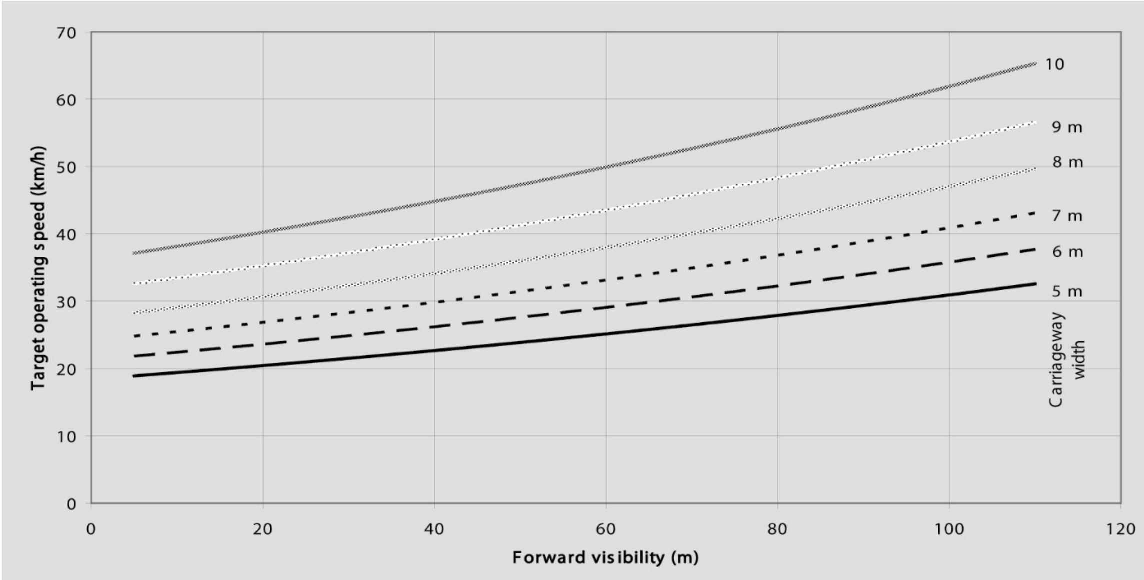


Figure 3.2 – Influence of road geometry on speed

3.3.6 Parking, Passing, and Loading

Public parking and loading can be provided either on-street including indented, or off-street. 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). 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.

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 8.8 m 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 Drawing 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

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. When designing cycle facilities, the webpage: Designing a Cycling Facility, should be followed.

If there are conflicts between the Code and other documents referenced in this section 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 TCD 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 Property and Infrastructure Department.

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 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.

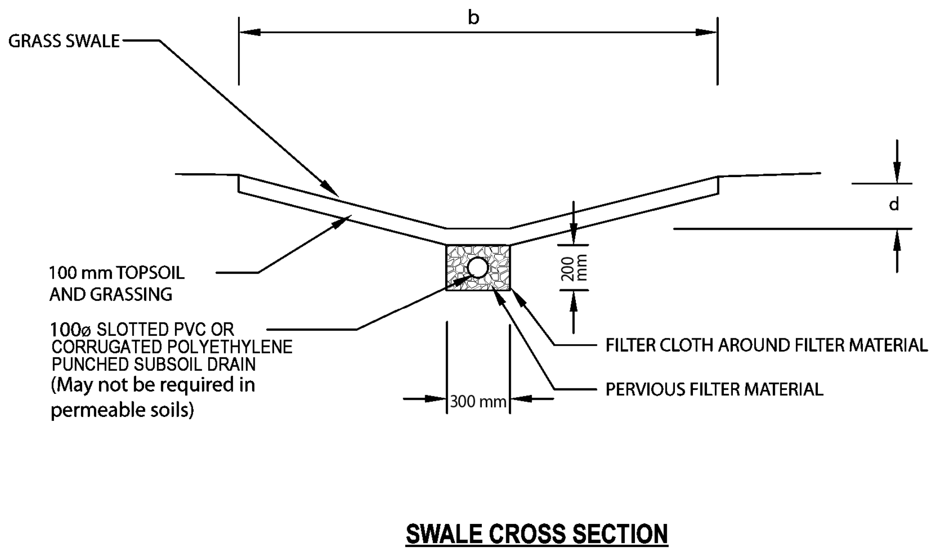
Such discharges shall be subject to the approval of affected property owners and be shown to be neither diverting catchments nor significantly changing peak flows or flow patterns.

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, unless 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.



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

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 greenfield sites 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 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 1,000m^3 required over 2,000m^3 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 Deflection (mm)	Chipseal Surface Deflection (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
GT5	ONRC - Primary Collector	Major collectors that link neighbourhoods to townships/districts.	Urban > 3,000 Rural > 1,000	1	1.2
GT6	ONRC - Secondary Collector	Minor collectors that link local areas to neighbourhoods.	Urban > 1,000 Rural > 1,000	1	1.5

GT7	ONRC - Access	Movement within a local area or to access areas outside the local area.	Urban < 1,000 Rural < 200	1	1.8
GT8	ONRC - Low Volume	Low volume movement within a local area.	Urban < 200 Rural < 50	1.6	1.8

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 heavy duty 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 Section 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 Section 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 Infrastructure 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 5% AEP peak flowrate (with climate change adjusted rainfall); and

(b) A secondary system for a 1% AEP peak flow rate (with climate change adjusted rainfall) 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

These blockage factors serve as a default unless demonstrated with suitable justification to Council approval that a lower blockage factor can be applied. *Australian Rainfall Runoff – Book 6 (Flood Hydraulics) / Chapter 6 (Blockage of Hydraulic Structures)* provides specific guidance on a risk-based approach for determining blockage factors.

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_gV_{ave}) specified below:

Lower likelihood	d_gV_{ave} <0.6 m2/s
Higher likelihood	d_gV_{ave} <0.4 m2/s

When blockage factors are applied, the above requirements may be relaxed on a case-by-case basis, subject to justification and P&I approval. These requirements will still apply in an unblocked scenario.

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_gV_{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' for an overall total catchment. A simple catchment is defined as:

- Less than 10 ha;
- Has no significant external catchment overland runoff onto the development; and
- 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 Discharge requirements

All developments shall provide primary network drainage for the post-development 5% AEP peak flowrate (with climate change adjusted rainfall) from all contributing catchments.

Primary event

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 unless otherwise approved by council:

- For catchments with time of concentration ≤ 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 time of concentration > 60minutes, discharge to downstream shall be no greater than the 20% AEP pre-development peak flow rate

When discharging to new primary drainage networks or networks with known suitable 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.

Secondary event

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.

Discharge comparisons

When assessing the discharges, the following is required:

- Post-development (current rainfall) to be compared with pre-development (current 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.

Overland discharges and/or discharges to watercourse

All overland discharges and discharges to informal or formal watercourse must maintain pre-development downstream hydrological regimes for storm events through onsite attenuation and multiple storm event outlet controls. These are to be checked and shown for a 50% AEP, 5% AEP and 1% AEP event at a minimum. If the pre-development hydrological regimes are not maintained, 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 receiving environment that is sensitive or susceptible to erosion or sediments (either directly, or further downstream) a detention system must be provided to protect and mitigate erosion effects for more frequent rainfall events. An assessment of the receiving environment shall be undertaken prior to commencement of the design and agreed with the TA in accordance with Section 4.2.1 of this code.

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

Climate change adjusted 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.

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

Current rainfall 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.

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 **Error! Reference source not found.**. However, the following exceptions to this can be applied:

- For catchments consisting of 100% roof areas, the E1/VM1 Method for stormwater infrastructure with storage components can be used.
- For simple catchments with an area of 0.5 ha or less, and a time of concentration ≤ 10mins (pre-development and post-development) a Rational excess rainfall hyetograph and a triangular unit hydrograph can be used. The time to peak of the hydrograph should be equal to 3/4 of the time of concentration and the base time should equal twice the peak time.

For undertaking any time of concentration calculations, the Equal-Areas Method is to be used to determine catchment slope.

When undertaking Rational Method calculations, the time of concentration (Tc) may be determined following the approach outlined in NZBC E1/VM1. This includes a consideration of the transition from overland flow to shallow concentrated flow, as water begins to form small rills, channels, and tracks. Additionally, where applicable, the influence of open channels and piped networks on the flow must be considered.

When undertaking Rational Method calculations, the Rational runoff coefficients provided in Table 4-1 should be used, based on surface permeability in Table 4-2.

Table 4-1: 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 4-2: 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. The determination of a well-established method can be determined by a suitably qualified person.

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. A complete copy of all stormwater models shall be provided to Council at no charge if requested. Applicants should either provide access to a PC with a modelling licence and the stormwater model or be prepared to present and explain the model in detail with a suitably qualified person if requested.

4.3.5.2 Freeboard

The minimum freeboard height additional to the computed top water flood level of the 1% AEP design (including blockage factors in Section 4.3.4.1 if applicable) 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

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.

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 in Table 4-3. 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 4-3: 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 4-4.

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 4-4 for loss coefficients).

Table 4-4: 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	
90º	0.90
45º	0.60
22.5º	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 runoff from the first 20mm of rainfall from the post-development catchment impervious area. Of this, a minimum of 5mm rainfall should be discharged to ground through soakage where feasible. 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 water quality management 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 QLDC approved materials list, 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 Property and Infrastructure Department 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 prefer 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;

(k) Tree pits.

4.3.7.7 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.

Designers are to check if any future storage areas are classifiable dams. All relevant ORC requirements and guidelines are to be followed. QLDC Property and Infrastructure department must be notified on the classification status if found to be a dam.

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 drawings B5-5, B5-6 and B5-7.

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.

4.3.8 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 lots, roofs, parking areas, and roads where conventional pit and pipe infrastructure is unavailable or unfeasible.

The developer must enter into a Stormwater Developer Agreement (DA) with QLDC to ensure the soakage device system operates effectively and is maintainable prior to vesting with QLDC.

Note - For soakage devices designed and approved under the building consent process the building code methodology applies.

4.3.8.1 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.

All inlet and internal pipework and air vents must provide flow capacity for the 5% AEP storm event peak flow.

4.3.8.2 Draindown

All soakage devices must have a draindown period (to empty) within 24 hours from the end of the design storm event for which the device was sized for. This requirement is to ensure that soakage devices have capacity for back-to-back design storm events.

4.3.8.3 Area of soakage

The area of soakage for design of a soakage device must be calculated as the pervious base area. If the soil strata in the proposed location of the soakage device are of uniform type, and expected to provide a uniform soakage rate, then ½ of the pervious side wall area of the soakage device may also be included in the area of soakage.

4.3.8.4 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.

4.3.8.5 Freeboard

A 300mm freeboard must be provided from the soakage devices design storm event (5% AEP) top water level to the lowest invert of the upstream infrastructure outlet.

4.3.8.6 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 device), or 5 m; whichever is greater. Exemptions to these requirements may be granted by Council at its sole discretion based on specialist advice. Deep-bored soakage devices may require greater distances and specialist advice will be required for installing these types of soakage devices.

Any privately owned soakage pits covered under this Code of Practice must provide an Operation and Maintenance manual and an agreement to maintain the soakage pit in perpetuity from body corporation or other ownership structure.

4.3.8.7 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.

4.3.8.8 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. Potential ingress of sediments into devices during the construction process should be both considered and avoided.

All soakage devices to be vested with Council must provide design elements compliant with the Appendix B Drawing B4-4 if applicable.

The general 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.

Alternatives approaches to the above for vested soakage devices may be approved at the discretion of Council. Pre-treatment, sediment ingress, design life and maintenance will be key considerations of this.

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

4.3.8.9 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 (note a total Factor of Safety of 2 to be adopted as a minimum unless otherwise approved by council)*

$F_{(c)}$ *= Factor of Safety representing the consequences of failure from Table 4-5*

$F_{(u)}$ *= Factor of Safety representing testing uncertainty from Table 4-6*

Equation 2 should be used to calculate the factored soil infiltration rate (K):

Equation 2

$$K = k/F_{(total)}$$

Where:

k *= unfactored soil infiltration rate (from Section 4.3.8.11)*

Table 4-5, 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 4-6 shows suggested safety factors for the uncertainty in input data.

Table 4-5: 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**
Soakpit, Rockbore or other Low Impact Device	1.0	1.5	2.5

Consequence Level 1: The secondary flow path complies with Section 4.3.4.1 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 4.3.4.1 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 4.3.4.1 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.

Table 4-6: 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 soakage device.

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 (or no impact from groundwater to soakage device across all possible seasonal and rainfall event variations). 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 (or no impact from groundwater to soakage device across all possible seasonal and rainfall event variations), 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.

4.3.8.10 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.

4.3.8.11 Soakage testing

All unfactored soil infiltration rates in testing and design calculations should be presented in L/hr/m2 units.

If the unfactored soil infiltration rate is found to be less than 50 l/hr/m2, further justification from a recognised competent geo-professional and specific agreement from Council will be required. Where testing shows an unfactored soil infiltration rate of less than 25 l/hr/m2, soakage is generally not appropriate and will not be accepted by Council as a stormwater disposal option unless further justification from a recognised competent geo-professional is provided, with specific agreement from Council.

A maximum unfactored infiltration rate of 2000 L/hr/m2 will be accepted by Council. Should higher infiltration rates be proposed these will require further justification from a recognised competent geo-professional and specific agreement from Council.

Soakage tests must be undertaken prior to the detailed design of soakage devices. If, during construction, flows from disturbed soil areas have entered the soakage device location or the area has been compacted, soakage rates must be reconfirmed afterward.

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 consideration applied to test results.

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.

A description of testing methodology and calculations used are required to be provided alongside the adopted soakage rate.

Further detail on soakage testing requirements are as follows in Section 4.3.8.11.1, 4.3.8.11.2 and �.

If there are cases where another method is more suitable to the local environment and soil conditions, an alternative testing method may be proposed and undertaken by a recognised competent geo-professional subject to Council.

4.3.8.11.1 Soakage testing method general requirements

- Water levels shall be recorded from a static reference height at all times.
- 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.
- Soakage tests shall be performed to the desired depth of the proposed soakage device
- Geological layers and soil types should be recorded in bore logs in accordance with New Zealand Geotechnical Society guidelines.
- Water table levels must be recorded if applicable, 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.
- Soakage tests positioned within 10 m of each other should be tested simultaneously to ensure that the effect of interference is accounted for.
- All boreholes and test pits should be pre-soaked prior to testing. For this they should be filled with water and kept topped up for 4 hours (unless the borehole or pit fully drains in less than 5 minutes). If the borehole or pit drains completely in less than 5 minutes, the hole must be filled a minimum of 5 times prior to testing.

4.3.8.11.2 Specific borehole testing requirements

Boreholes are generally recommended for **fine grained soils** (35% or more material passing the No. 230 / 0.063 mm sieve) **and rock.**

- Boreholes in soil should be between 100 mm to 150 mm in diameter
- Remove all loose materials and smeared clays from the sides of the hole to provide a natural soil interface through which water can infiltrate
- If collapse of a drilled hole seems likely, a perforated PVC pipe or equivalent should be used to case and hold it open.
- If boreholes are to be left open, then the hole shall be fenced off or covered to prevent harm to public or animals if applicable
- Testing methodology prescribed in Auckland Council's GD07 guideline, Appendix A1.4 and Appendix A1.5 is to be used for constant head tests. Testing should be continued at minimum until the inflow becomes "constant" across three consecutive readings, or until the last change in inflow differs by less than 10%.
- Testing methodology prescribed in Auckland Council's GD07 guideline, Appendix A1.6 is to be used for falling head tests. Testing should be continued at minimum 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.
- Other methods may be proposed to the council for review and approval.

Note – Constant head tests are generally preferred to falling head tests

4.3.8.11.3 Specific test pit requirements

Test pits are generally recommended in **Coarse grained soils** (More than 35% of the soil particles are retained on a No. 230 / 0.063 mm sieve).

- A soakage test pit should be excavated to the bottom level of the proposed soakage device with a minimum base area of $1m^2$.
- The walls of the soakage test pit should be laid back at a suitable angle to prevent caving in and erosion during the test.
- 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
- Test pits shall not be left open without suitable support if there is a risk of side wall collapse. Preference for standpipes installed rather than leaving test pits open.
- If test pits are to be left open, then the pit shall be fenced off or covered to prevent public or animal access or harm if applicable.
- Testing methodology prescribed in Auckland Council's GD07 guideline, Appendix A1.4 and Appendix A1.5 is to be used for constant head tests. Alternatively, a double ring infiltrometer may be used instead of the Talsma-Hallam permeameter detailed in Appendix A1.5. Use of a double ring infiltrometer is to follow the methodology prescribed in Christchurch City Councils WWDG Appendix 6.2. Testing should be continued at minimum until the inflow becomes "constant" across three consecutive readings, or until the last change in inflow differs by less than 10%.
- Testing methodology prescribed in Auckland Council's GD07 guideline, Appendix A1.6 is to be used for falling head tests. Testing should be continued at minimum 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.
- Other methods may be proposed to the council for review and approval.

Note – Constant head tests are generally preferred to falling head tests

4.3.9 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.

4.3.10 Pipelines and culverts

4.3.10.1 Location and alignment of public mains

The preferred location of public mains shall be within the road reserve or within other public land.

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.

4.3.10.2 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.

4.3.10.3 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.

4.3.10.4 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.

4.3.10.5 Minimum gradients and flow velocities

In flat areas gradients should be as steep as possible to control silt deposition. The minimum velocity should be at least 0.6 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.

4.3.10.6 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.

4.3.10.7 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.

4.3.10.8 Outfall water levels

Where a pipeline or waterway discharges into a much larger system the peak flows generally do not coincide. Backwater profiles should produce satisfactory water levels when assessed as follows:

(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.

4.3.10.9 Subsoil drains

Subsoil drains are installed to control groundwater levels. Perforated or slotted pipe used under all areas subject to vehicular traffic loads shall comply with 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.

4.3.10.10 Bulkheads for pipes on steep grades

Bulkheads, or anti-scour blocks, shall be detailed on the design drawings. Spacing of bulkheads shall be:

Table 4-7: 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.

4.3.10.11 Trenchless technology

See 5.3.6.8 and 5.3.6.9 for guidance on the use of trenchless technology.

4.3.11 Manholes

4.3.11.1 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.

4.3.11.2 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.

4.3.11.3 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 3 or more inlets required several inlets, consultation with the TA on the layout of the chamber is recommended.

The base layout of MHs shall comply with 5.3.8.4.2 of this Code of Practice.

4.3.11.4 Shallow manholes (or mini manholes)

The minimum internal diameter of a manhole shall be 600 mm.

4.3.11.5 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.

4.3.11.6 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.

4.3.11.7 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.

4.3.11.8 Flotation

In areas of high-water table, all MHs shall be designed to provide a factor of safety against flotation of 1.25.

4.3.11.9 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.

4.3.12 Connection to the public system

Where the connection of individual lots and developments are to the public system they shall meet the following requirements:

(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.

4.3.13 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.

4.3.13.1 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.

4.3.14 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.

4.3.15 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%

4.3.16 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.

4.3.17 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.

4.3.18 Pipe decommissioning

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 2021 should be adhered to.

See Appendix B Drawings B3-3 to B3-9 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 Infrastructure 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 B3-10 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	Design flow

(Water usage)	(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; or
- 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	0.55
225	0.33
300	0.25

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.

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.

5.3.5.7 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 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 AS/NZS 2032 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.

> ***C5.3.8.4.1***
>
> *When traditional concrete benching is proposed, QLDC's preference is for earthenware/clay inlays to be used within the benching channels to reduce the risk of corrosion.*

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).

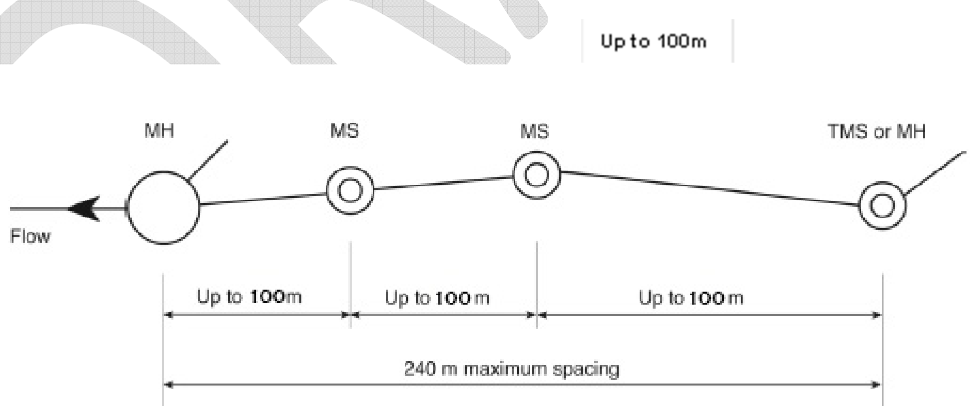


Figure 5.1– Multiple MSs between MH and 'last' MH/TMS

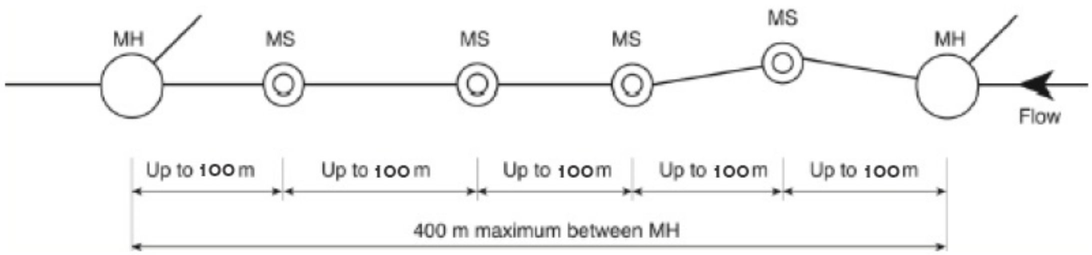


Figure 5.2 – Multiple MSs between consecutive MHs

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.

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 Figure 5.1 and Figure 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.

5.3.11 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 subject 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 Water Services Act 2021. 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 Infrastructure 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 Property and Infrastructure Department.

The maximum allowable operating pressure of rider mains 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 Water Services Act 2021.The requirement to protect water supplies from the risk of backflow is stated in the Water Services Act 2021 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 1.11 - 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 1.11 - 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 Property and Infrastructure Department 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. For a connection of a less than 100mm internal diameter pipe to an existing line, only a valve is required for the new connection.

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, FI-Soc, or FI-FI) 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 6.1and 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.

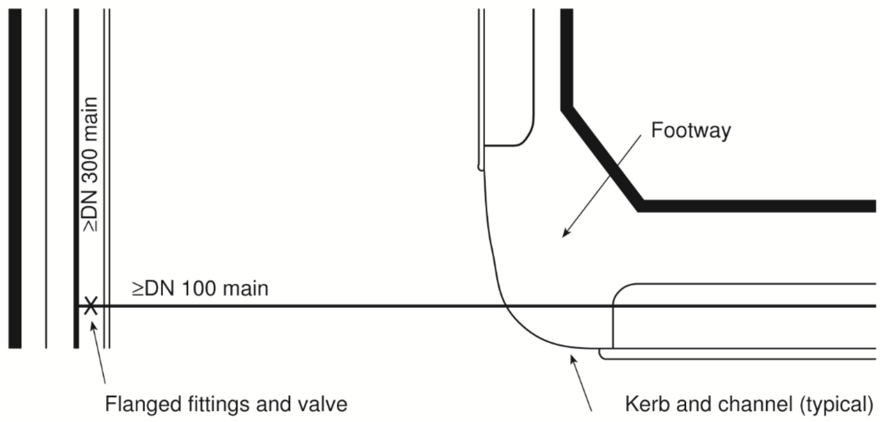


Figure 6.1– Branch valve adjacent to main

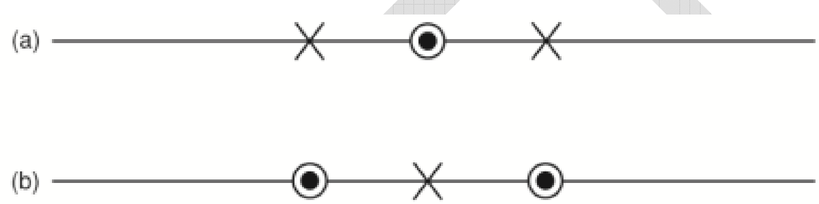


Figure 6.2 – Valve and hydrant combinations for pressure zone dividing valves

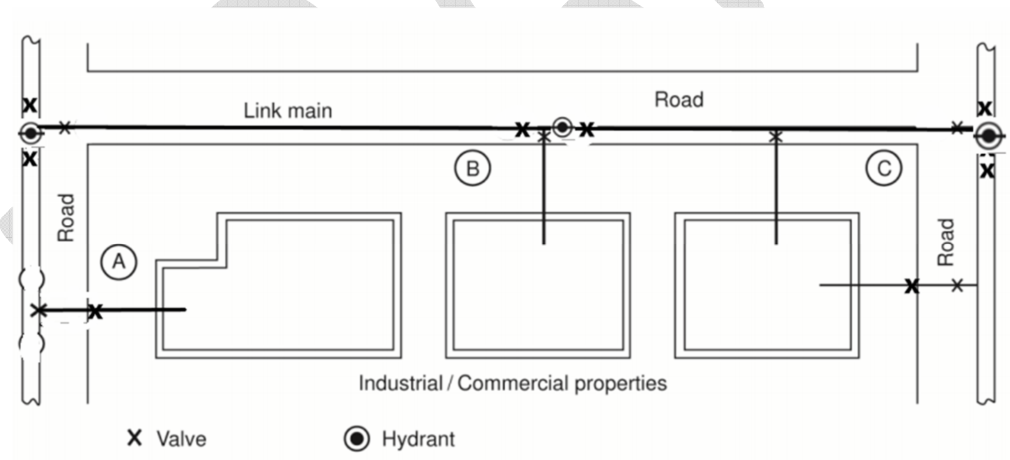


Figure 6.3 – Secure connection

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 or new water supply mains with a nominal internal diameter greater than 150 mm are not permitted unless specific and prior approval from the TA is received. Any connections to mains greater than 300 mm nominal internal 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

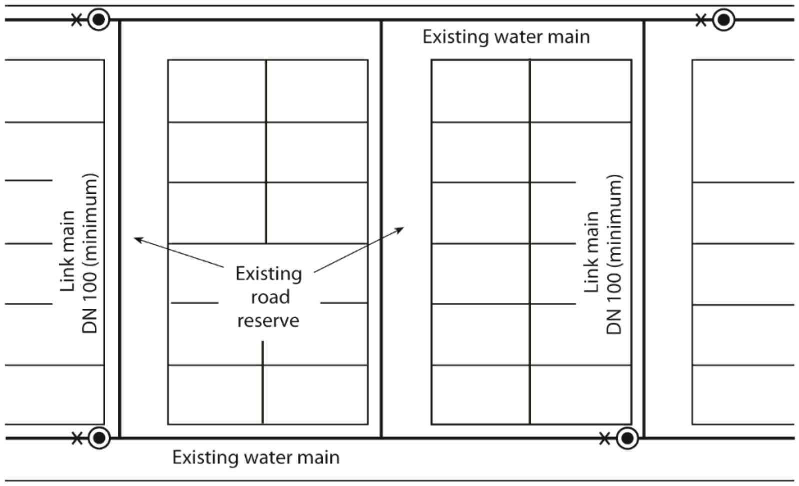
Live tapping only up to 50mm ID will be allowed unless approved by the TA. PVC and AC live tapping is only allowed from the side of the main only, unless self-tapping Talbots are used.

6.3.16.5 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 Council's Property & Infrastructure Department.

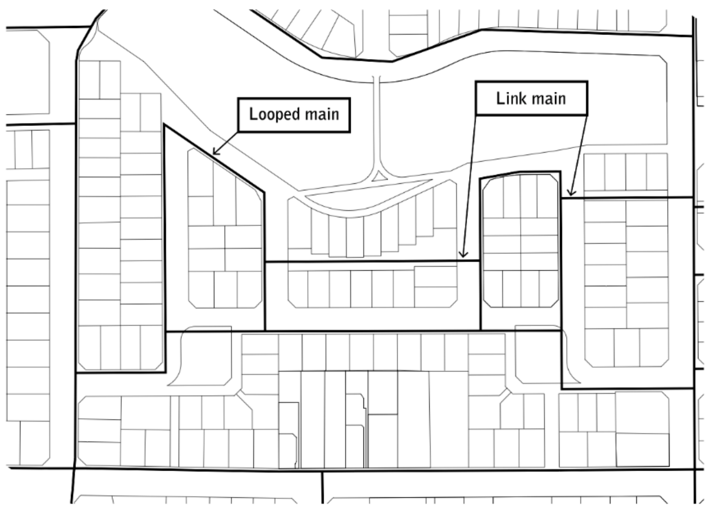
6.3.17 Termination points

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 Figure 6.4 and Figure 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 Property and Infrastructure Department.

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 Drawing B1-4).

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 Section 3.4.2. 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 subdivisions 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 audits

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 are 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 QLDC's Property & Infrastructure Department 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, nonappearance 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 be 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 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.

Appendix A - Acceptable Pipe and Fitting Materials
(Informative)

Table A1 and Table A2 give information on acceptable pipe and fitting materials. The information is sourced with permission from the Water Services Association of Australia. Refer also to WSA 02 (Sewerage Code of Australia) and WSA 03 (Water Supply Code of Australia) for further information.

For ALL PE pipes dimensions shall be provided for Outside Diameter (OD), Inside Diameter (ID) and Nominal Diameter (ND).

Table A1 – Acceptable pipe materials and Standards

Note: PVC only used if specifically agreed with TA

NOTE – Refer also to WSA 02 (Sewerage Code of Australia) and WSA 03 (Water Supply Code of Australia)

Pipe materials	Standard applicable	Stormwater (Gravity)	Wastewater (Pressure sewer/ rising main)	Wastewater (Gravity)	Water supply (Pressure)	Notes
PVC-U	AS/NZS 1260 (Class SN 4, 8, or 16 as required by TA)	✓	–	✓	–	Gravity applications only. Well established methods of repair. Suitable for aggressive groundwater, anaerobic conditions and tidal zones. Can be used for trenchless installation with suitable end load resistant joints.
PVC-U	AS/NZS 1254 (Class SN 4, or 8, as required by TA)	✓	–	–	–	Gravity stormwater applications only.
PVC-O	AS/NZS 4441 (Series 1 or Series 2, as required by the TA)	–	✓	–	✓	Improved fracture toughness compared with PVC-U. Improved fatigue resistance compared with PVC-U and PVC-M. NOTE – Use only DI fittings in pumped mains to achieve full fatigue resistance. Has increased hydraulic capacity compared with PVC-U and PVC-M. Suitable for aggressive groundwater, anaerobic conditions, and tidal zones. Specific design for dynamic stresses (fatigue) required for pressure sewer applications.
PVC-U	AS/NZS 1477 (Series 1 or Series 2, as required by the TA)	–	✓	–	✓	Well established methods of repair. Alternative installation techniques possible, for example slip lining. Suitable for aggressive groundwater, anaerobic conditions, and tidal zones. Can be used for trenchless installation with suitable end load resistant joints. Specific design for dynamic stresses (fatigue) required for pressure sewer applications.

Table A1 – Acceptable pipe materials and Standards (continued)

Note: PVC only used if specifically agreed with TA

Pipe materials	Standard applicable	Stormwater (Gravity)	Wastewater (Pressure sewer/ rising main)	Wastewater (Gravity)	Water supply (Pressure)	Notes
PVC-M	AS/NZS 4765 (Series 1 or Series 2, as required by the TA)	–	✓	–	✓	Improved fracture toughness compared with PVC-U. Has increased hydraulic capacity compared with PVC-U. Inferior fatigue resistance compared with PVC-U and PVC-O. Suitable for aggressive groundwater, anaerobic conditions and tidal zones. Specific design for dynamic stresses (fatigue) required for pressure sewer applications.
PE (PE 80B or PE 100 as required by the TA)	AS/NZS 4130	–	✓	–	✓	Generally for pressure applications. Can be easily curved to eliminate the need for bends. Alternative installation techniques possible, for example pipe cracking, direction drilling, and slip lining. Can be welded to form an end load resistant system. Compression couplings and end load resistant fittings are available in smaller diameters. Pipe longitudinal flexibility accommodates large differential ground settlement. Fusion jointing requires skilled installers and special equipment. Retrospective installation of fittings/repair complicated. Specific design for dynamic stresses (fatigue) required for pressure sewer applications. ≤ DN 125 available in long coiled lengths for fewer joints. Suitable for aggressive groundwater, anaerobic conditions or tidal zones. Suitable for ground with high subsidence potential, for example fill or mining areas.

Table A1 – Acceptable pipe materials and Standards (continued)

Note: PVC only used if specifically agreed with TA

Pipe materials	Standard applicable	Stormwater (Gravity)	Wastewater (Pressure sewer/ rising main)	Wastewater (Gravity)	Water supply (Pressure)	Notes
PE (Stiffness Class SN 4, 8, 10, or 16 as required by the TA)	AS/NZS 5065	✓	–	✓	–	Only for gravity applications. Can be easily curved. Alternative installation techniques possible, for example pipe cracking and slip lining. Can be welded to form an end load resistant system. Fusion jointing requires skilled installers and special equipment. Retrospective installation of fittings/repair complicated. Smaller diameters available in long coiled lengths for fewer joints. Suitable for aggressive groundwater, anaerobic conditions, or tidal zones.
PP (Stiffness Class SN 4, 8, 10, or 16 as required by the TA)	AS/NZS 5065	✓	–	✓	–	Only for gravity applications.
GRP	AS 3571.1	✓	✓	✓	–	Alternative installation techniques possible, for example slip lining. UV resistant (special product). Custom made fittings can be manufactured. Suitable for use without additional corrosion protection in areas where stray electrical currents occur. Low impact resistance and ease of damage to thermosetting resin, makes GRP susceptible to damage during transportation, and installation, in above ground installations, from vandalism, or when damaged as a consequence of nearby excavation. Suitable for aggressive groundwater, anaerobic conditions or tidal zones.

Table A1 – Acceptable pipe materials and Standards (continued)

Note: PVC only used if specifically agreed with TA

Pipe materials	Standard applicable	Stormwater (Gravity)	Wastewater (Pressure sewer/ rising main)	Wastewater (Gravity)	Water supply (Pressure)	Notes
GRP	AS 3571.2	–	–	–	✓	Alternative installation techniques possible, for example slip lining. UV resistant (special product). Custom made fittings can be manufactured. Suitable for use without additional corrosion protection in areas where stray electrical currents occur. Low impact resistance and ease of damage to thermosetting resin, makes GRP susceptible to damage during transportation, and installation, in above ground installations, from vandalism, or when damaged as a consequence of nearby excavation. Suitable for aggressive groundwater, anaerobic conditions, or tidal zones.
VC	BS EN 295	✓	–	✓	–	Gravity applications only. Has benefits for particularly aggressive industrial wastes. Not recommended for active seismic (earthquake) zones, or unstable ground.
RRRC (rubber ring joint reinforced concrete)	AS/NZS 4058	✓	–	✓	–	Requires protection from hydrogen sulphide attack in sewer applications, by plastic lining or selection of appropriate cement additives.

Table A1 – Acceptable pipe materials and Standards (continued)

Note: PVC only used if specifically agreed with TA

Pipe materials	Standard applicable	Stormwater (Gravity)	Wastewater (Pressure sewer/ rising main)	Wastewater (Gravity)	Water supply (Pressure)	Notes
CLS (SCL) (concrete lined welded steel)	NZS 4442 AS 1579	–	✓	–	✓	Cement mortar lined, PE coating below ground or heavy duty coating above ground High mechanical strength and toughness. Available in long lengths. RRJ and welded joints available. Custom made, specially configured steel fittings can be made to order. Can be welded to form a system that will resist end load and joint permeation. UV resistant/vandal proof/impact resistant (where PE coated). Cathodic protection (CP) can be applied to electrically continuous pipelines to provide enhanced corrosion protection. PE lined and coated – RRJ As above for CLS (SCL). Suitable for conveying soft water. Corrosion resistant under all conditions. General notes Standard Portland cement mortar not resistant to H2S attack, at any high points or discharge points in the main. High alumina cement has improved resistance. Welded joints require skilled installers and special equipment. Welded joints require reinstatement of protection systems on site. Special design required for welded installations parallel, and adjacent to high voltage (> 66 kV) transmission lines. Cathodic protection requires regular monitoring and maintenance. Seal coating may be required over cement mortar linings, when conveying soft water, or in low flow extremities of reticulation mains, to prevent potentially high PH. Suitable for high load applications such as railway crossings and major roads. Large diameters are available. Suitable for aerial or suspended pipeline applications.

Table A1 – Acceptable pipe materials and Standards (continued)

Note: PVC only used if specifically agreed with TA

Pipe materials	Standard applicable	Stormwater (Gravity)	Wastewater (Pressure sewer/ rising main)	Wastewater (Gravity)	Water supply (Pressure)	Notes
DI (ductile iron pipe)	AS/NZS 2280 AS 3681	–	✓	–	✓	Fatigue analysis not normally required (pressure sewer applications). High mechanical strength and toughness. Ease of jointing. UV resistant/vandal proof/impact resistant. Well established methods of repair. Suitable for high pressure and above ground pipelines. Restrained joint systems available. Sufficient ring stiffness to not rely on side support, for structural adequacy for the usual water supply installation depths. Elevated PH may occur when conveying soft water, or in low flow extremities of reticulation mains. PE sleeving is required, and must be carefully applied and repaired when damaged. Standard Portland cement mortar not resistant to H2S attack, at any high points or discharge points in the main. (Wastewater applications. High alumina cement has improved resistance.) Not suitable for aggressive groundwater, anaerobic conditions, or tidal zones.
Corrugated aluminium pipe	AS/NZS 2041	✓	–	–	–	Generally of short length (for culverts and so on). Joints need consideration in fine soils with high water tables. Invert may need lining to extend life.
Corrugated steel pipe	AS/NZS 2041 NZS 4405 NZS 4406	✓	–	–	–	Generally only for short length (culverts and so on). Joints need consideration in fine soils and high water tables. Invert may need lining to extend life.
ABS	AS/NZS 3518 AS/NZS 3690 AS/NZS 3879	–	✓	–	✓	Specific design for dynamic stresses (fatigue required for pressure sewer applications).

Pipe materials	Standard applicable	Stormwater (Gravity)	Wastewater (Pressure sewer/ rising main)	Wastewater (Gravity)	Water supply (Pressure)	Notes
PVC-U	AS/NZS 1260	✓	–	✓	–	Gravity applications only.
PVC-U	AS/NZS 1254	✓	–	–	–	Gravity stormwater applications only.

Table A2 – Acceptable fitting materials and Standards

Fittings Materials	Standard applicable	Stormwater (Gravity)	Wastewater (Pressure sewer/ rising main	Wastewater (Gravity)	Water supply (Pressure)	Notes
PVC-U	AS/NZS 1254	✓	–	–	–	Gravity stormwater applications only.
PE	AS/NZS 4129	✓	✓	✓	✓	PE pressure fittings, including mechanical compression, butt fusion or electrofusion, as approved by the TA.
Access covers and grates	AS 3996	✓	–	✓	–	
Ductile iron	AS/NZS 2280	–	✓	–	✓	Generally for pressure applications. Shall be coated with a polymeric coating, applied in accordance with AS/NZS 4158.
Ductile iron unrestrained mechanical couplings	AS/NZS 4998	–	✓	–	✓	Generally for pressure applications. Shall be coated with a polymeric coating, applied in accordance with AS/NZS 4158.
Plastic or metallic tapping bands	AS/NZS 4793	–	✓	–	✓	Generally for pressure applications. Tapping bands used on flexible pipes shall be AS/NZS 4793 Type F – that is, 'full circle design'. Ductile iron tapping bands shall be coated with a polymeric coating, applied in accordance with AS/NZS 4158.
Fire hydrants	NZS/BS 750	–	✓	–	✓	Generally pressure applications.
Resilient seated gate valves	AS 2638.2	–	✓	–	✓	Generally pressure applications.
PE (Stiffness Class SN 4, 8, 10 or 16 as required by the TA)	AS/NZS 5065	✓	–	✓	–	Gravity applications only.
PP (Stiffness Class SN 4, 8, 10 or 16 as required by the TA)	AS/NZS 5065	✓	–	✓	–	Gravity applications only.

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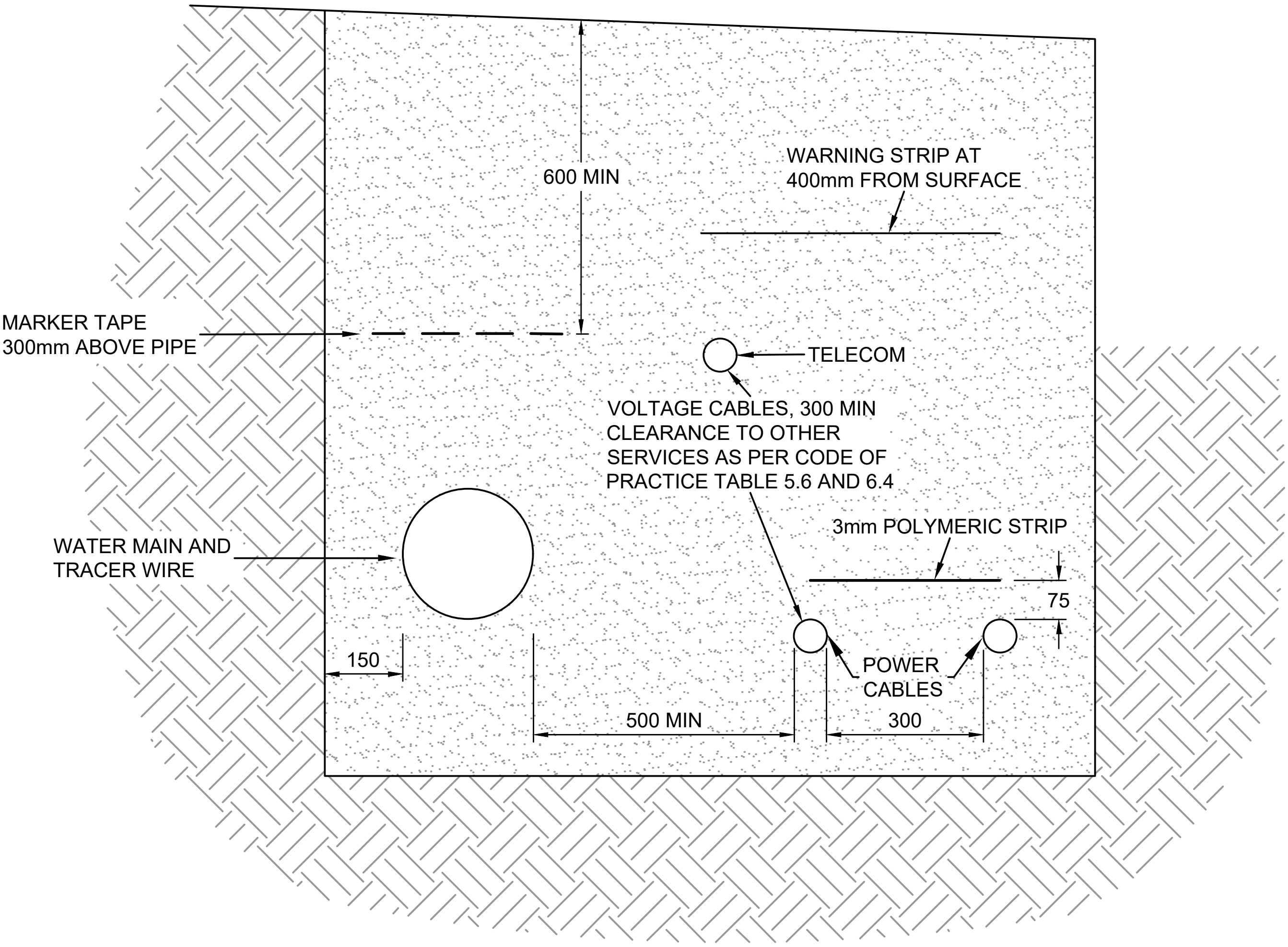
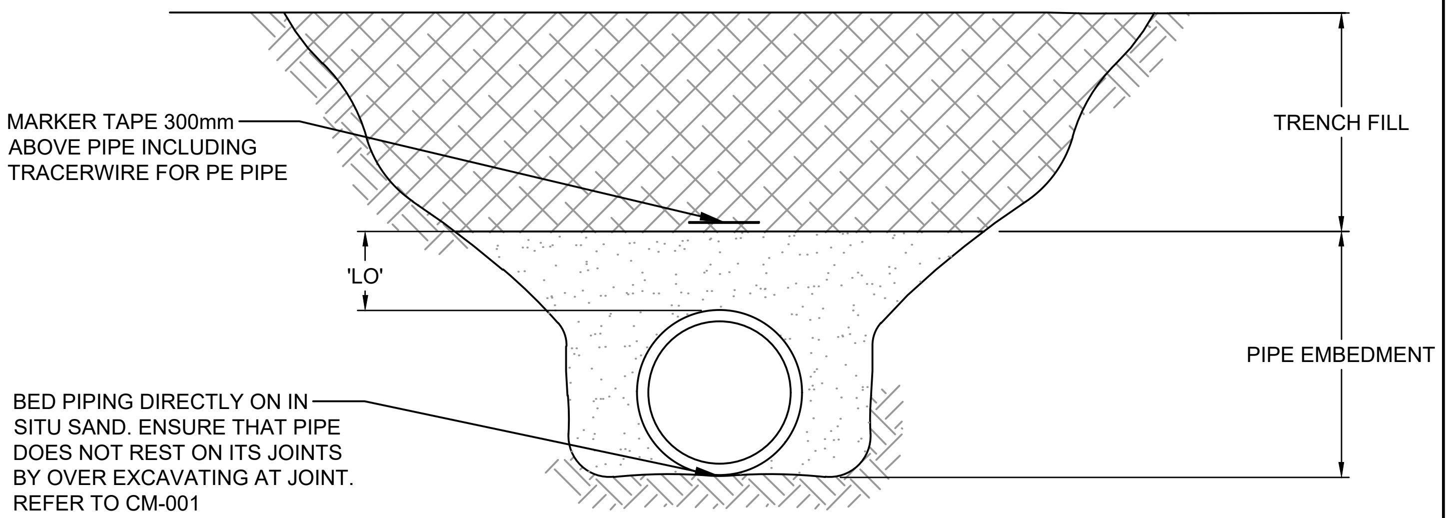


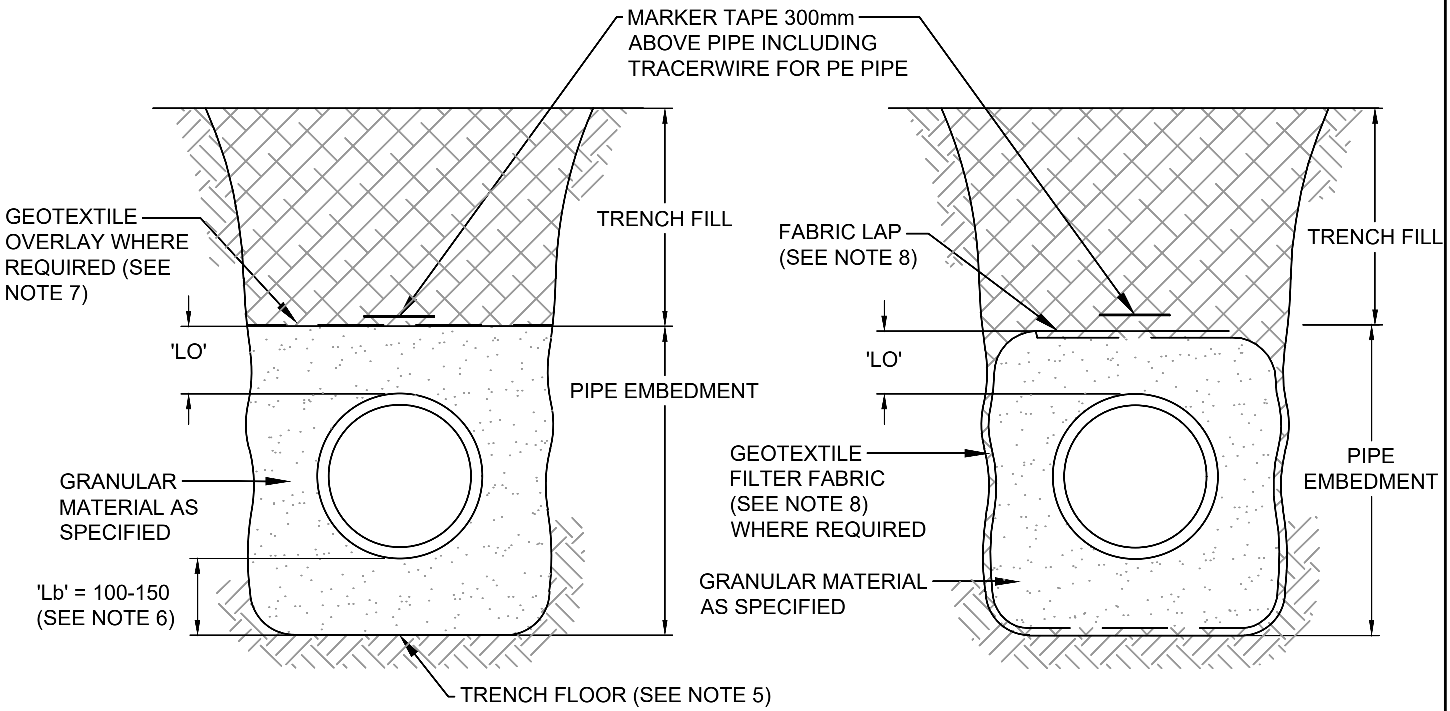
TRENCH DETAILS & UNDERGROUND UTILITIES IN VERGE

NOTE
SEPARATION FROM WATERMAIN DEFINED IN COP TABLE 6.4 (VARIES WITH PIPE SIZE)

QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Typical Combined Service Trench Detail	NOT TO SCALE Drawing No. B1-1



TRENCH IN SAND STRATA



TYPE 3 SUPPORT

FOR FLEXIBLE AND RIGID PIPES (SEE NOTE 3)

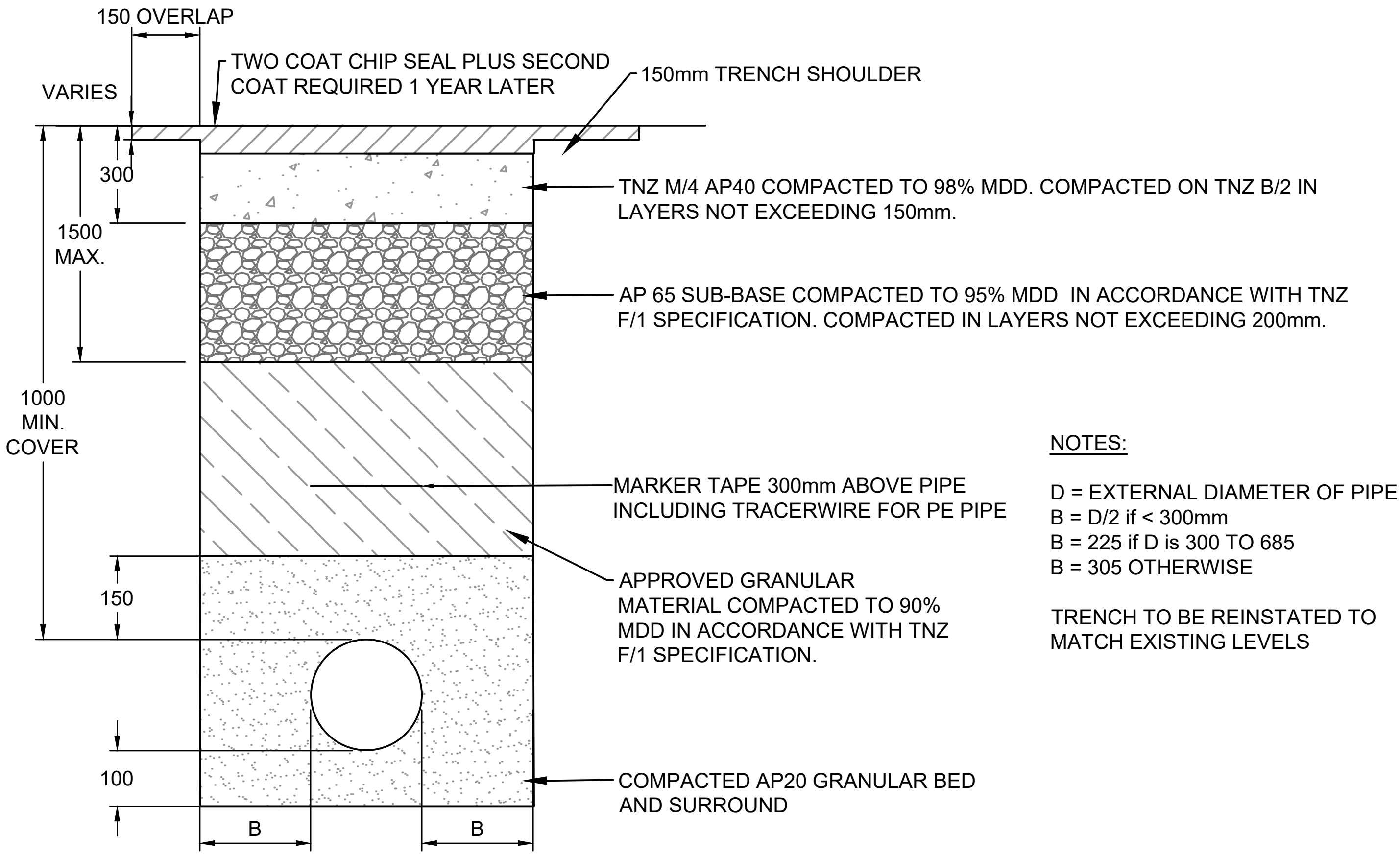
TYPE 4 SUPPORT

WITH GEOTEXTILE FOR FLEXIBLE AND RIGID PIPES (SEE NOTE 3)

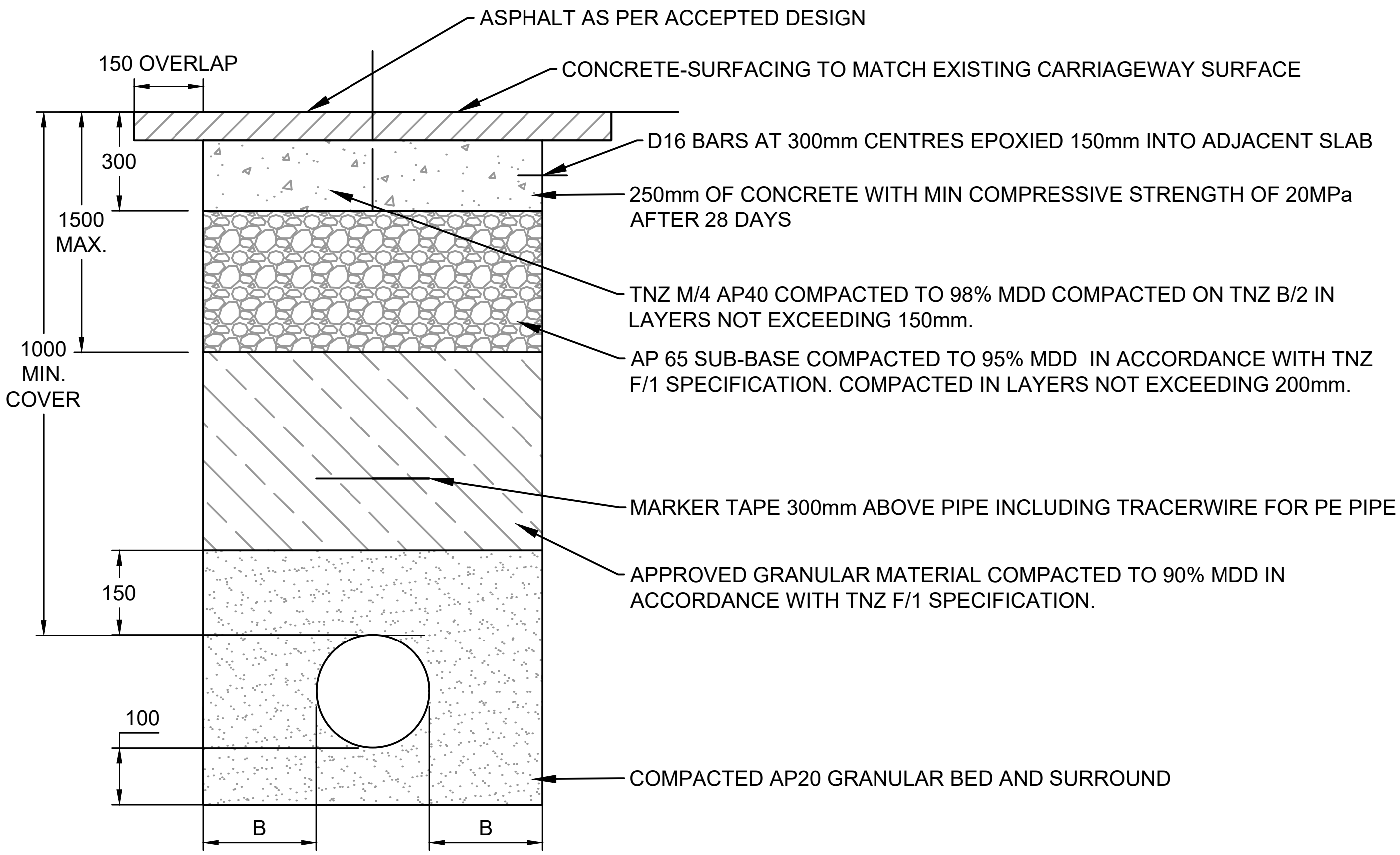
NOTES:

1. ALL DIMENSIONS IN MILLIMETRES
2. THIS DRAWING TO BE READ IN CONJUNCTION WITH CM-001
3. PIPE CLASSIFICATION
   a. RIGID PIPES: VC, RC, STEEL AND CL
   b. FLEXIBLE PIPES: PVC, GRP AND PE
4. PLACEMENT OF EMBEDMENT, TRENCH FILL AND COMPACTION TO MEET THE REQUIREMENTS OF DRAWINGS AND SPECIFICATION.
5. EXCAVATE OR COMPACT TRENCH FLOOR TO PROVIDE A FLAT FIRM BASE TO SUPPORT BEDDING MATERIAL AND MINIMISE PIPE SETTLEMENT. WHEN EXCAVATED, REPLACE WITH GRANULAR MATERIAL AS SPECIFIED FOR BEDDING OR ADOPT TYPE 1,2,3 OR 4 SUPPORT AS REQUIRED.
6. ENSURE BEDDING IS DEEP ENOUGH THAT PIPE JOINT PROJECTIONS (SOCKETS AND FLANGES) DO NOT TOUCH TRENCH FLOOR - SEE CM-001
7. TYPE 4 SUPPORT TO BE USED WHERE MIGRATORY NATIVE SOILS (SANDS AND CLAYS) ARE ENCOUNTERED ADJACENT TO THE EMBEDMENT ZONE AND SINGLE SIZED AGGREGATE IS USED.
8. GEOTEXTILE OVERLAY IS REQUIRED FOR COARSE AGGREGATE EMBEDMENT >5mm. LAY GEOTEXTILE FILTER FABRIC AGAINST TRENCH FLOOR AND WALLS SUCH THAT IT FULLY ENCASES THE EMBEDMENT
   - PRESS FILTER FABRIC INTO VOIDS BEFORE INSTALLING EMBEDMENT TO PREVENT FABRIC TEARING
   - PROVIDE A MINIMUM OF 250 OVERLAP AT ALL FILTER FABRIC JOINTS
9. IN SOME AREAS LOCAL PRACTICE MAY ALLOW USE OF SELECTED EXCAVATED MATERIAL AS PIPE EMBEDMENT.
10. IN UNSUITABLE GROUND CONDITIONS SPECIFIC DESIGN IS REQUIRED REFER TO WSA 03 & WSA 04 DRAWINGS FOR GUIDANCE.
11. CONCRETE PIPES SHOULD BE BASED ON FIGURES 11 TO 13 IN ASNZS 3725.

QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Standard Pipe Embedment	NOT TO SCALE Drawing No. B1-2

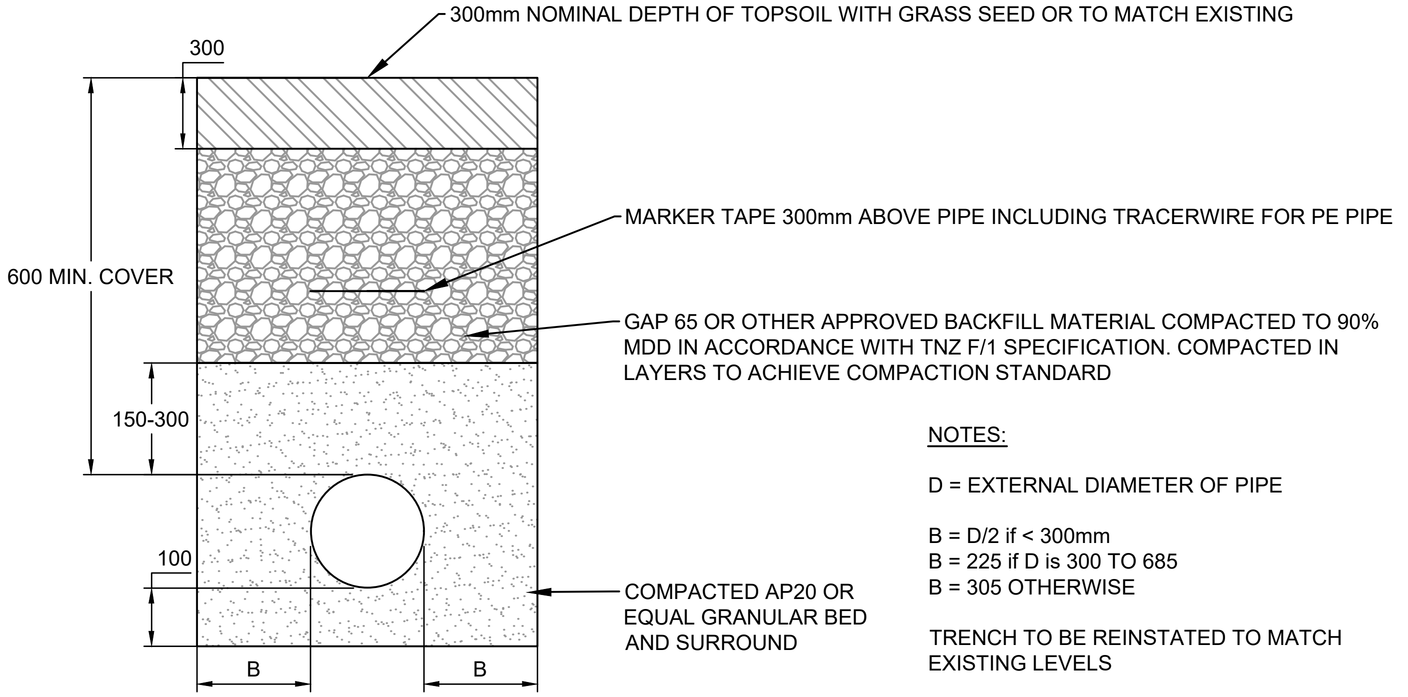


CHIPSEAL CARRIAGEWAY CROSS SECTION



ASPHALT/CONCRETE CARRIAGEWAY CROSS SECTION

QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Typical Pipe Bedding & Backfill for Carriageways	NOT TO SCALE Drawing No. B1-3



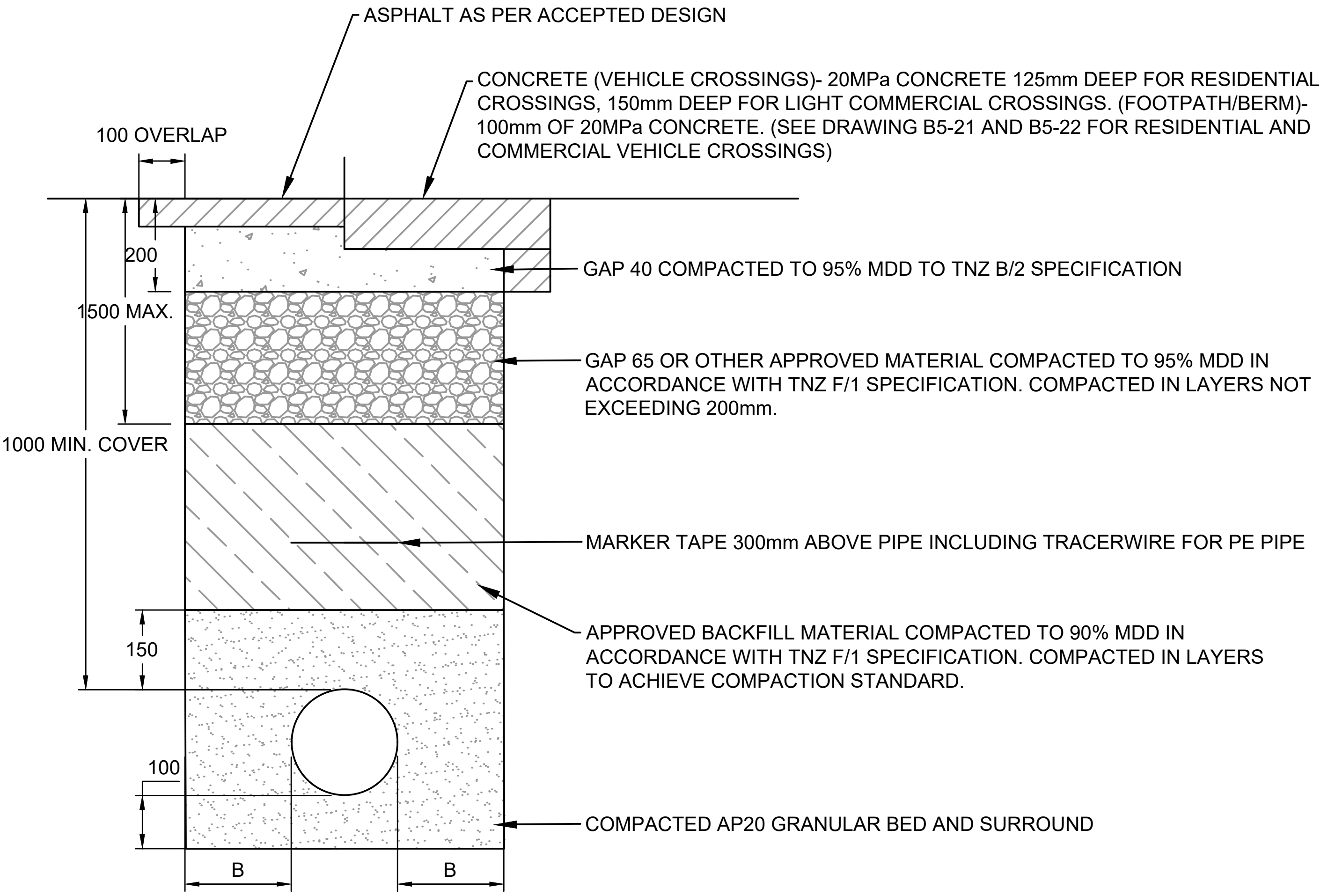
NOTES:

D = EXTERNAL DIAMETER OF PIPE

B = D/2 if < 300mm
B = 225 if D is 300 TO 685
B = 305 OTHERWISE

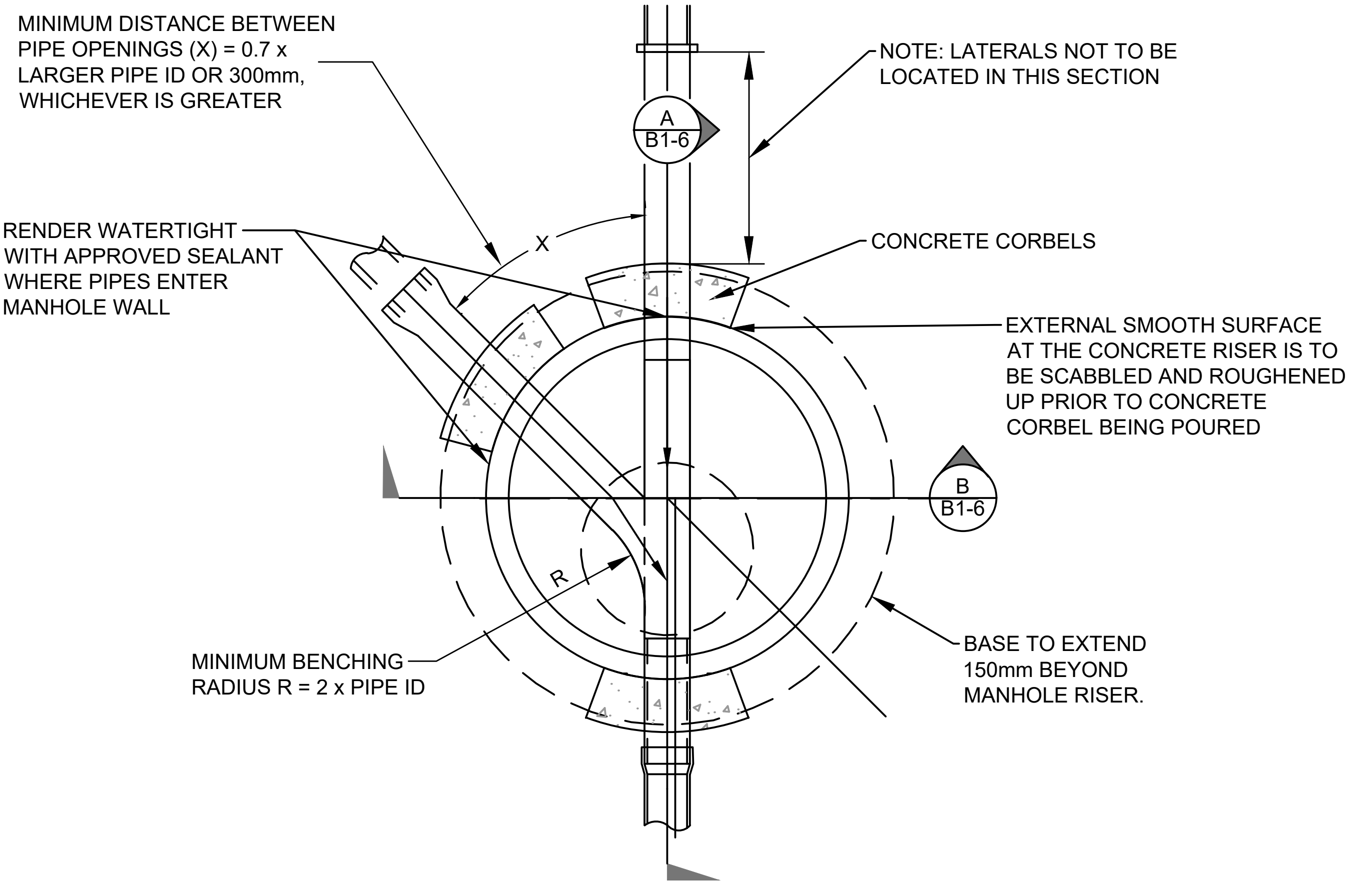
TRENCH TO BE REINSTATED TO MATCH EXISTING LEVELS

BERM/NON TRAFFICABLE CROSS SECTION



VEHICLE CROSSING CROSS SECTION

QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Typical Pipe Bedding & Backfill for Vehicle Crossings & Non Trafficable	NOT TO SCALE Drawing No. B1-4

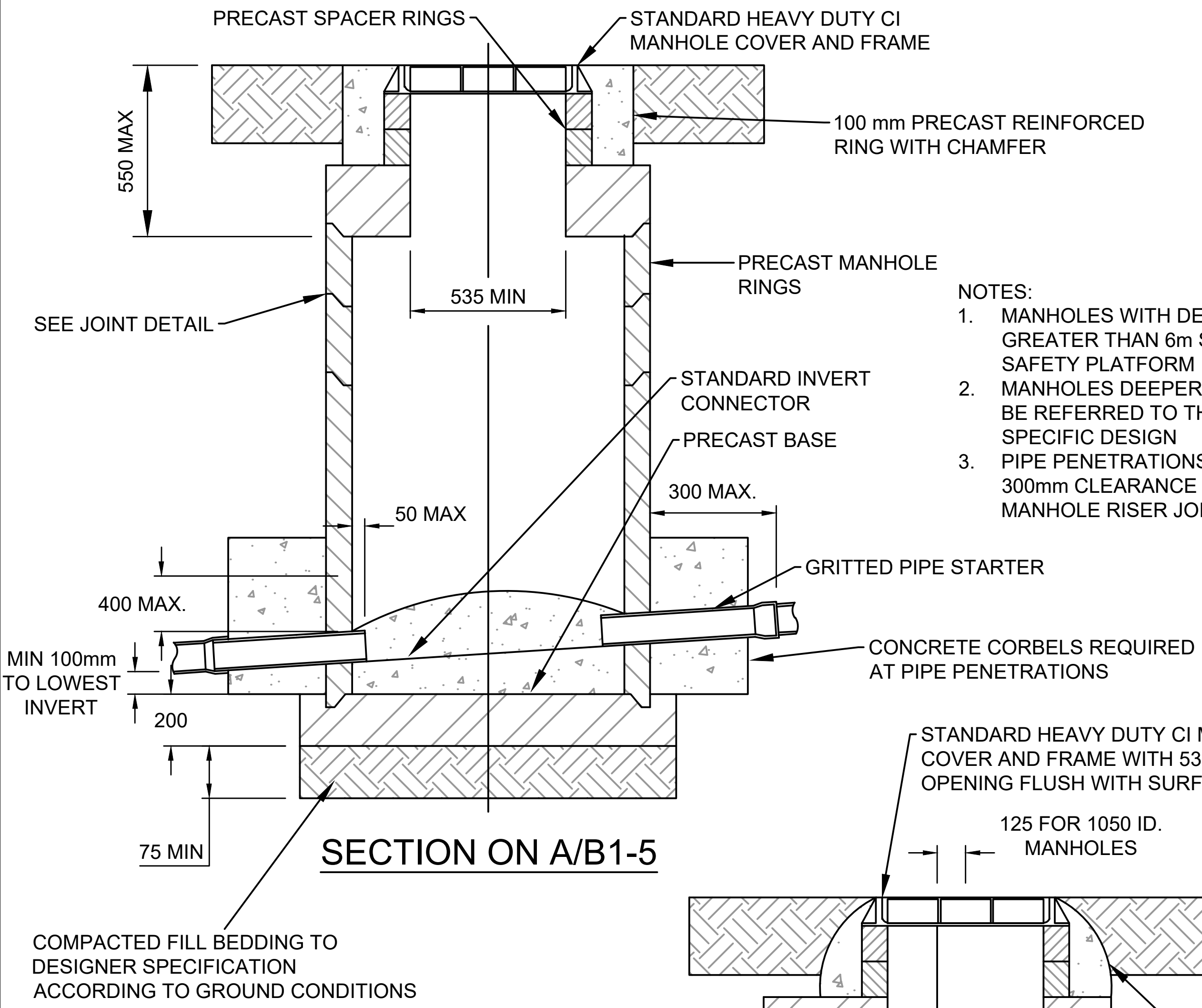


PLAN

NOTES

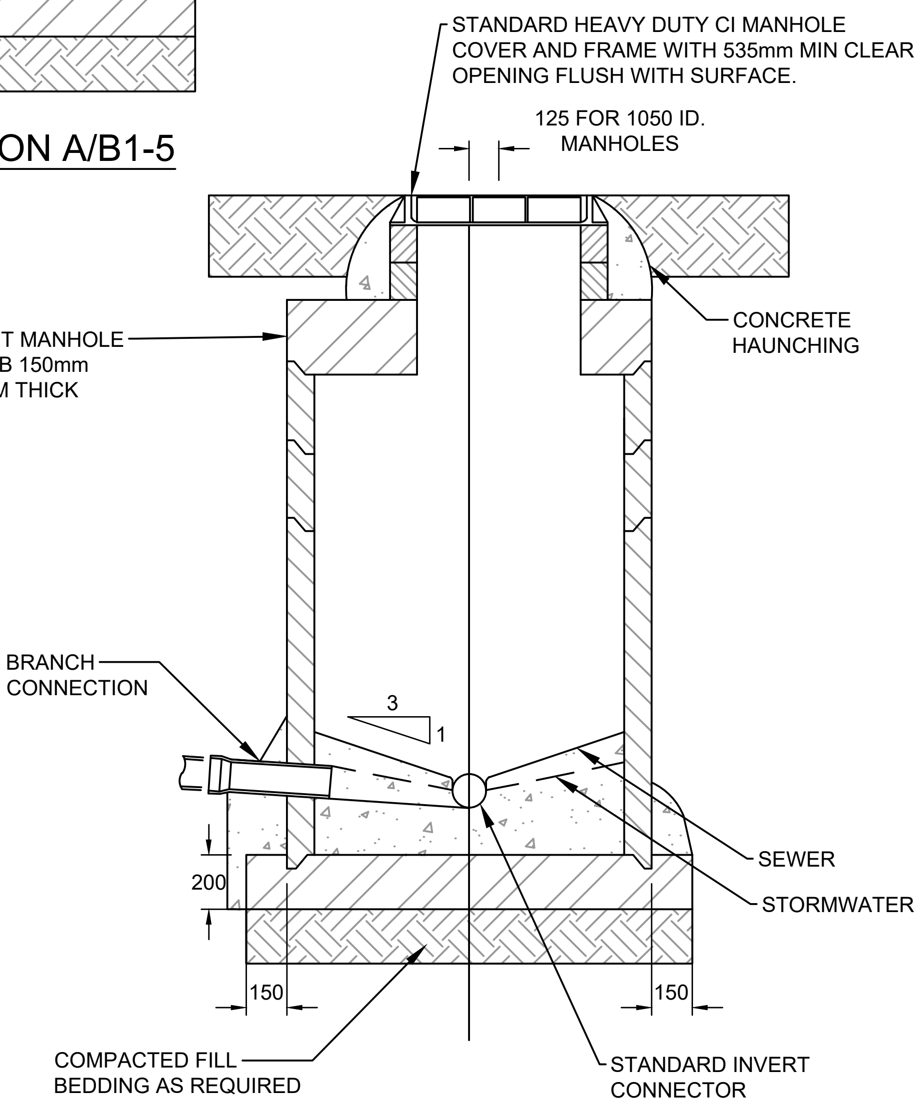
1. ALL IN SITU CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 20MPa @ 28 DAYS.
2. ALL PRECAST MANHOLE UNITS (SHOWN SHADED IN DRAWING B1-6) TO BE STANDARD MANUFACTURED UNITS. (IE. HUMES OR SIMILAR APPROVED)
3. ALL BRANCHES SHALL BE CONSTRUCTED SUCH THAT THEY CAN BE READILY ACCESSED BY CCTV CAMERA. THE CORBALS DETAIL (IE. CROSS SECTION) SHALL NOT BE COMPROMISED. IF REQUIRED, THE "STRAIGHT THROUGH" CHANNEL SHALL BE OFFSET FROM THE MANHOLE CENTRELINE AND THE BRANCH CHANNELLING LEFT STRAIGHT FOR A SUFFICIENT LENGTH TO ACHIEVE THE DESIRED RESULT.
4. ACCESS OPENING TO BE LOCATED OVER THE DOWNSTREAM SIDE OF THE MANHOLE.
5. IF A DEVIATION IS SOUGHT FROM THE REQUIREMENTS IN THE DETAIL ABOVE, JUSTIFIABLE CALCULATIONS MUST BE GIVEN AND BE TO COUNCIL'S SATISFACTION.
6. >75° DEFLECTION SHALL REQUIRE SPECIFIC DESIGN FOR MANHOLE RISERS FOR ANY DIAMETER OF PIPE >375mm.

QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Manhole Detail A - Typical Plan View	NOT TO SCALE Drawing No. B1-5

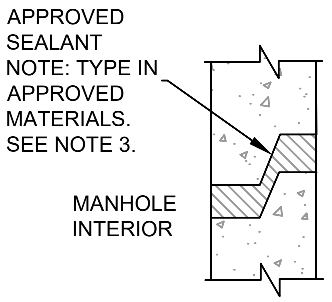


SECTION ON A/B1-5

NOTES:
1. MANHOLES WITH DEPTH TO INVERT GREATER THAN 6m SHALL HAVE A SAFETY PLATFORM INSTALLED
2. MANHOLES DEEPER THAN 4m SHALL BE REFERRED TO THE ENGINEER FOR SPECIFIC DESIGN
3. PIPE PENETRATIONS TO BE MINIMUM 300mm CLEARANCE FROM THE MANHOLE RISER JOINT

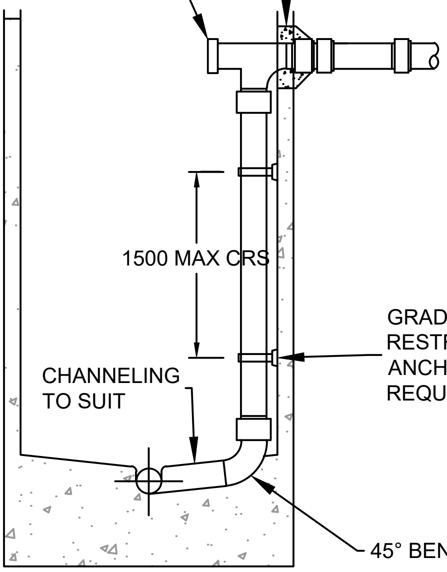


SECTION ON B/B1-5

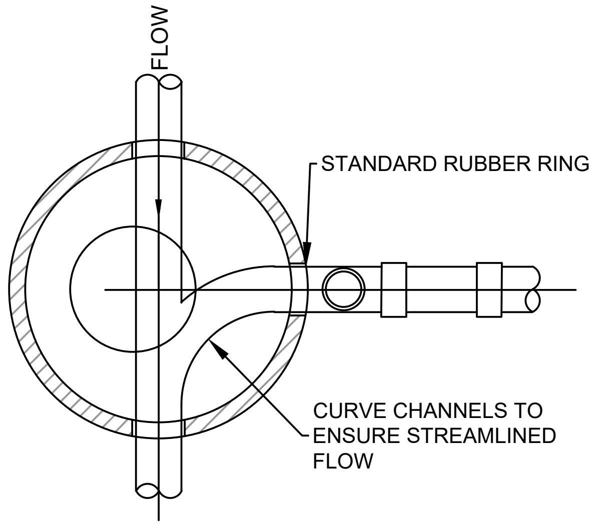


TYPICAL JOINT DETAIL

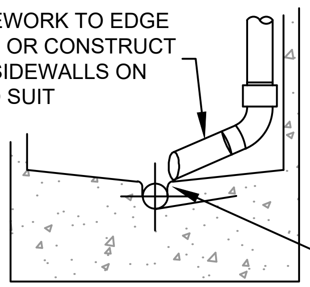
QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Manhole Detail B - Typical Cross Section	NOT TO SCALE Drawing No. B1-6



SECTION - INTERNAL DROP MANHOLE

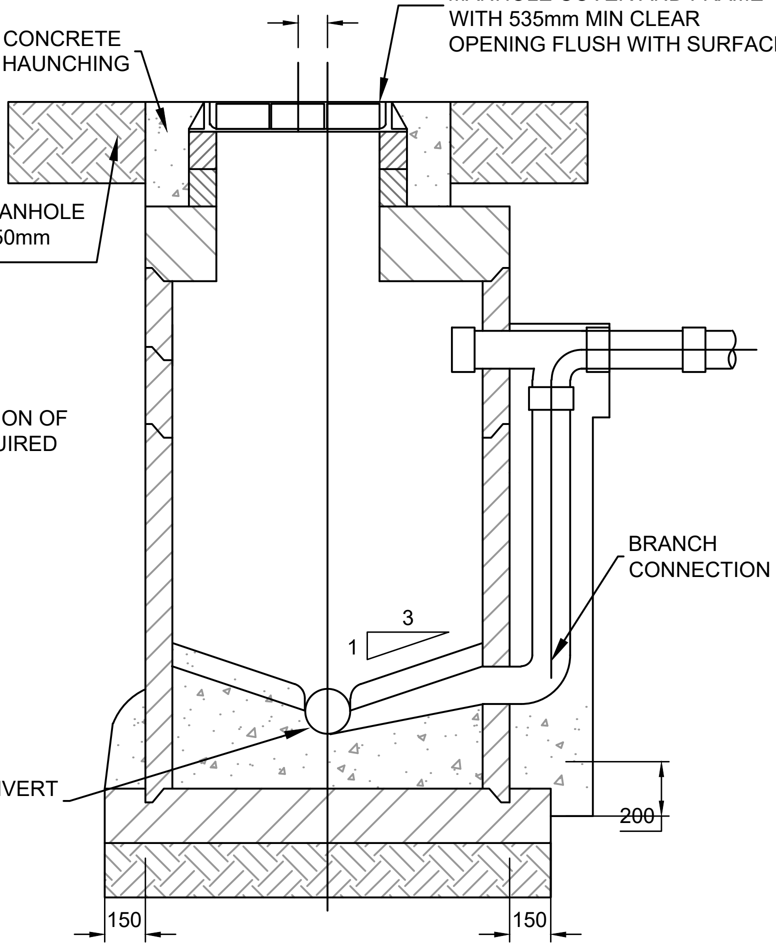


PLAN - EXTERNAL DROP MANHOLE

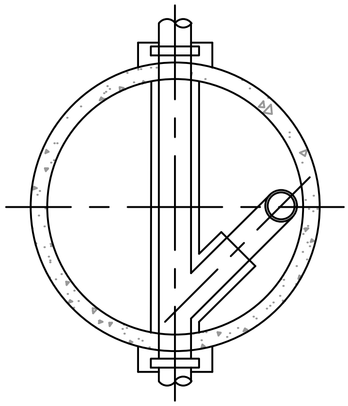


INTERNAL DROP POST CONSTRUCTION INSTALLATION DETAIL

(WHERE AUTHORISED BY TERRITORIAL AUTHORITY)



SECTION - EXTERNAL DROP MANHOLE



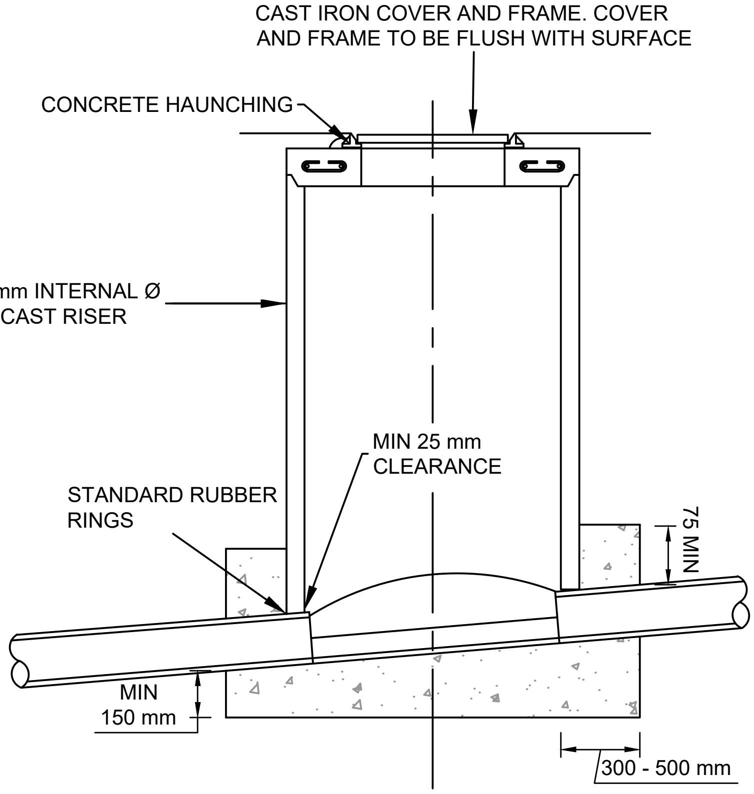
PLAN - TYPICAL INTERNAL DROP

SUITABLE FOR INSITU AND PRECAST MH (WHERE AUTHORISED BY TERRITORIAL AUTHORITY)

NOTES:

1. ALL DIMENSIONS IN MILLIMETRES.
2. MANHOLES WITH DEPTH TO INVERT GREATER THAN 6m SHALL HAVE A SAFETY PLATFORM INSTALLED.
3. MANHOLES DEEPER THAN 4m SHALL BE REFERRED TO THE ENGINEER FOR SPECIFIC DESIGN.
4. MINIMUM DN 1200 MH TO BE USED WITH INTERNAL DROP STRUCTURES.
5. INTERNAL DROP NOT NORMALLY USED IN STORMWATER APPLICATIONS.
6. ALL CAST IN-SITU BENCHING AND HAUNCHING TO BE 30MPa CONCRETE UNLESS OTHERWISE SPECIFIED BY TA.

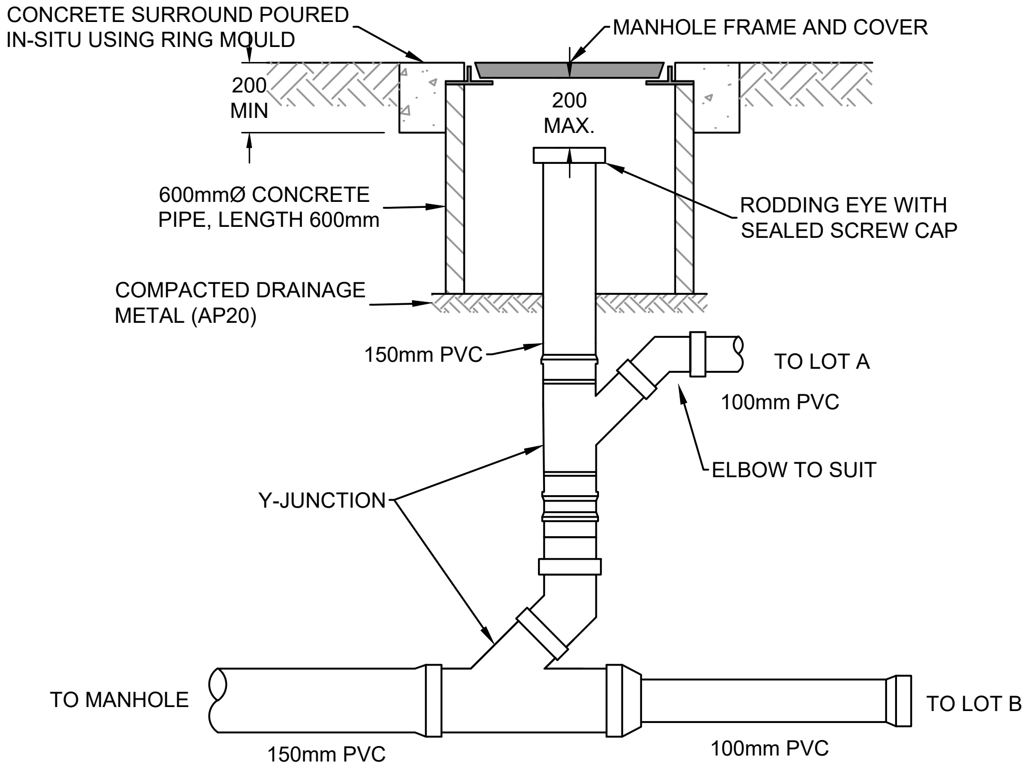
QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: External and Internal Drop Manhole	NOT TO SCALE Drawing No. B1-7



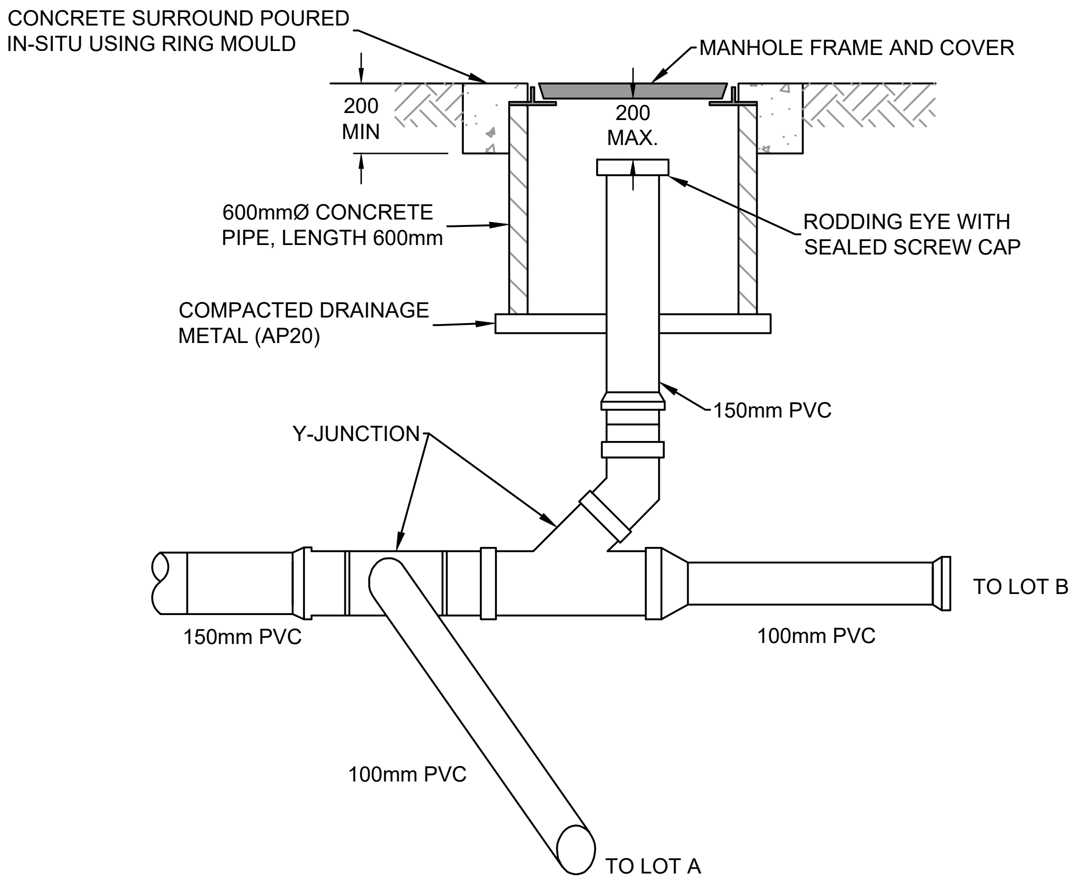
(DEPTH NOT TO EXCEED 1.2m)

MINI MANHOLE

NOTE:
1. ALL DIMENSIONS IN MILLIMETRES.
2. ALL CAST IN-SITU BENCHING AND HAUNCHING TO BE 30MPa CONCRETE UNLESS OTHERWISE SPECIFIED BY TA.

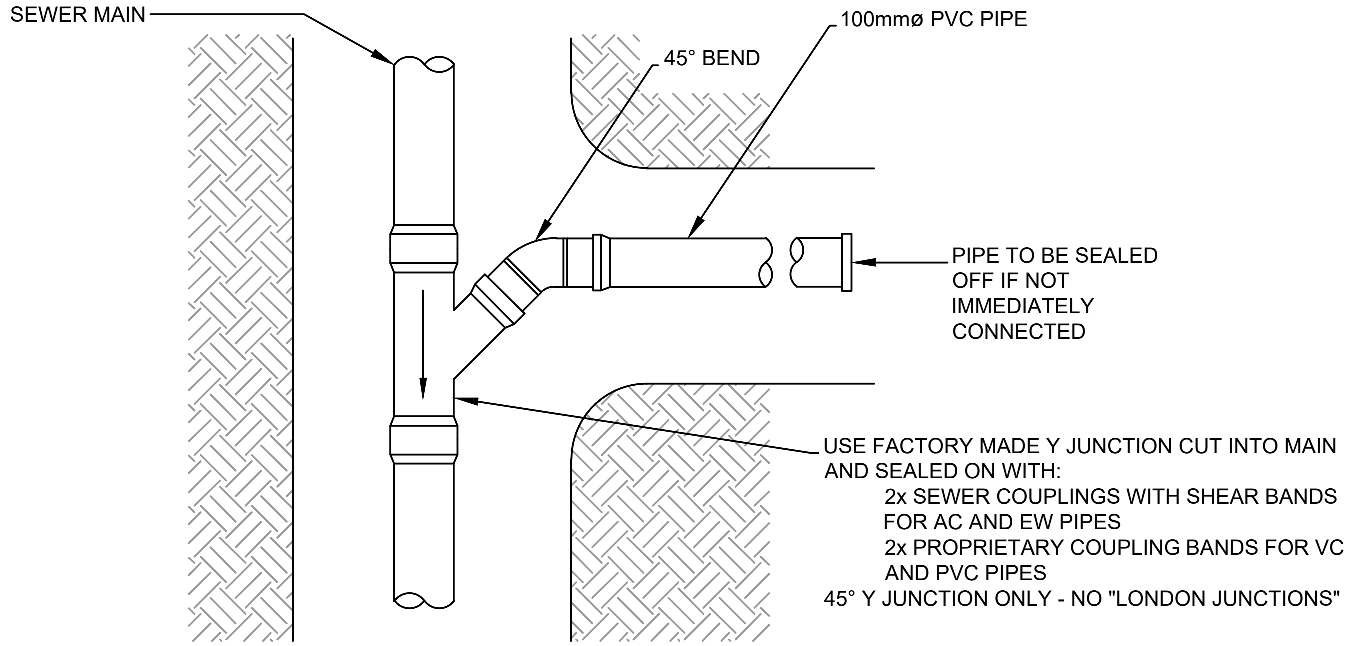


LATERAL OFF RODDING EYE STANDPIPE

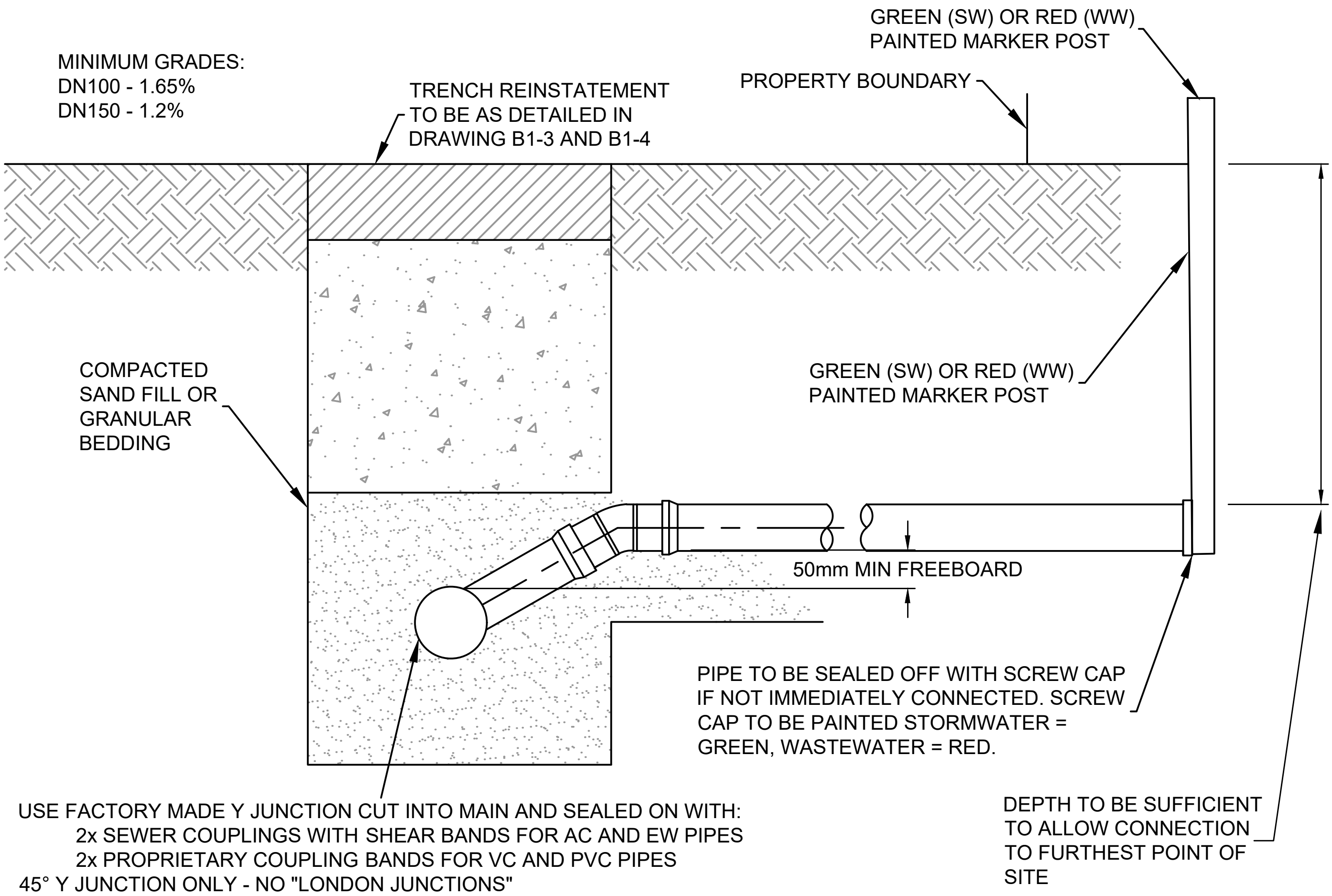


LATERAL OFF 150mm CONNECTION TO MANHOLE

QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Lateral Connections For Two Properties	NOT TO SCALE Drawing No. B1-9



PLAN VIEW



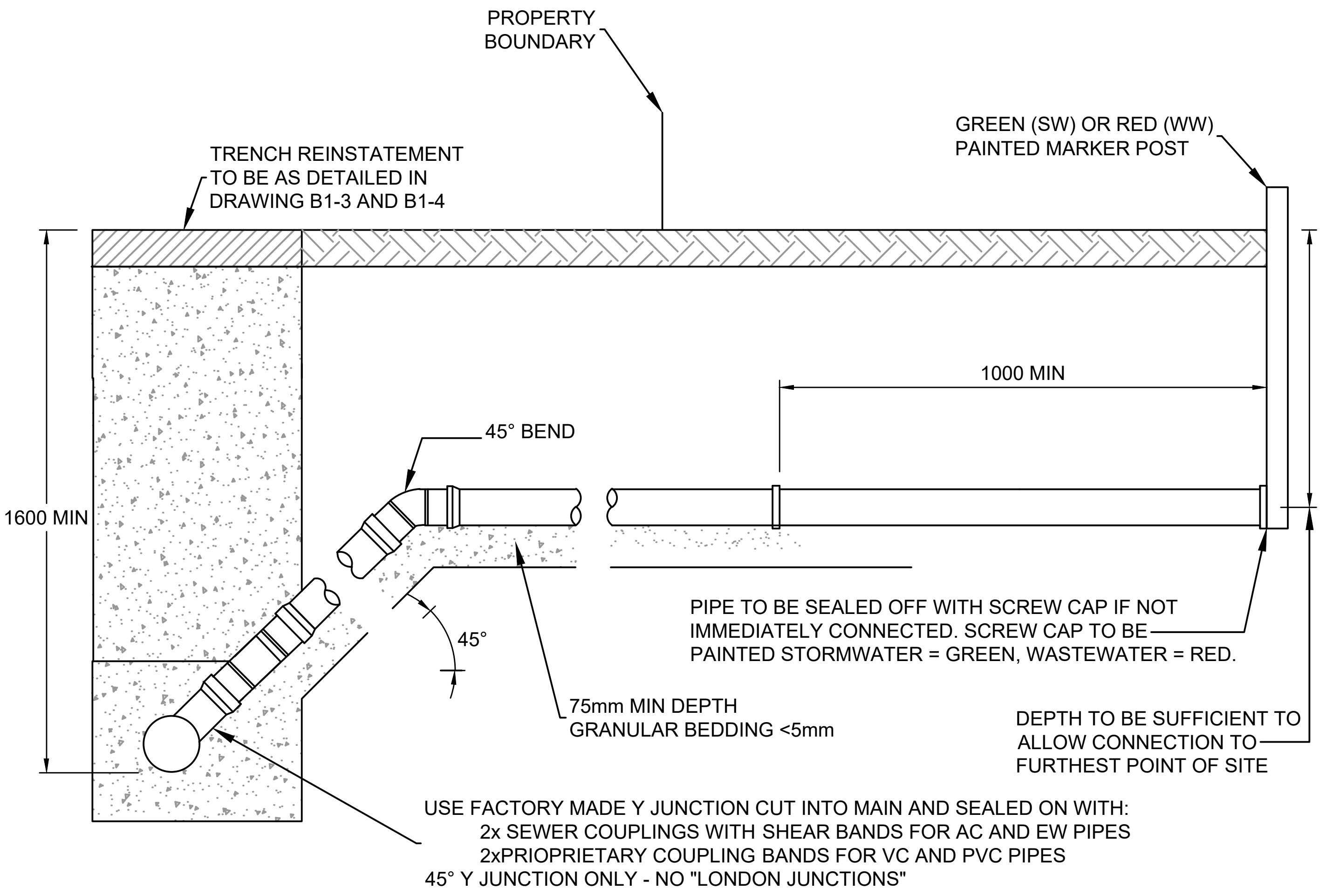
STANDARD CONNECTION

DEPTH TO INVERT LESS THAN 2.5m

NOTES:

1. ALL CONNECTIONS SHALL HAVE NO ACCESS FITTINGS ON LINE, NO CHANGE OF DIRECTION, OR CHANGE OF GRADE WITHIN 3m OF MAIN CONNECTION.

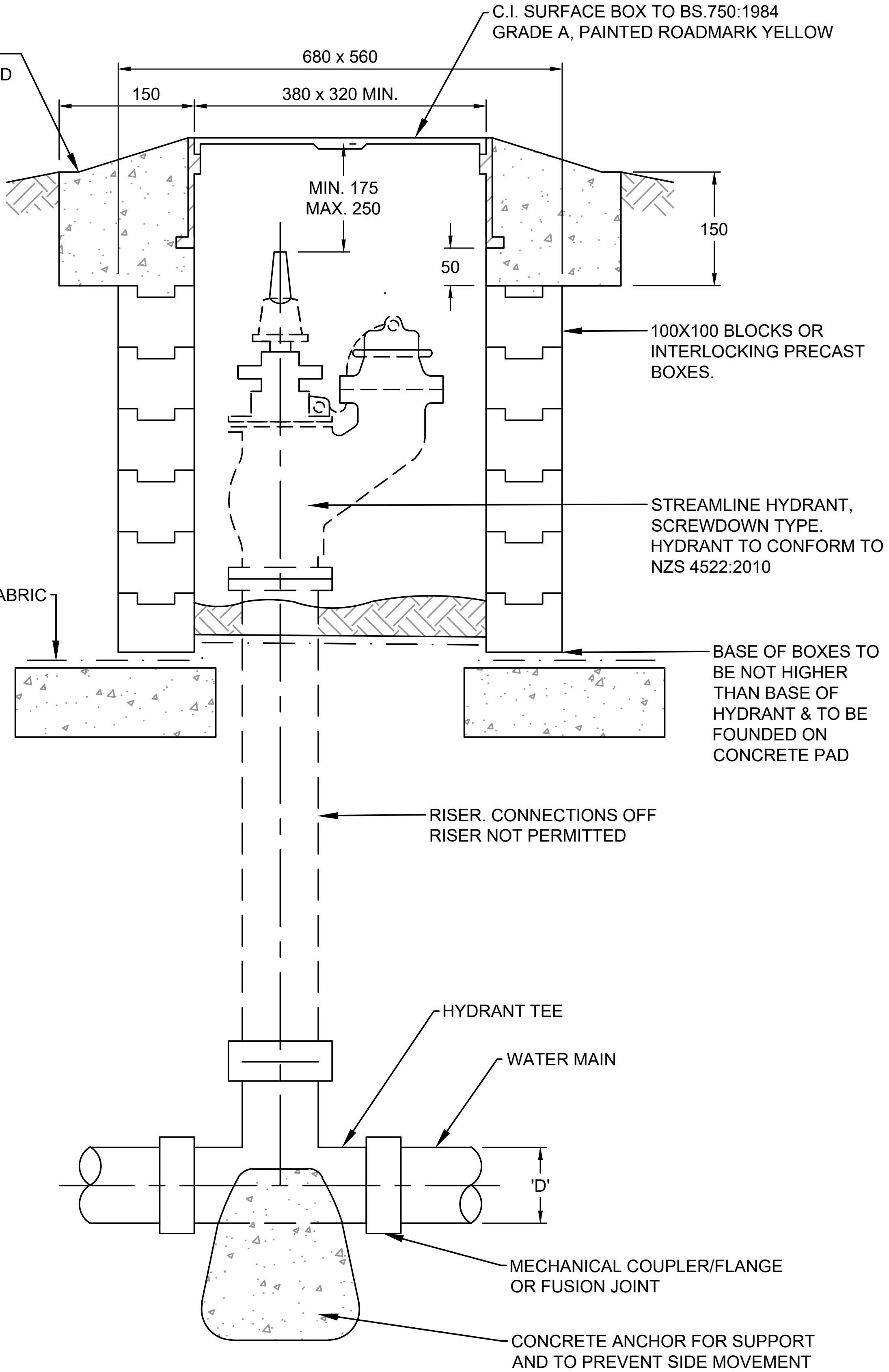
QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Domestic Drainage (Standard Connection) Detail	NOT TO SCALE Drawing No. B1-10



DEEP CONNECTION

DEPTH TO INVERT MORE THAN 2.5m

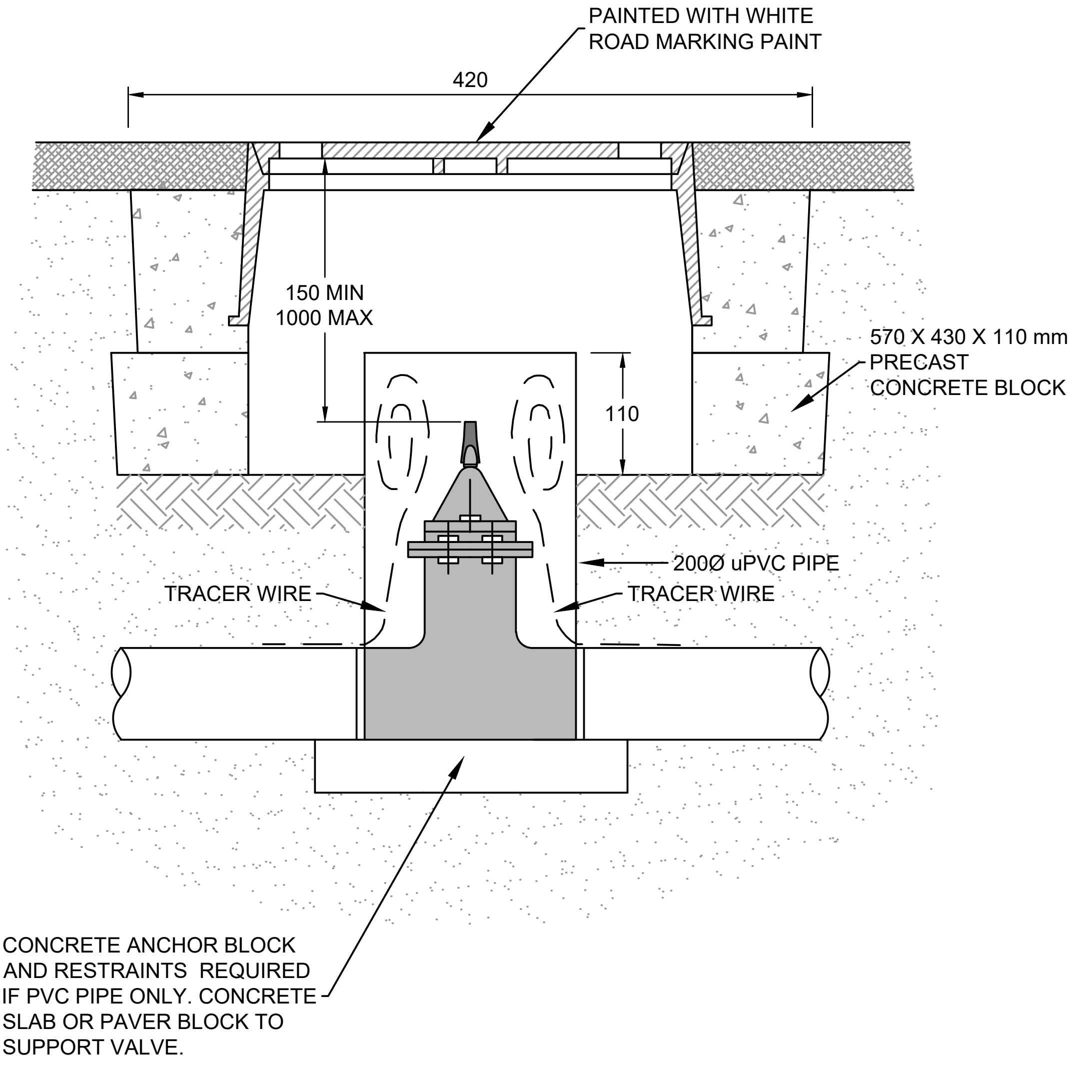
QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Domestic Drainage (Deep Connection) Detail	NOT TO SCALE Drawing No. B1-11



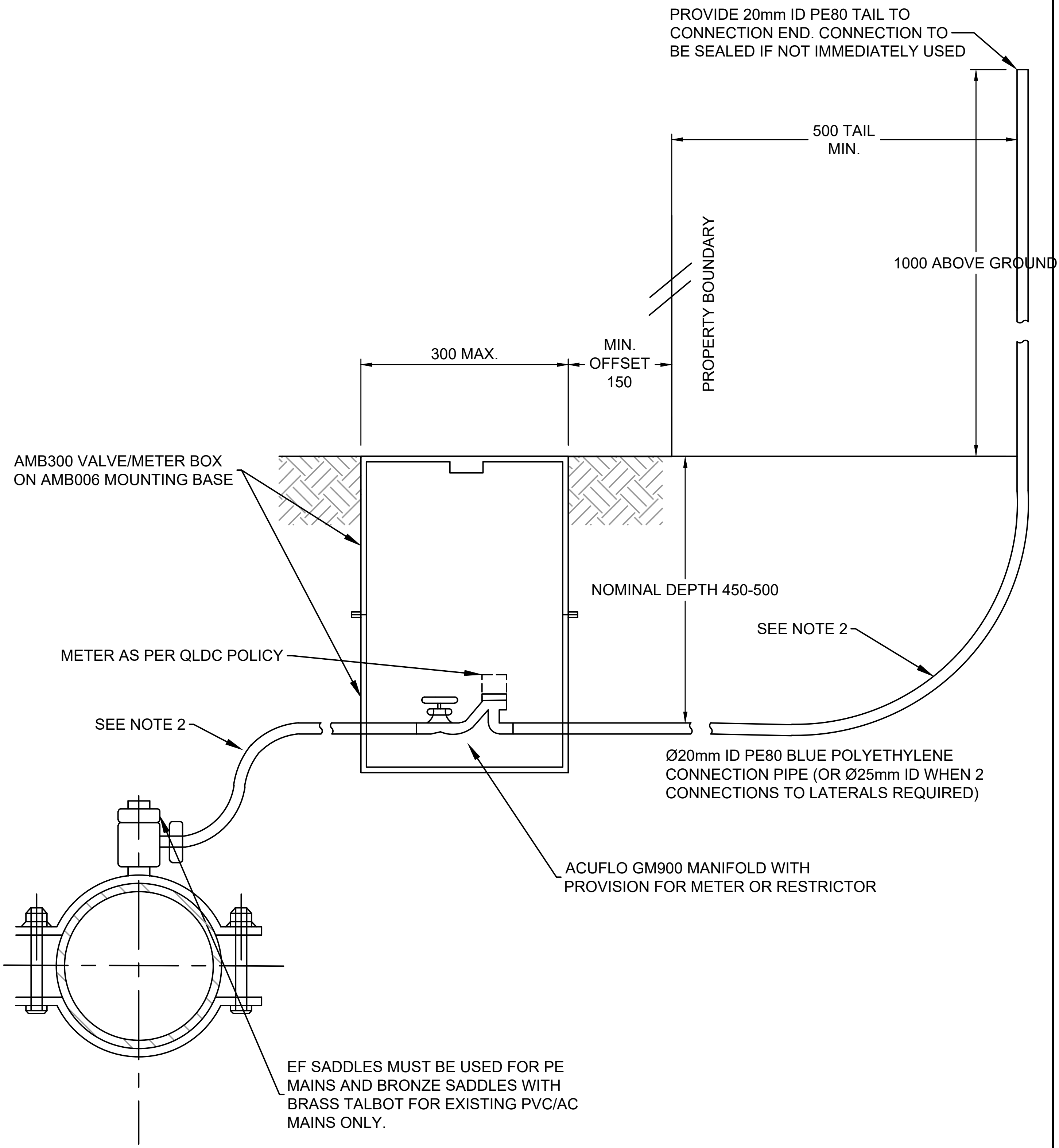
NOTES:

1. ALL DIMENSIONS IN MILLIMETRES.
2. WHERE MAINS ARE CONSTRUCTED IN PVC, USE STANDARD CAST IRON HYDRANT TEE AND STEP MECHANICAL COUPLER.
3. FROST PLUG TO BE INSTALLED.
4. ALL FIRE HYDRANTS SHALL BE INSTALLED ON SUPPLY PIPES THAT HAVE A MINIMUM COVER OF 1000mm TO ALLOW FOR SUITABLE CLEARANCES, IF REQUIRED LOCALISED LOWERING OF THE SUPPLY PIPES CAN BE ACHIEVED BY TAPERING DOWN FROM 5m EITHER SIDE OF THE FIRE HYDRANT.

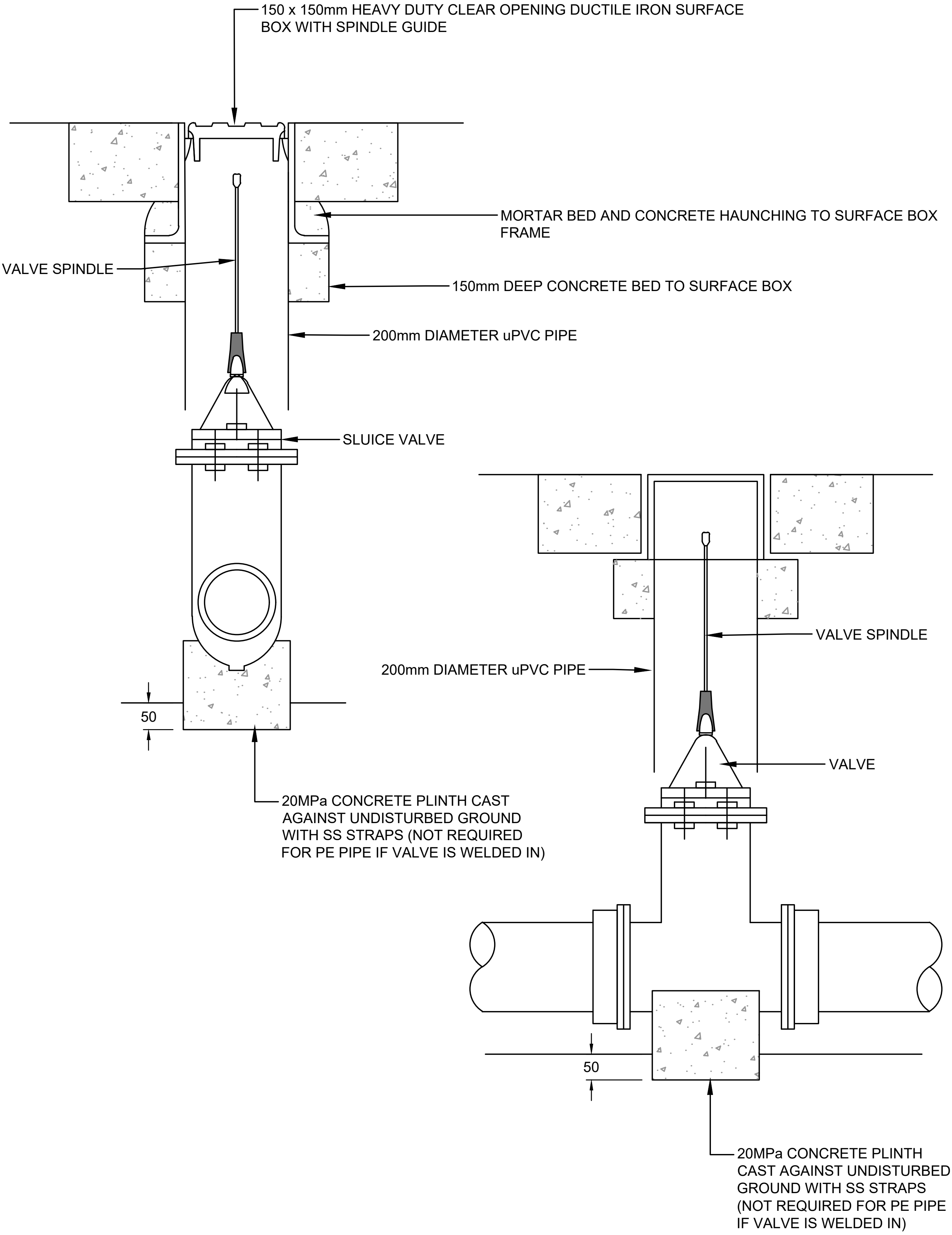
Fire Hydrant



NOTES:
1. CONCRETE SURROUNDS 370x480x90H Ø200 HOLE FITS CAST IRON VALVE BOX 225x235
2. FIRE HYDRANT CONCRETE SURROUND 570x430x110H FITS 405x255 SV OR FH CAST IRON BOX



NOTES:
1. OPTION OF USING 50 mm BRASS TALBOT INSTEAD OF ELBOW OFF MAIN.
2. OPTION OF A CONTINUOUS PIPE LAID IN ACCORDANCE WITH MANUFACTURE MINIMUM BEND RADIUS, AND IF THIS CANNOT BE ACHIEVED THEN ELECTRO FUSION (EF) ELBOWS ARE TO BE USED.
3. WHEN THERE IS NO OPTION BUT TO INSTALL A TOBY BOX IN A TRAFFICABLE AREA THEN A TRAFFICABLE CAST BOX WITH CAST IRON LID IS REQUIRED. REFER TO DRAWING B2-2 FOR DETAILS.
4. 25mm ID CONNECTIONS REQUIRE 2 x ACUFLO BOXES OR 500mm JUMBO BOX WITH BASES.
5. AN ACUFLO GM900 MANIFOLD WITH BLANK CAP AND SCREW-IN DUAL CHECK VALVE SHALL BE INSTALLED ON EACH CONNECTION AND POSITIONED INSIDE AN AMB035 (LID-LESS BOX/BASE COMBINATION) WITH A AMB300 (300mm WITH LID) BOX POSITIONED ABOVE TO GIVE REQUIRED DEPTH (450mm) NEAR THE PROPERTY BOUNDARY AND ALSO BE CLEAR OF ANY VEHICULAR MOVEMENTS.



QLDC LDSC 2025
Standard Details

Revision: 000B
Rev Date: 10/02/2025

QUEENSTOWN LAKES DISTRICT COUNCIL

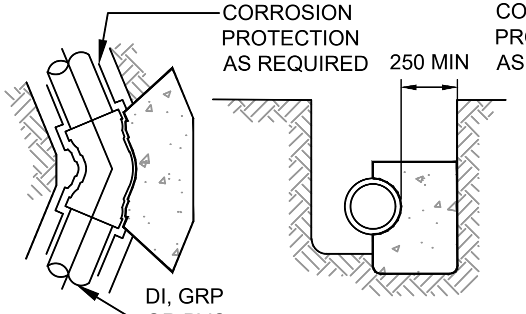
Drawing Title:

Sluice Valve Detail

NOT TO SCALE

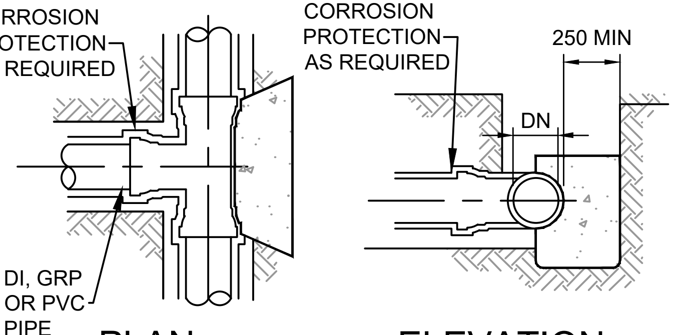
Drawing No.

B2-4



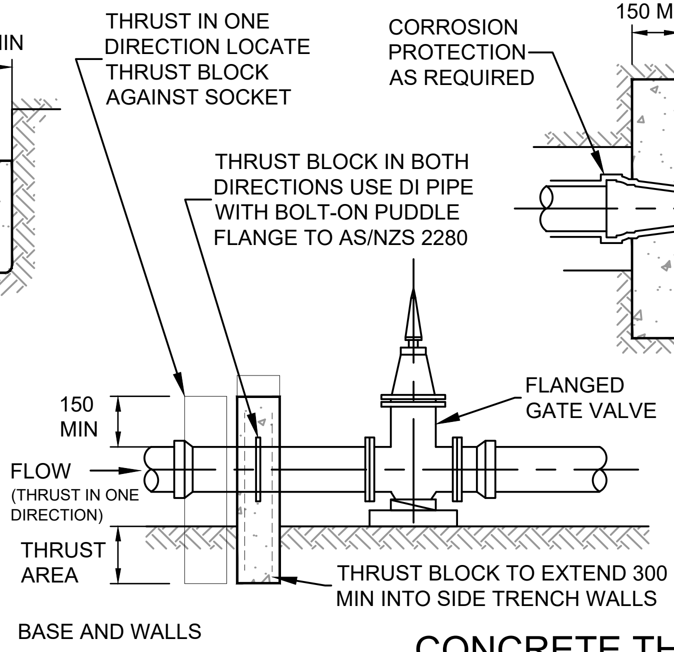
THRUST BLOCK FOR BENDS

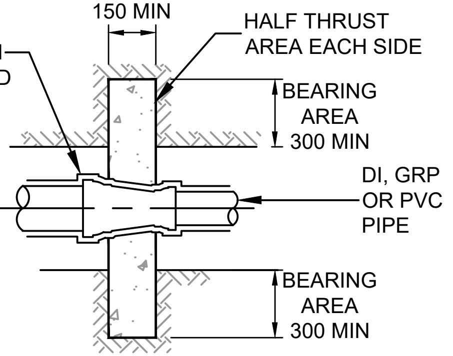
(FOR HORIZONTAL THRUST)



THRUST BLOCK FOR TEES

(FOR HORIZONTAL THRUST)





TAPER THRUST BLOCK

(FOR HORIZONTAL THRUST)

CONCRETE THRUST BLOCK FOR FLANGED VALVES

MINIMUM THRUST AREA FOR BLOCKS IN SQUARE METRES (m^2) DESIGN PRESSURE 1000 kPa (NOM. 100m HEAD)

SOIL CLASSIFICATION AND ALLOWABLE HORIZONTAL BEARING PRESSURE OF GROUND. (SEE NOTE 1)	90° & 60° HORIZONTAL BENDS			45° & 30° HORIZONTAL BENDS			22.5° HORIZONTAL BENDS			11.25° HORIZONTAL BENDS			TEES AND DEAD ENDS		
FOR HORIZONTAL THRUST ON TRENCH WALLS WHERE THE COVER OVER PIPES IS 450 OR GREATER	STIFF CLAY MEDIUM DENSE CLEAN SAND	VERY STIFF CLAY DENSE SAND/GRAVEL DECOMPOSED ROCK	HARD CLAY SOUND ROCK	STIFF CLAY MEDIUM-DENSE CLEAN SAND	VERY STIFF CLAY DENSE SAND/GRAVEL DECOMPOSED ROCK	HARD CLAY SOUND ROCK	STIFF CLAY MEDIUM-DENSE CLEAN SAND	VERY STIFF CLAY DENSE SAND/GRAVEL DECOMPOSED ROCK	HARD CLAY SOUND ROCK	STIFF CLAY MEDIUM-DENSE CLEAN SAND	VERY STIFF CLAY DENSE SAND/GRAVEL DECOMPOSED ROCK	HARD CLAY SOUND ROCK	STIFF CLAY MEDIUM-DENSE CLEAN SAND	VERY STIFF CLAY DENSE SAND/GRAVEL DECOMPOSED ROCK	HARD CLAY SOUND ROCK
PBH kPa	50	100	200	50	100	200	50	100	200	50	100	200	50	100	200
NOMINAL DIAMETER OF FITTING (DN)															
100	0.32	N	N	N	N	N	N	N	N	N	N	N	.023	N	N
150	0.68	0.34	N	0.37	N	N	0.19	N	N	N	N	N	0.48	0.24	N
200	1.07	0.54	0.27	0.58	0.29	N	0.30	N	N	N	N	N	0.76	0.38	0.19
225	1.46	0.73	0.37	0.79	0.40	0.20	0.40	0.20	N	0.20	N	N	1.03	0.52	0.26
250	1.64	0.82	0.41	0.88	0.44	0.22	0.45	0.23	N	0.23	N	N	1.16	0.58	0.29
300	2.59	1.30	0.65	1.40	0.70	0.35	0.72	0.36	N	0.36	N	N	1.83	0.92	0.46
375	3.95	1.98	0.99	2.14	1.07	0.53	1.09	0.55	0.27	0.55	0.27	N	2.79	1.40	0.70
450	5.60	2.80	1.40	3.03	1.51	0.76	1.54	0.77	0.39	0.78	0.39	0.19	3.96	1.98	0.99
500	6.16	3.08	1.54	3.34	1.67	0.83	1.70	0.85	0.43	0.85	0.43	0.21	4.36	2.18	1.09
600	9.69	4.84	2.42	5.24	2.62	1.31	2.67	1.34	0.67	1.34	0.67	0.34	6.85	3.43	1.71
750	14.40	7.20	3.60	7.79	3.90	1.95	3.97	1.99	0.99	2.00	1.00	0.50	10.18	5.09	2.54

N' DENOTES NOMINAL THRUST AREA - (SEE NOTES 4 & 5)

PBH - ALLOWABLE HORIZONTAL BEARING PRESSURE

NOTES:

1. SOIL CLASSIFICATIONS USED IN THIS TABLE ARE EXPLAINED IN APPENDIX G OF WSA 03.
2. CAST THE THRUST AREA OF ALL THRUST BLOCKS AGAINST A CLEAN FACE OF UNDISTURBED NATURAL SOIL. THRUST BLOCKS NOT TO INTERFERE WITH OTHER SERVICES.
3. DO NOT USE STANDARD THRUST BLOCKS IN:
   - VERY SOFT, SOFT OR FIRM CLAY;
   - LOOSE CLEAN SAND;
   - UNCOMPACTED FILL OR REFUSE;

   A GEOTECHNICAL ASSESSMENT AND INDIVIDUAL DESIGN IS REQUIRED FOR THESE SOILS.
3. THE NOMINAL THRUST AREA ‘N’ TO BE ACHIEVED BY POURING CONCRETE THE FULL LENGTH OF THE FITTING AND EXTENDING FROM THE FLOOR OF THE TRENCH TO ABOVE THE FITTING (SEE NOTE 5).
4. FOR SYSTEM TEST PRESSURES OTHER THAN 1000 kPa REDUCE OR INCREASE THE MINIMUM THRUST AREA BY THE RATIO OF THE APPLICABLE PRESSURES EXCEPT WHERE:
   - THRUST AREA IS $<0.18m^2$, AND
   - ‘N’ APPEARS IN THE TABLE AND THE APPLICABLE PRESSURE IS ABOVE 1000 kPa CALCULATE THE AREA.
5. FINISH THRUST BLOCKS APPROXIMATELY 100 mm ABOVE THE TOP OF THE FITTING OR BEARING PAD AND EXTEND TO THE FLOOR OF THE TRENCH OR DEEPER IF NECESSARY TO ACHIEVE THE REQUIRED THRUST AREA. MAXIMUM ENCASEMENT TO BE 180°.
6. THE MINIMUM THRUST AREA FOR TAPER THRUST BLOCKS TO BE EQUAL TO THE DIFFERENCE BETWEEN THE THRUST AREAS FOR DEAD-ENDS OF EQUIVALENT DIAMETER TO THOSE EACH SIDE OF TAPER.
7. FOR DOWNWARD VERTICAL THRUST, THE ALLOWABLE BEARING PRESSURES FOR VARIOUS SOILS MAY BE TAKEN AS TWICE THAT FOR HORIZONTAL THRUST SHOWN.
8. WHEN POURING CONCRETE AGAINST FITTINGS PLACE A MEMBRANE OF POLYETHYLENE, PVC OR FELT BETWEEN THE FITTING AND CONCRETE TO PREVENT DAMAGE TO THE FITTING. JOINTS TO BE CLEAR OF CONCRETE.
9. CONCRETE TO BE KEPT CLEAR OF BOLTS & FLANGES OR GIBAULT JOINTS TO ALLOW FITTINGS TO BE REMOVED WITHOUT INTERFERING WITH ANCHOR BLOCK.
10. THE USE OF THRUST BLOCKS IS GENERALLY NOT REQUIRED FOR PE PIPE. THRUST BLOCKS MAY BE REQUIRED IN CASES WHERE SPECIAL GASKETED MECHANICAL FITTINGS ARE USED.

QLDC LDSC 2025
Standard Details

Revision: 000B
Rev Date: 10/02/2025

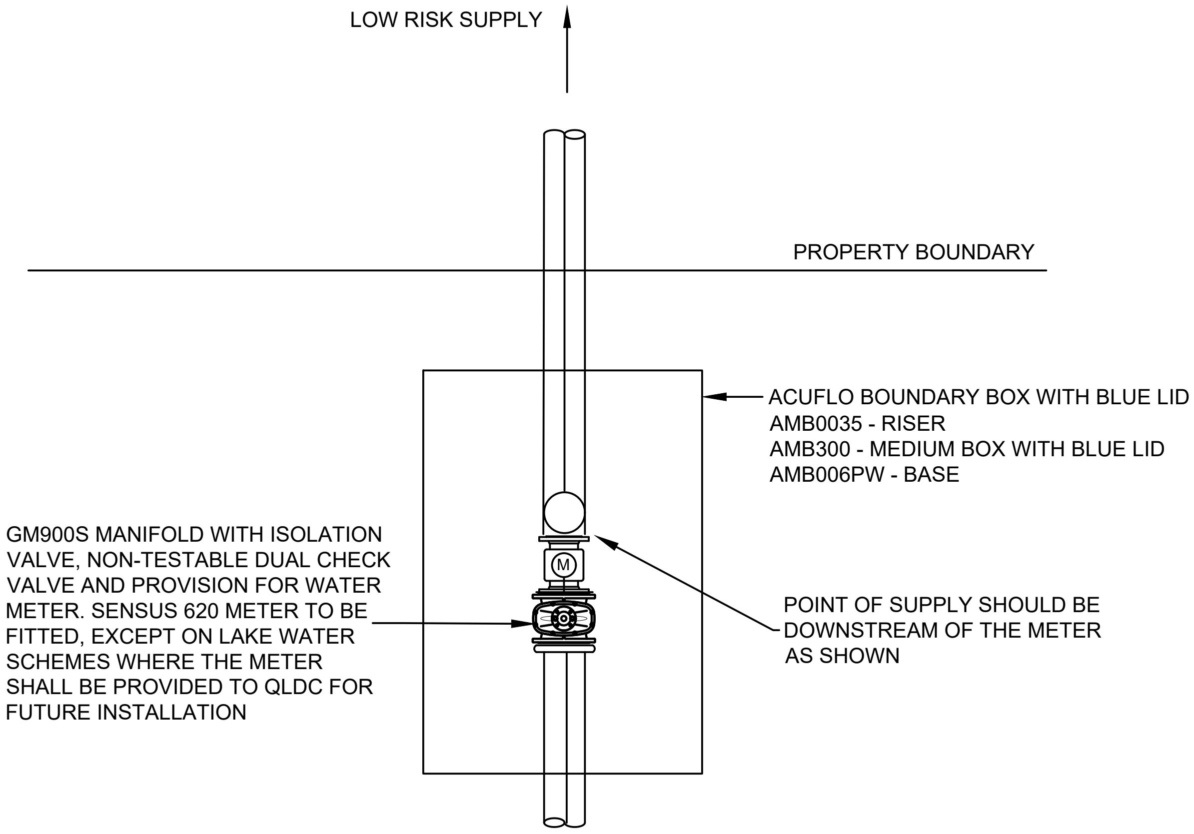
QUEENSTOWN LAKES DISTRICT COUNCIL

Drawing Title:

Typical Thrust Block Details

NOT TO SCALE

Drawing No.
B2-5



DETAIL 1

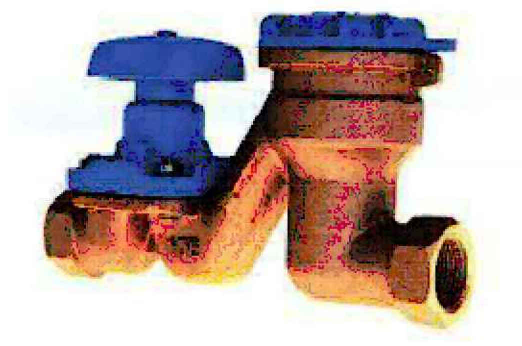


IMAGE OF GM900S MANIFOLD

(EXCLUDING BOX, BASE, RISER AND LID)

NOTES

GENERAL

1. THE BACKFLOW PREVENTION (BFP) DEVICE SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURES RECOMMENDATIONS.
2. THE POINT OF SUPPLY SHALL BE THE DOWNSTREAM CONNECTION OF THE MANIFOLD/METER. FOR CONNECTIONS WHICH INCLUDE A FIRE SUPPLY. THE POINT OF SUPPLY SHALL BE DOWNSTREAM OF THE FIRST ISOLATION VALVE AFTER THE MAIN.
3. THE ISOLATION VALVE & METER SHALL BE LOCATED ON THE ROAD RESERVE IN ALL INSTANCES AND SHALL NOT BE LOCATED ON A R.O.W., EASEMENT OR PRIVATE PROPERTY WITHOUT WRITTEN APPROVAL FROM THE TA.
4. GREEN LID TO BE USED FOR IRRIGATION BFP IN-GROUND BOXES. BLUE LID TO BE USED FOR ALL OTHER BFP IN-GROUND BOXES.
5. IF THE WATER SUPPLY IS PROPOSED TO BE DIVIDED INTO MULTIPLE LINES TO SERVICE DIFFERENT AREAS OF THE SITE, THE BFP SHALL BE LOCATED ON THE SINGLE INCOMING WATER SUPPLY LINE IN ADVANCE OF ANY SUCH DIVISION.
6. ALL WORKS TO BE IN ACCORDANCE WITH QLDC BACKFLOW POLICY.
7. WATER METERS TO BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS AND MUST CONFORM WITH QLDC WATER METER POLICY.

LOW RISK ONLY

1. LOW RISK WITH ID>25mm MUST BE SAME CONFIGURATION AS DETAIL 3.

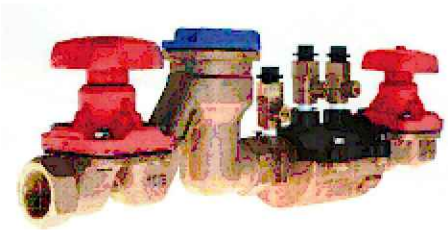
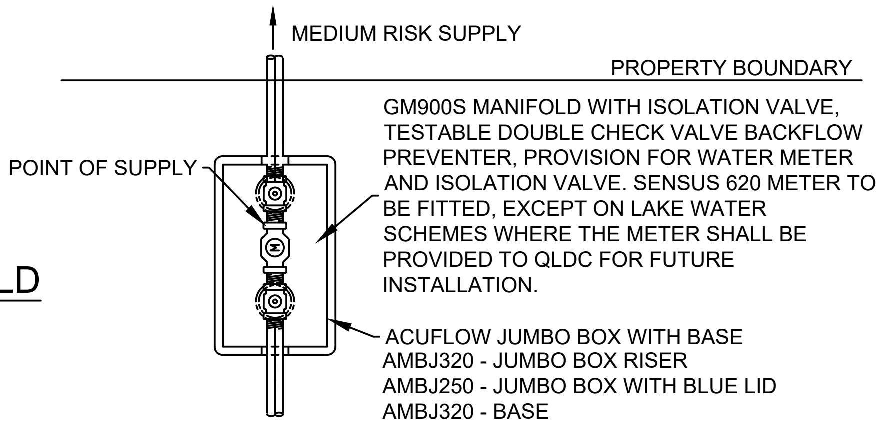


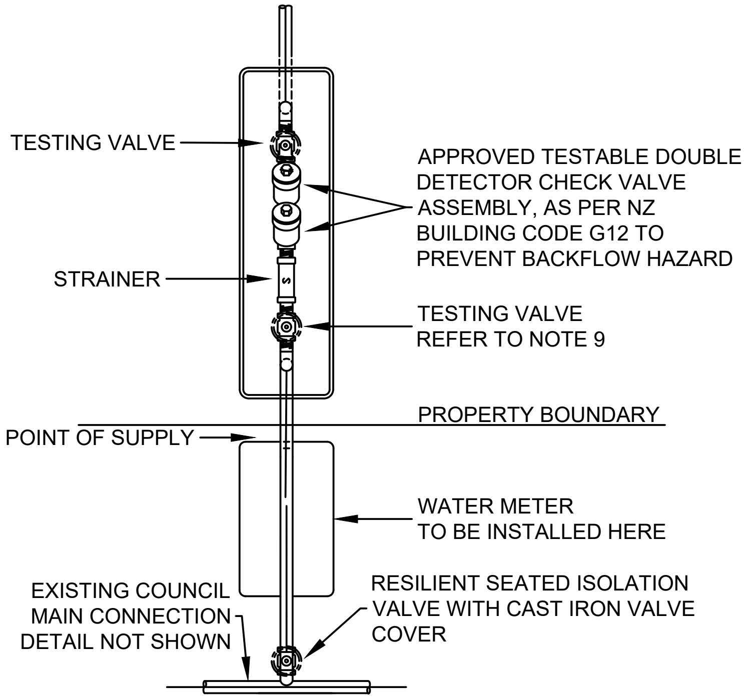
IMAGE OF GM900STR MANIFOLD

(EXCLUDING BOX, BASE, RISER AND LID)



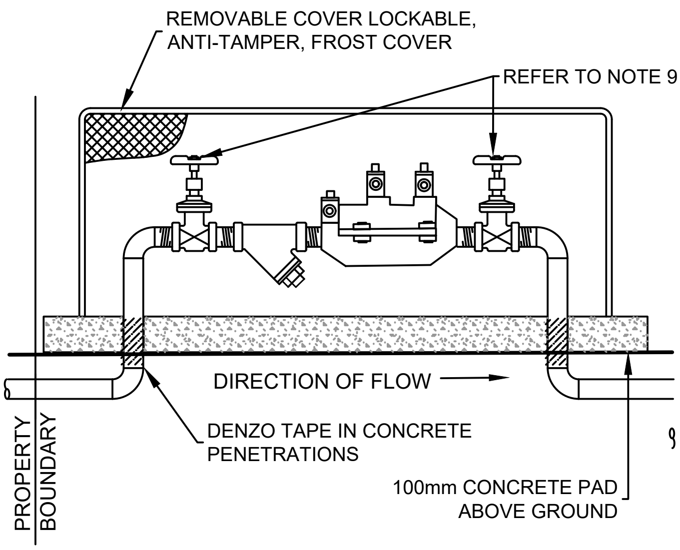
DETAIL 2 MEDIUM RISK - POTABLE WATER SUPPLY ONLY

FOR CONNECTIONS UP TO 25mm ID



DETAIL 3 MEDIUM RISK - POTABLE WATER SUPPLY ONLY

FOR CONNECTIONS GREATER THAN 25mm ID



SIDE ELEVATION FOR DETAIL 3

NOTES

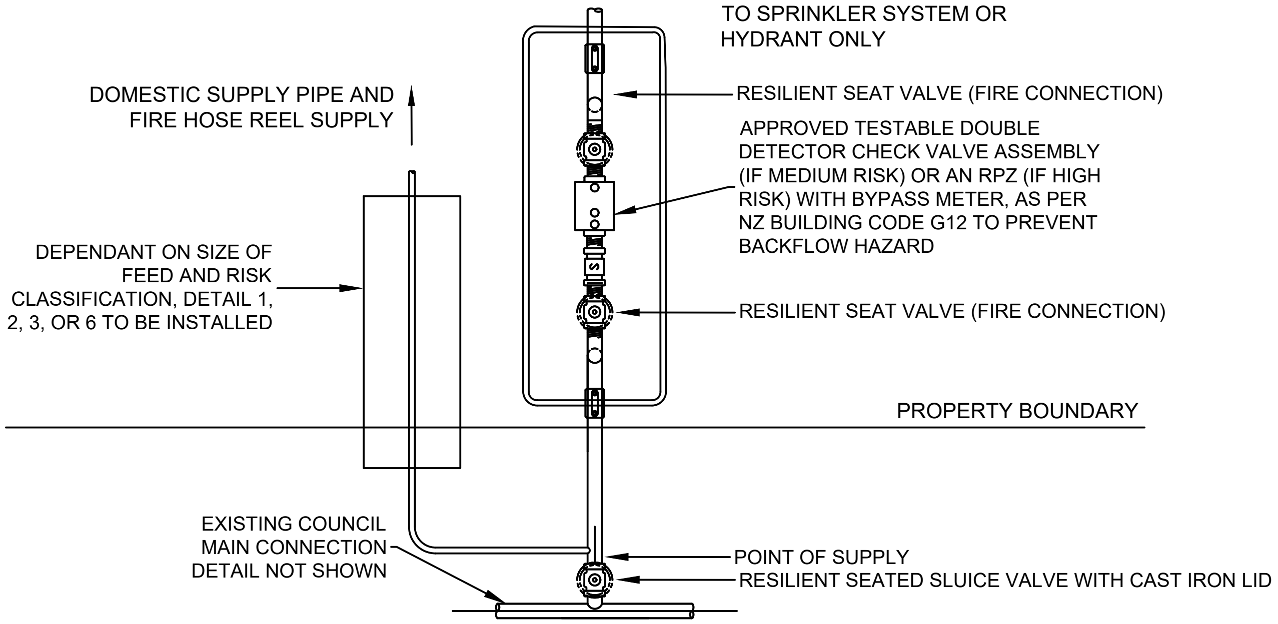
GENERAL

1. THE BACKFLOW PREVENTION (BFP) DEVICE SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURES RECOMMENDATIONS.
2. THE POINT OF SUPPLY SHALL BE THE DOWNSTREAM CONNECTION OF THE MANIFOLD/METER. FOR CONNECTIONS WHICH INCLUDE A FIRE SUPPLY. THE POINT OF SUPPLY SHALL BE DOWNSTREAM OF THE FIRST ISOLATION VALVE AFTER THE MAIN.
3. THE ISOLATION VALVE & METER SHALL BE LOCATED ON THE ROAD RESERVE IN ALL INSTANCES AND SHALL NOT BE LOCATED ON A R.O.W. EASEMENT OR PRIVATE PROPERTY WITHOUT WRITTEN APPROVAL FROM THE TA.
4. GREEN LID TO BE USED FOR IRRIGATION BFP IN-GROUND BOXES. BLUE LID TO BE USED FOR ALL OTHER BFP IN-GROUND BOXES.
5. IF BFP, ACCORDING TO RISK LEVEL AND RELEVANT DETAIL, SHOULD BE WITHIN THE PROPERTY BOUNDARY BUT CANNOT FIT, AN ALTERNATIVE CONFIGURATION MUST BE APPROVED BY THE TA.
6. IF THE WATER SUPPLY IS PROPOSED TO BE DIVIDED INTO MULTIPLE LINES TO SERVICE DIFFERENT AREAS OF THE SITE, THE BFP SHALL BE LOCATED ON THE SINGLE INCOMING WATER SUPPLY LINE IN ADVANCE OF ANY SUCH DIVISION.
7. ALL WORKS TO BE IN ACCORDANCE WITH QLDC BACKFLOW POLICY.
8. WATER METERS TO BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS AND MUST CONFORM WITH QLDC WATER METER POLICY.

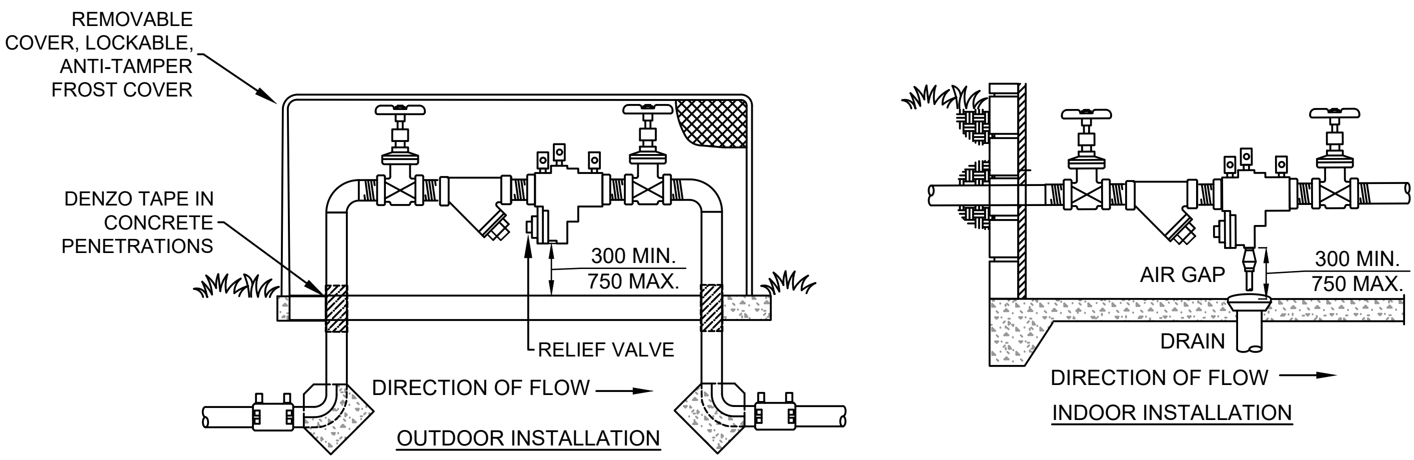
MEDIUM & HIGH RISK ONLY

9. TESTING VALVES FOR ALL MEDIUM & HIGH RISK BFP UP TO 50mm ID TO BE BALL VALVE. ABOVE 50mm ID, TESTING VALVES TO BE BUTTERFLY OR RESILIENT SEATED VALVES.
10. IF INTERNAL DIAMETER (ID) >25mm, BFP MUST BE ABOVE GROUND. IF THIS CANNOT BE ACHIVED AN ALTERNATIVE CONFIGURATION MUST BE APPROVED BY THE TA. ALL HIGH RISK BFP MUST BE ABOVE GROUND.
11. FOR OUTSIDE ABOVE GROUND INSTALLATIONS <50mm (ID) A SUITABLE PROPRIETARY ENCLOSURE SHALL BE PROVIDED (DEKORRA 302-BG-C2 OR SIMILAR). FOR LARGER INSTALLATIONS A BESPOKE ENCLOSURE WILL BE REQUIRED.
12. FOR ABOVE GROUND INSTALLATION THE EXPOSED PIPEWORK ASSOCIATED WITH THE BFP SHALL BE PE, STAINLESS STEEL OR DUCTILE IRON.

QLDC LDSC 20202 Standard Details Revision: 0000B Rev Date: 17/05/2022	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Low and Medium Risk, Potable Supply Only for connections up to 25mm and > 25mm, no fire supply	NOT TO SCALE Drawing No. B2-7



DETAIL 4 FIRE SUPPLY WITH POTABLE WATER



SIDE ELEVATION FOR DETAIL 4 & 5 FIRE SUPPLY ONLY

NOTES

GENERAL

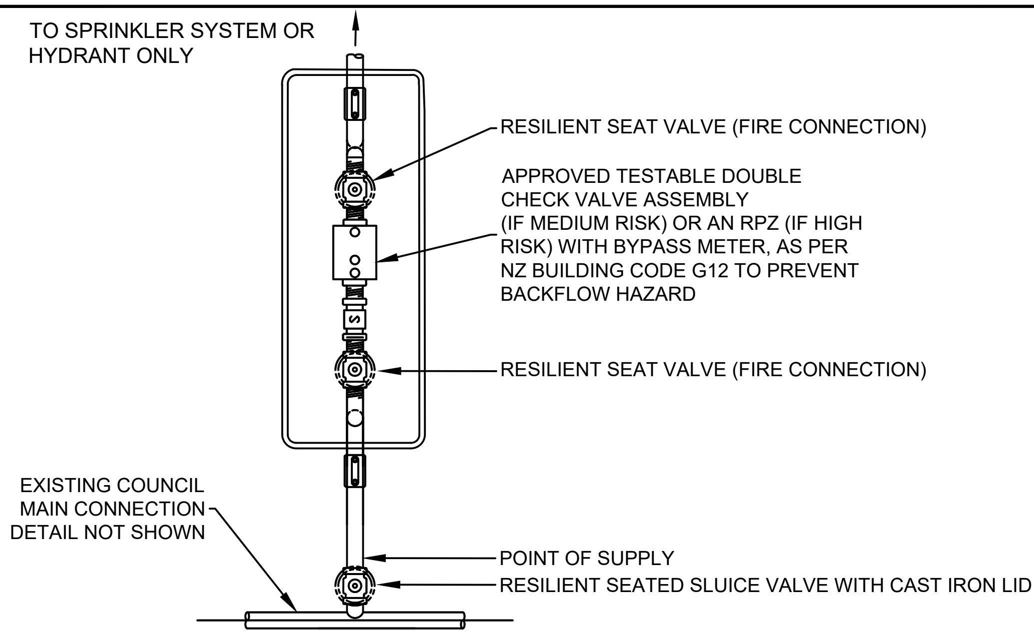
1. THE BACKFLOW PREVENTION (BFP) DEVICE SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURES RECOMMENDATIONS.
2. THE POINT OF SUPPLY SHALL BE THE DOWNSTREAM CONNECTION OF THE MANIFOLD/METER. FOR CONNECTIONS WHICH INCLUDE A FIRE SUPPLY. THE POINT OF SUPPLY SHALL BE DOWNSTREAM OF THE FIRST ISOLATION VALVE AFTER THE MAIN.
3. THE ISOLATION VALVE & METER SHALL BE LOCATED ON THE ROAD RESERVE IN ALL INSTANCES AND SHALL NOT BE LOCATED ON A R.O.W. EASEMENT OR PRIVATE PROPERTY WITHOUT WRITTEN APPROVAL FROM THE TA.
4. GREEN LID TO BE USED FOR IRRIGATION BFP IN-GROUND BOXES. BLUE LID TO BE USED FOR ALL OTHER BFP IN-GROUND BOXES.
5. IF BFP, ACCORDING TO RISK LEVEL AND RELEVANT DETAIL, SHOULD BE WITHIN THE PROPERTY BOUNDARY BUT CANNOT FIT, AN ALTERNATIVE CONFIGURATION MUST BE APPROVED BY THE TA.
6. IF THE WATER SUPPLY IS PROPOSED TO BE DIVIDED INTO MULTIPLE LINES TO SERVICE DIFFERENT AREAS OF THE SITE, THE BFP SHALL BE LOCATED ON THE SINGLE INCOMING WATER SUPPLY LINE IN ADVANCE OF ANY SUCH DIVISION.
7. ALL WORKS TO BE IN ACCORDANCE WITH QLDC BACKFLOW POLICY.
8. WATER METERS TO BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS AND MUST CONFORM WITH QLDC WATER METER POLICY.

MEDIUM & HIGH RISK ONLY

9. TESTING VALVES FOR ALL MEDIUM & HIGH RISK BFP UP TO 50mm ID TO BE BALL VALVE. ABOVE 50mm ID, TESTING VALVES TO BE BUTTERFLY OR RESILENT SEATED VALVES.
10. IF INTERNAL DIAMETER (ID) >25mm, BFP MUST BE ABOVE GROUND. IF THIS CANNOT BE ACHIVED AN ALTERNATIVE CONFIGURATION MUST BE APPROVED BY THE TA. ALL HIGH RISK BFP MUST BE ABOVE GROUND.
11. FOR OUTSIDE ABOVE GROUND INSTALLATIONS <50mm (ID) A SUITABLE PROPRIETARY ENCLOSURE SHALL BE PROVIDED (DEKORRA 302-BG-C2). FOR LARGER INSTALLATION A BES[POKE ENCLOSURE WILL BE REQUIRED.
12. FOR ABOVE GROUND INSTALLATION THE EXPOSED PIPEWORK ASSOCIATED WITH THE BFP SHALL BE PE, STAINLESS STEEL OR DUCTILE IRON.

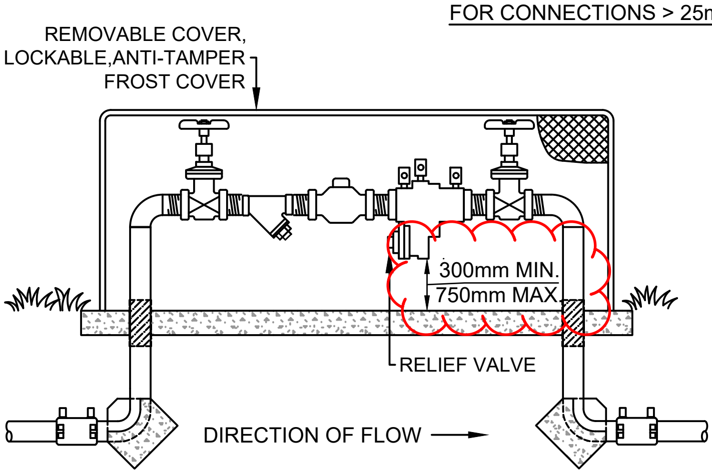
FIRE SUPPLY

1. ALL FIRE SUPPLY BFPS SHALL BE ABOVE GROUND.
2. FIRE SUPPLY CAN BE HIGH RISK (IF CHEMICALS/GLYCOL IS USED) OR MEDIUM RISK (IF NOT CHEMICALS/GLYCOL ARE USED).

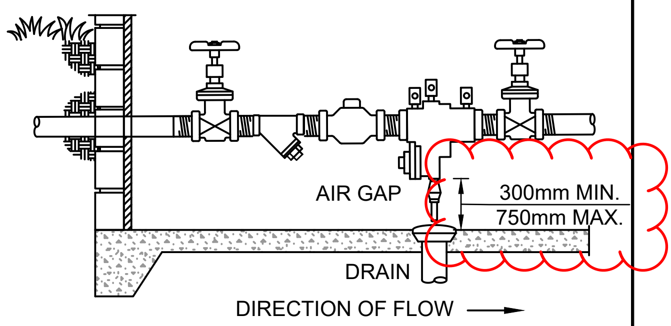


DETAIL 5 FIRE SUPPLY TO SPRINKLER SYSTEM OR HYDRANTS ONLY

FOR CONNECTIONS > 25mm (NOT TO SCALE)



OUTDOOR INSTALLATION



INDOOR INSTALLATION

NOTES

GENERAL

1. THE BACKFLOW PREVENTION (BFP) DEVICE SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURES RECOMMENDATIONS.
2. THE POINT OF SUPPLY SHALL BE THE DOWNSTREAM CONNECTION OF THE MANIFOLD/METER. FOR CONNECTIONS WHICH INCLUDE A FIRE SUPPLY. THE POINT OF SUPPLY SHALL BE DOWNSTREAM OF THE FIRST ISOLATION VALVE AFTER THE MAIN.
3. THE ISOLATION VALVE & METER SHALL BE LOCATED ON THE ROAD RESERVE IN ALL INSTANCES AND SHALL NOT BE LOCATED ON A R.O.W., EASEMENT OR PRIVATE PROPERTY WITHOUT WRITTEN APPROVAL FROM THE TA.
4. GREEN LID TO BE USED FOR IRRIGATION BFP IN-GROUND BOXES. BLUE LID TO BE USED FOR ALL OTHER BFP IN-GROUND BOXES.
5. IF BFP, ACCORDING TO RISK LEVEL AND RELEVANT DETAIL, SHOULD BE WITHIN THE PROPERTY BOUNDARY BUT CANNOT FIT, AN ALTERNATIVE CONFIGURATION MUST BE APPROVED BY THE TA.
6. IF THE WATER SUPPLY IS PROPOSED TO BE DIVIDED INTO MULTIPLE LINES TO SERVICE DIFFERENT AREAS OF THE SITE, THE BFP SHALL BE LOCATED ON THE SINGLE INCOMING WATER SUPPLY LINE IN ADVANCE OF ANY SUCH DIVISION.
7. ALL WORKS TO BE IN ACCORDANCE WITH QLDC BACKFLOW POLICY.
8. WATER METERS TO BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS AND MUST CONFORM WITH QLDC WATER METER POLICY.

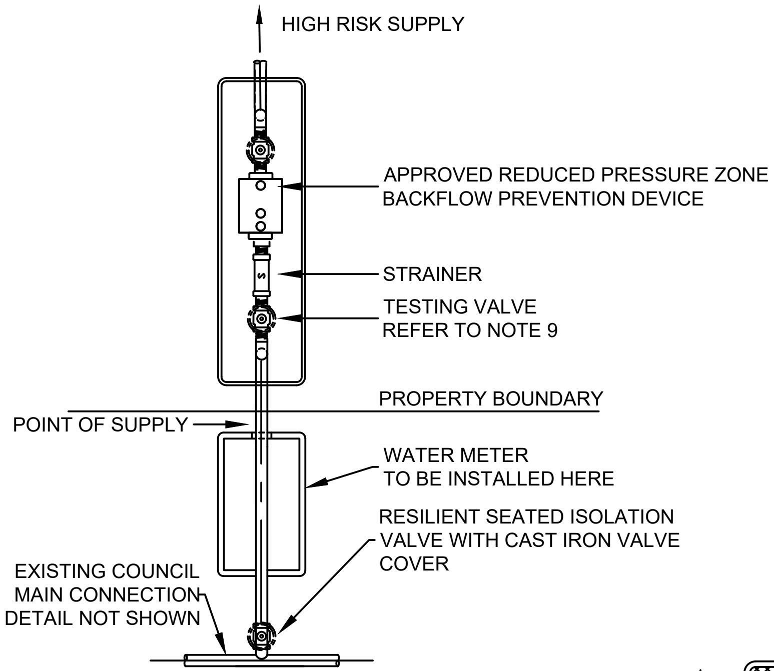
MEDIUM & HIGH RISK ONLY

9. TESTING VALVES FOR ALL MEDIUM & HIGH RISK BFP UP TO 50mm ID TO BE BALL VALVE. ABOVE 50mm ID, TESTING VALVES TO BE BUTTERFLY OR RESILENT SEATED VALVES.
10. IF INTERNAL DIAMETER (ID) >25mm, BFP MUST BE ABOVE GROUND. IF THIS CANNOT BE ACHIVED AN ALTERNATIVE CONFIGURATION MUST BE APPROVED BY THE TA. ALL HIGH RISK BFP MUST BE ABOVE GROUND.
11. FOR OUTSIDE ABOVE GROUND INSTALLATIONS <50mm (ID) A SUITABLE PROPRIETARY ENCLOSURE SHALL BE PROVIDED (DEKORRA 302-BG-C2 OR SIMILAR). FOR LARGER INSTALLATION A BESPOKE ENCLOSURE WILL BE REQUIRED.
12. FOR ABOVE GROUND INSTALLATION THE EXPOSED PIPEWORK ASSOCIATED WITH THE BFP SHALL BE PE, STAINLESS STEEL OR DUCTILE IRON.

FIRE SUPPLY

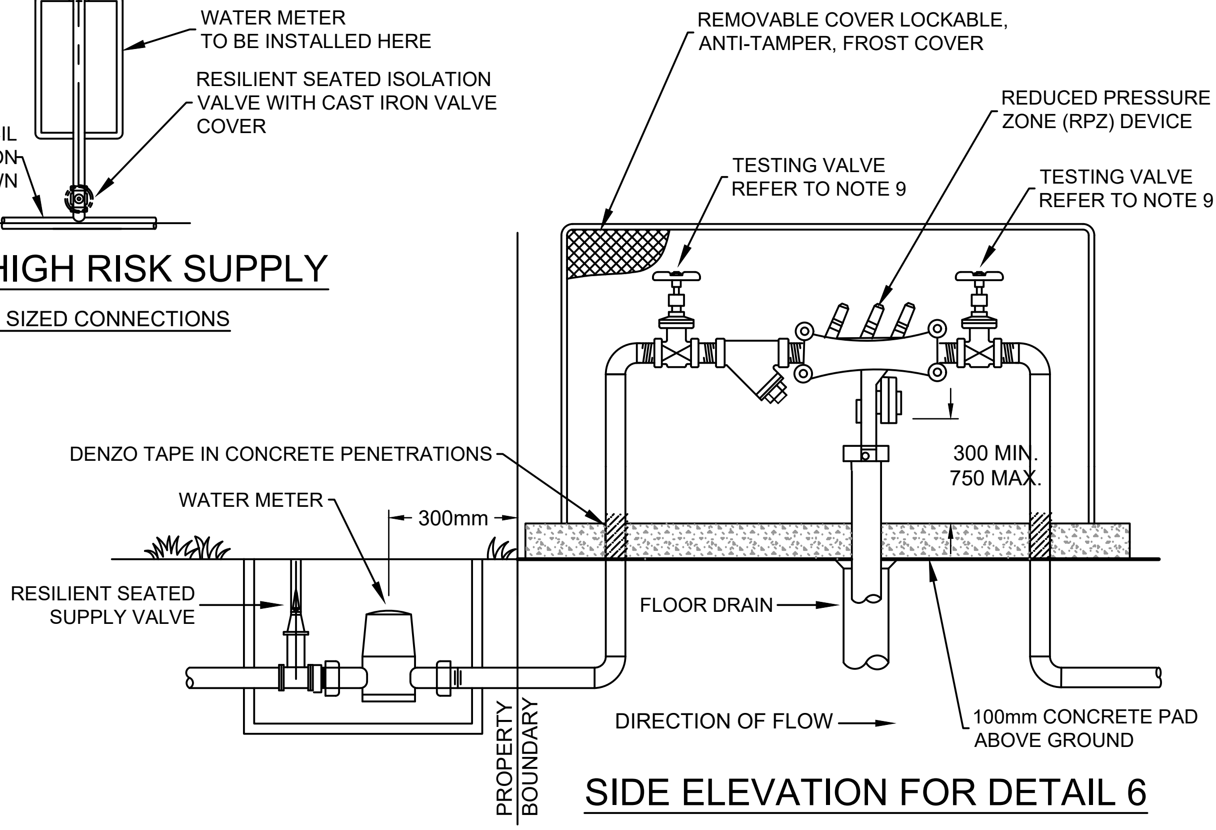
1. ALL FIRE SUPPLY BFPS SHALL BE ABOVE GROUND.
2. FIRE SUPPLY CAN BE HIGH RISK (IF CHEMICALS/GLYCOL IS USED) OR MEDIUM RISK (IF NOT CHEMICALS/GLYCOL ARE USED).

QLDC LDSC 20202 Standard Details Revision: 0000B Rev Date: 17/05/2022	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Fire Supply Only for connections up to 25mm and > 25mm no potable supply	NOT TO SCALE Drawing No. B2-9



DETAIL 6 HIGH RISK SUPPLY

FOR ANY SIZED CONNECTIONS



SIDE ELEVATION FOR DETAIL 6

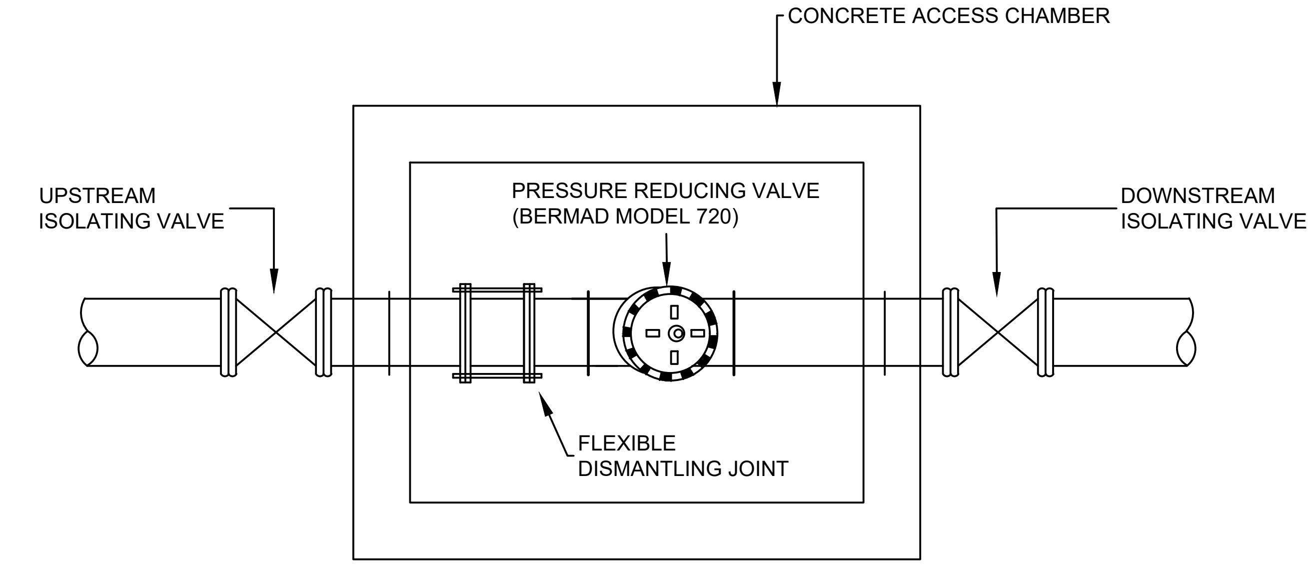
NOTES

GENERAL

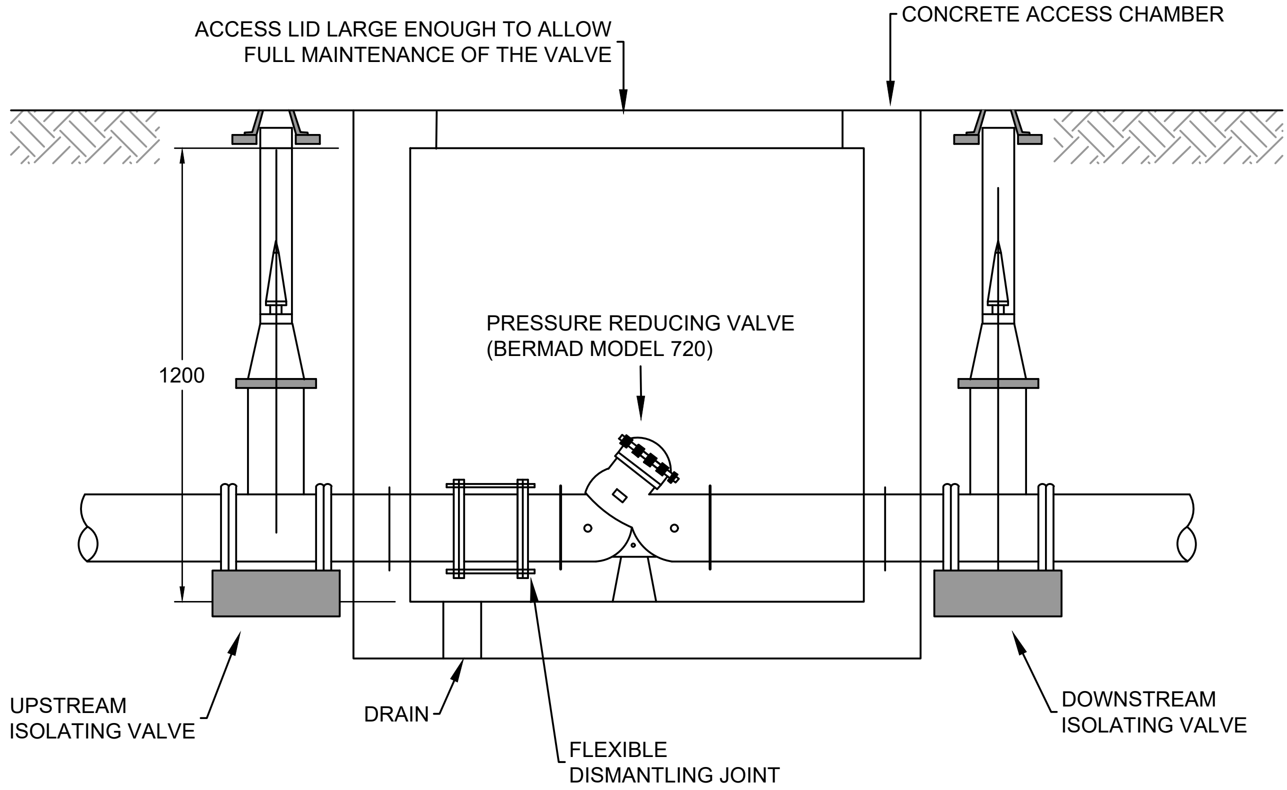
1. THE BACKFLOW PREVENTION (BFP) DEVICE SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURES RECOMMENDATIONS.
2. THE POINT OF SUPPLY SHALL BE THE DOWNSTREAM CONNECTION OF THE MANIFOLD/METER. FOR CONNECTIONS WHICH INCLUDE A FIRE SUPPLY. THE POINT OF SUPPLY SHALL BE DOWNSTREAM OF THE FIRST ISOLATION VALVE AFTER THE MAIN.
3. THE ISOLATION VALVE & METER SHALL BE LOCATED ON THE ROAD RESERVE IN ALL INSTANCES AND SHALL NOT BE LOCATED ON A R.O.W., EASEMENT OR PRIVATE PROPERTY WITHOUT WRITTEN APPROVAL FROM THE TA.
4. GREEN LID TO BE USED FOR IRRIGATION BFP IN-GROUND BOXES. BLUE LID TO BE USED FOR ALL OTHER BFP IN-GROUND BOXES.
5. IF BFP, ACCORDING TO RISK LEVEL AND RELEVANT DETAIL, SHOULD BE WITHIN THE PROPERTY BOUNDARY BUT CANNOT FIT, AN ALTERNATIVE CONFIGURATION MUST BE APPROVED BY THE TA.
6. IF THE WATER SUPPLY IS PROPOSED TO BE DIVIDED INTO MULTIPLE LINES TO SERVICE DIFFERENT AREAS OF THE SITE, THE BFP SHALL BE LOCATED ON THE SINGLE INCOMING WATER SUPPLY LINE IN ADVANCE OF ANY SUCH DIVISION.
7. ALL WORKS TO BE IN ACCORDANCE WITH QLDC BACKFLOW POLICY.
8. WATER METERS TO BE INSTALLED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS AND MUST CONFORM WITH QLDC WATER METER POLICY.

MEDIUM & HIGH RISK ONLY

9. TESTING VALVES FOR ALL MEDIUM & HIGH RISK BFP UP TO 50mm ID TO BE BALL VALVE. ABOVE 50mm ID, TESTING VALVES TO BE BUTTERFLY OR RESILENT SEATED VALVES.
10. IF INTERNAL DIAMETER (ID) >25mm, BFP MUST BE ABOVE GROUND. IF THIS CANNOT BE ACHIVED AN ALTERNATIVE CONFIGURATION
11. MUST BE APPROVED BY THE TA. ALL HIGH RISK BFP MUST BE ABOVE GROUND.
12. FOR OUTSIDE ABOVE GROUND INSTALLATIONS <50mm (ID) A SUITABLE PROPRIETARY ENCLOSURE SHALL BE PROVIDED (DEKORRA 302-BG-C2 OR SIMILAR). FOR LARGER INSTALLATION A BESPOKE ENCLOSURE WILL BE REQUIRED.
13. FOR ABOVE GROUND INSTALLATION THE EXPOSED PIPEWORK ASSOCIATED WITH THE BFP SHALL BE PE, STAINLESS STEEL OR DUCTILE IRON.
14. FOR DETAIL 6, IF PIPE ID >50mm, CONFIGURATION MUST BE APPROVED BY TA TO CONFIRM THE VALVE AND METER LAYOUT.



PLAN



SECTION

NOTES:

1. CONSIDERATION NEEDS TO BE GIVEN FOR UPSTREAM FILTER AND PRESSURE RELIEF VALVE WHEN DESIGNING THE INSTALLATION OF THESE VALVES.
2. CONSIDERATION NEEDS TO BE GIVEN FOR DRAINAGE WITHIN THE VALVE CHAMBER.

QUEENSTOWN LAKES DISTRICT COUNCIL

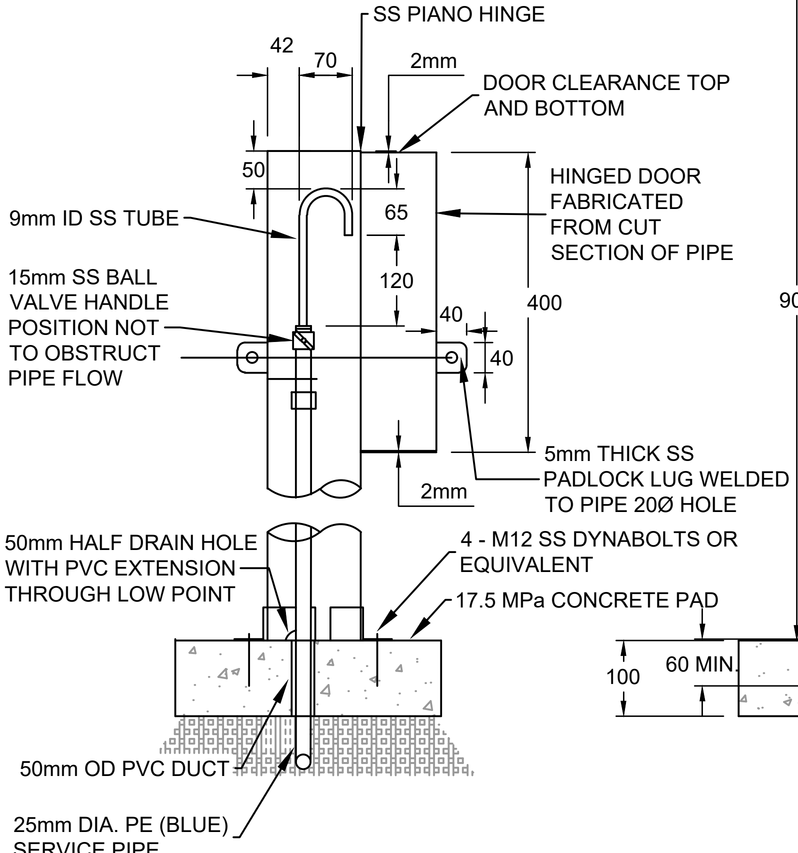
Drawing Title:

PRV Valve Chamber

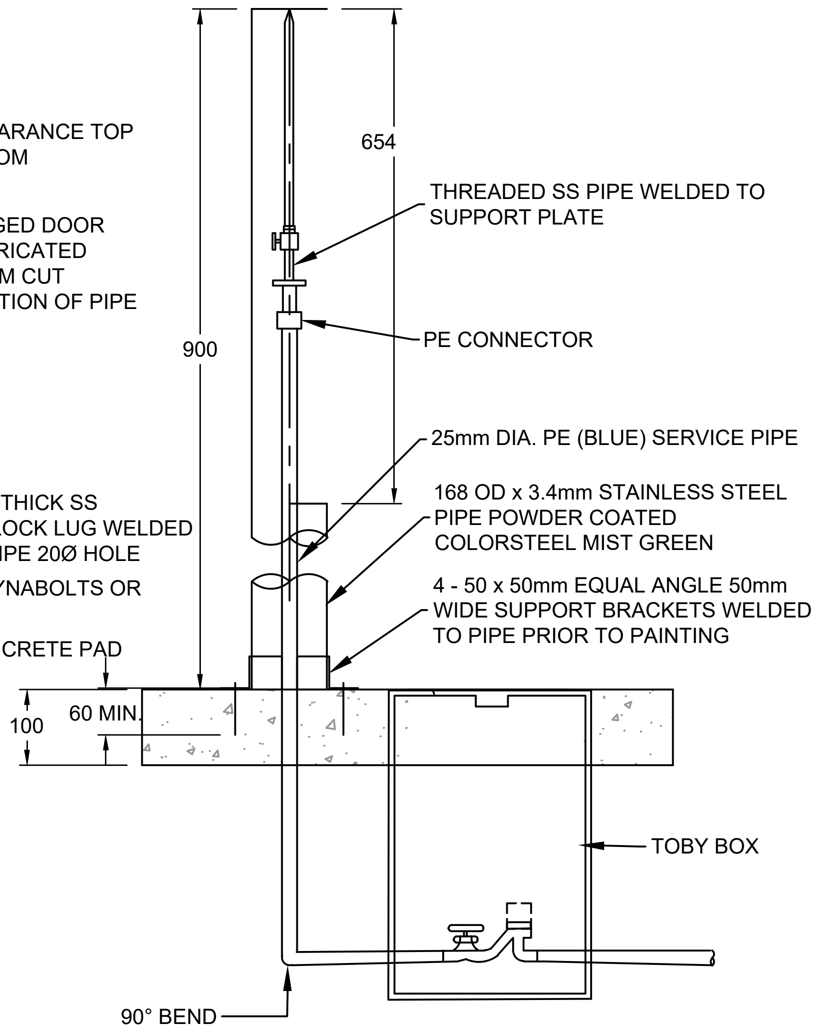
NOT TO SCALE

Drawing No.

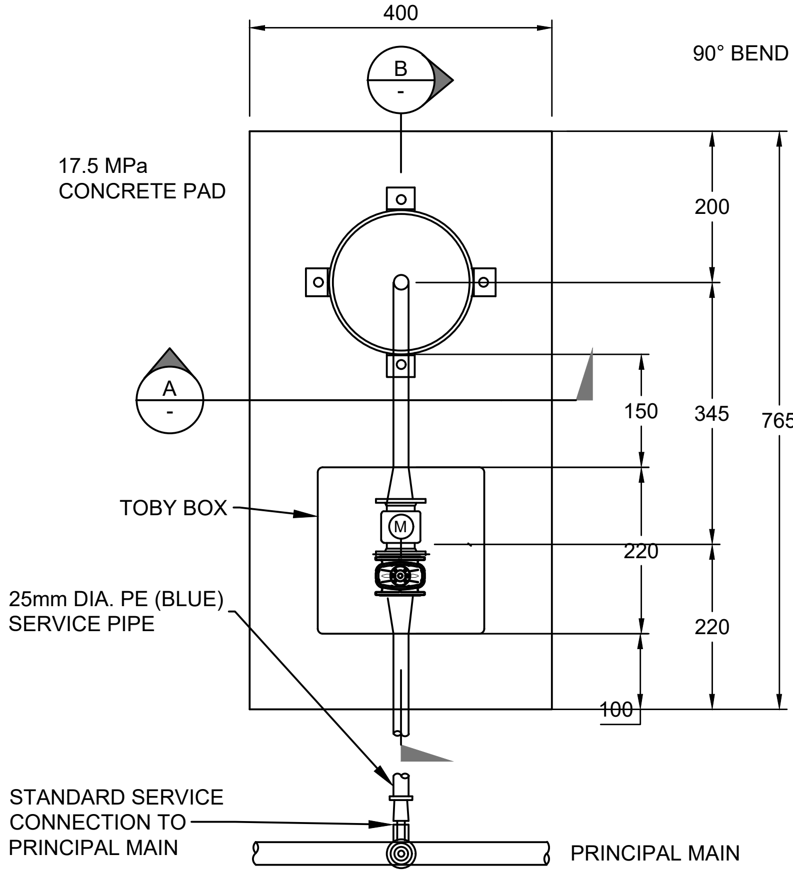
B2-11



SECTION A



SECTION B



PLAN

NOTES
1. THIS ARRANGEMENT IS TO BE USED FOR ALL SAMPLING POINTS IN THE DISTRIBUTION NETWORK.
2. ALL PE CONNECTORS TO BE EITHER PUSHLOK, PLASSON, PHILMAC OR SIMILAR APPROVED.
3. ON SLOPING GROUND INSTALL DOOR OPENING ON UPHILL SIDE.
4. ALL WELDS TO BE 4mm FILLET.
5. SAMPLING POINTS TO BE ADDED TO END OF NETWORKS, IN AREAS WHERE ACCESIBLE

QLDC LDSC 2025
Standard Details

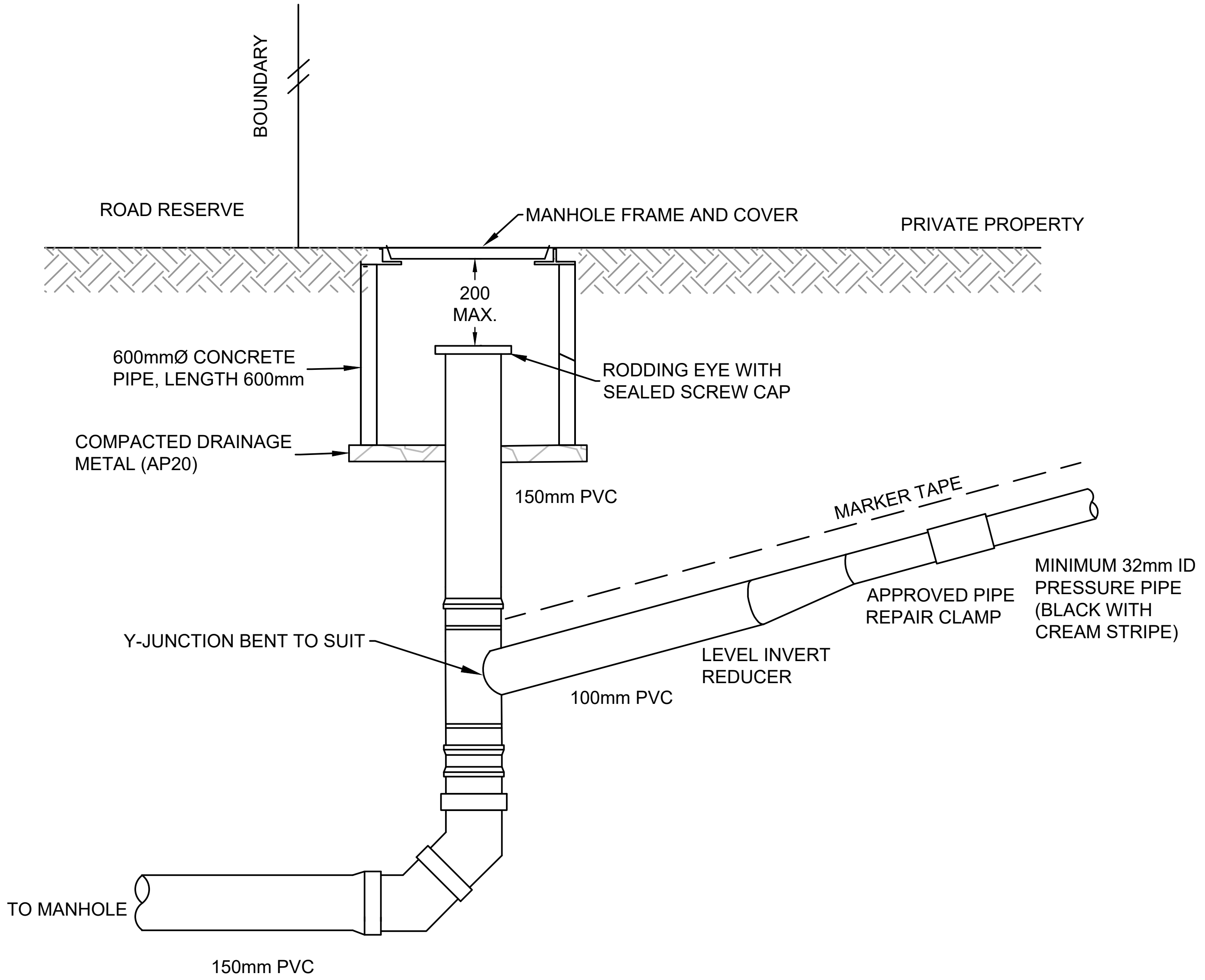
Revision: 000B
Rev Date: 10/02/2025

QUEENSTOWN LAKES DISTRICT COUNCIL

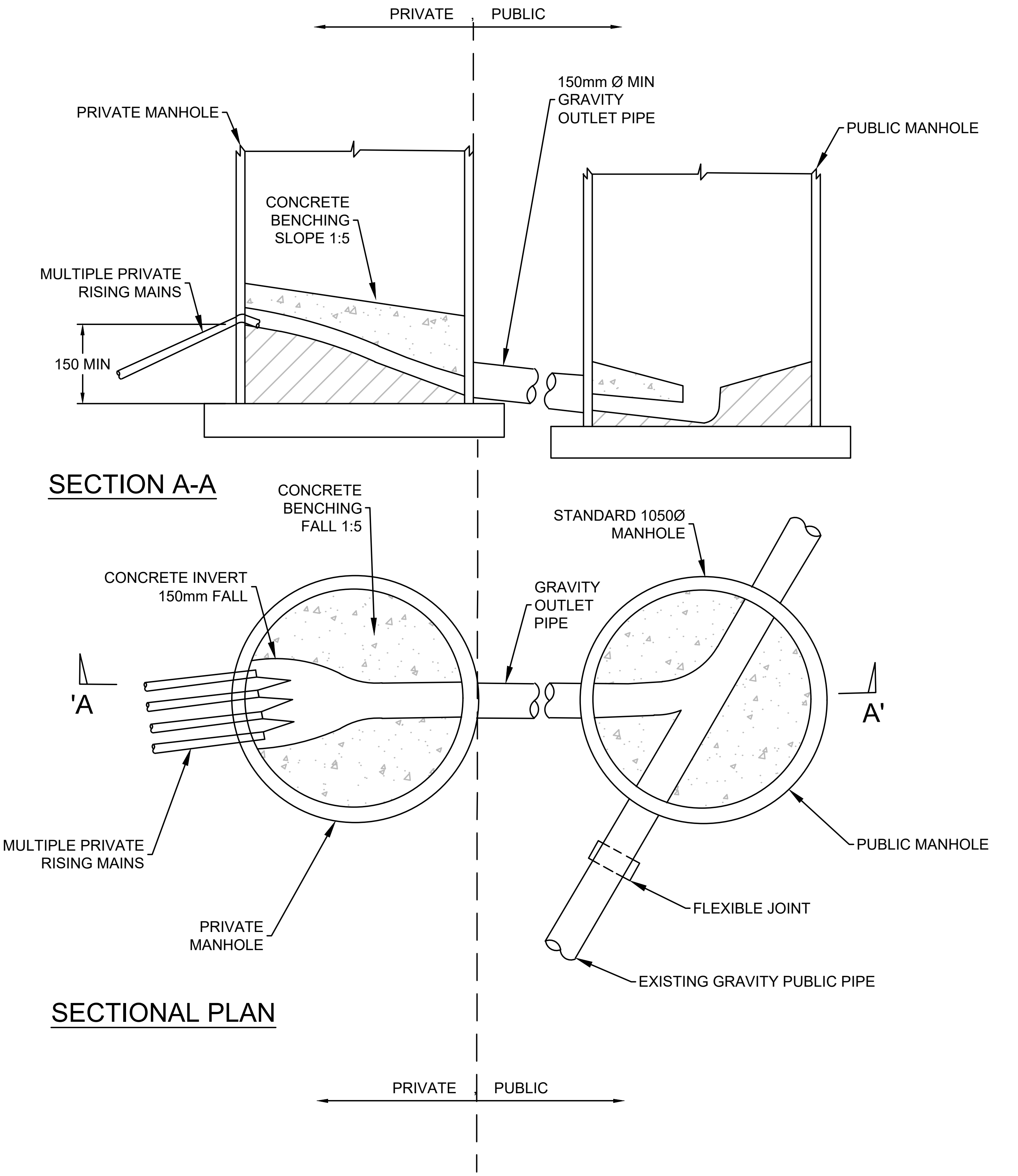
Drawing Title:
Water Sampling Point

NOT TO SCALE

Drawing No.
B2-12



QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Private Pressure Sewer Main Connection to Sewer Lateral	NOT TO SCALE Drawing No. B3-1

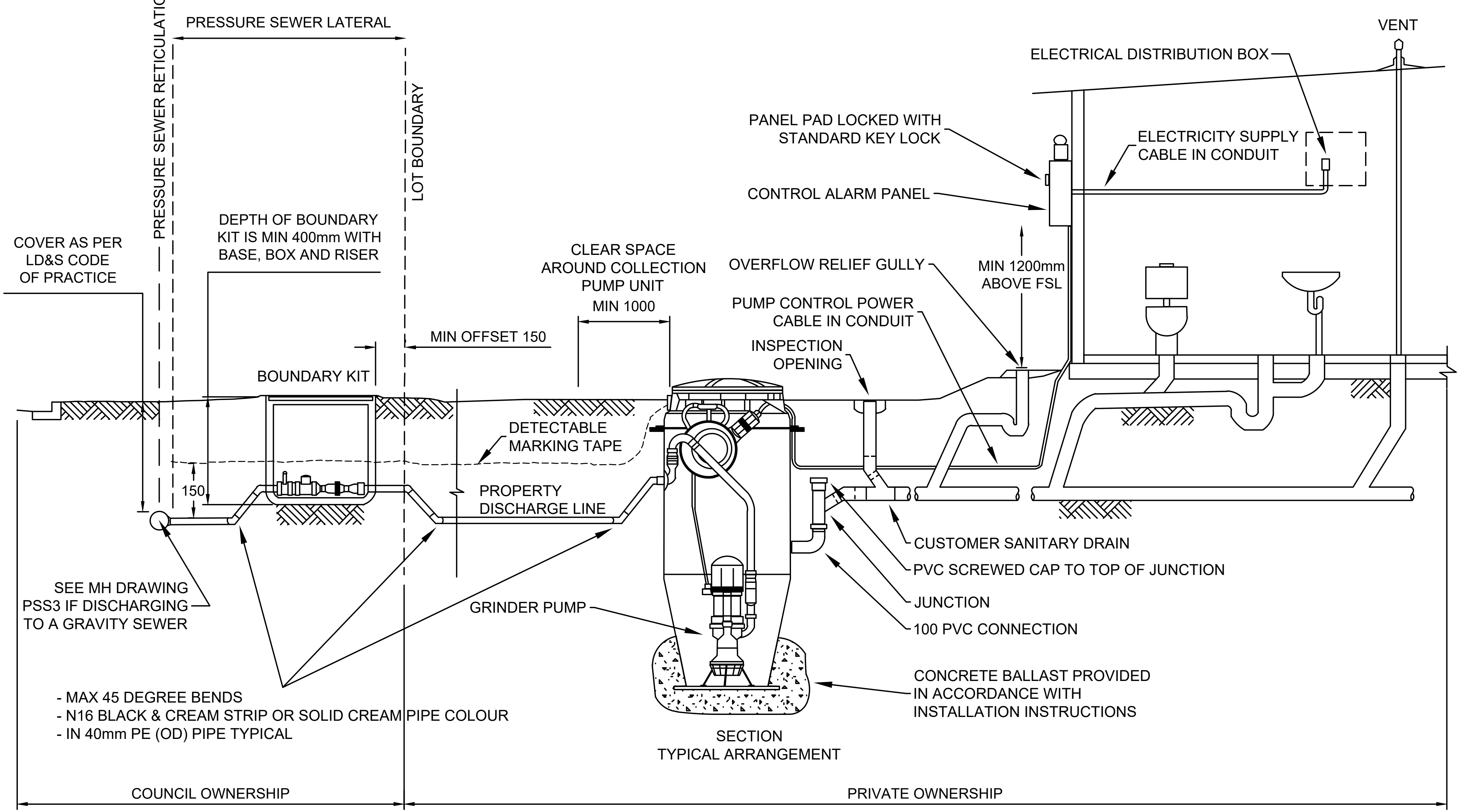


NOTES
1. ALL CONCRETE TO BE 17.5 MPa
2. A SINGLE PRIVATE MAIN CONNECTION TO THE PUBLIC SEWER SHALL BE MADE VIA A PRIVATE SHALLOW MANHOLE WITH A PUBLIC 150mm MIN GRAVITY PIPE FEED TO THE PUBLIC SEWER MANHOLE.

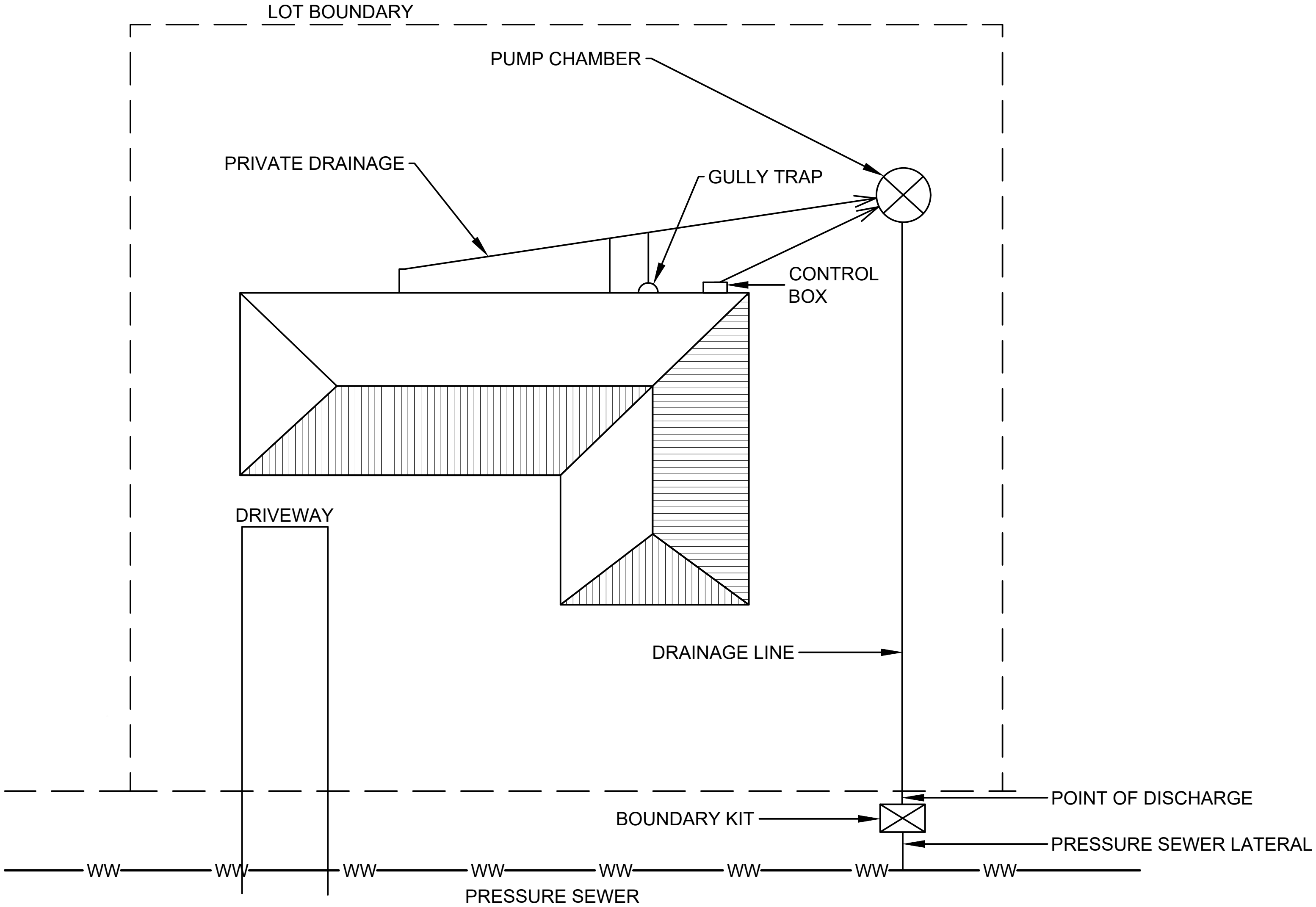
QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Rising Main Connection Private	NOT TO SCALE Drawing No. B3-2

NOTES:

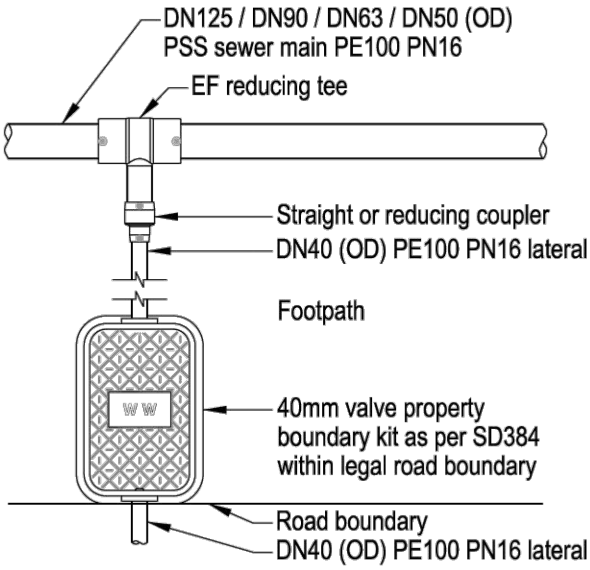
(1) ALL DIMENSIONS IN MM
(2) ANY PROPOSED ALTERNATIVE LAYOUTS OR OWNERSHIP RESPONSIBILITIES REQUIRE QLDC PRIOR APPROVAL



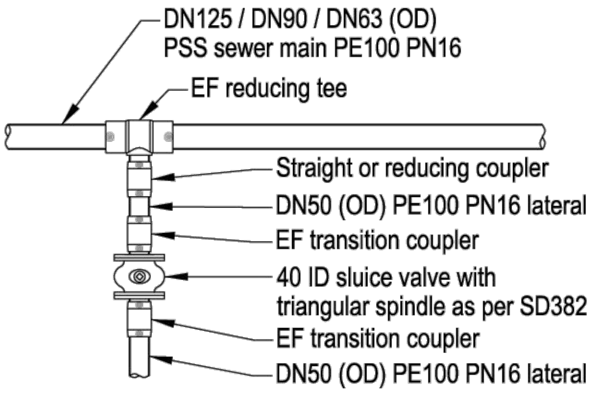
QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: QLDC Pressure Sewer System Standard Detail Typical Layout Drawing for Low Pressure Systems 2 - 4 lots	NOT TO SCALE Drawing No. B3-3



QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: QLDC Pressure Sewer - Typical On-Property Layout	NOT TO SCALE Drawing No. B3-4



A MAIN / DN40 (OD) PSS DWELLING CONNECTION DETAILS



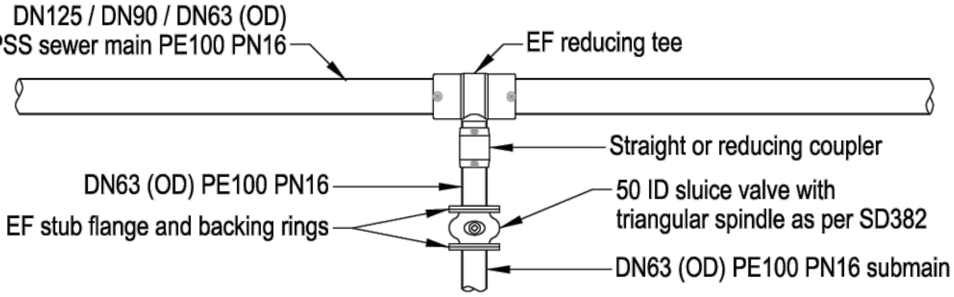
B MAIN / DN50 (OD) PSS SUBMAIN CONNECTION DETAILS

PE Tee and Reducer Summary

DN40 PSS Dwelling Connections			
Main	*Tee*	*Reducer*	*Reducer*
DN125	125/90	+ 90/50	+ 50/40
DN90	90/50	+ 50/40	
DN63	63/50	+ 50/40	
DN50 PSS Submain Connections			
Main	*Tee*	*Reducer*	*Valve*
DN125	125/90	+ 90/50	+ 40 ID Sluice valve
DN90	90/50	- - -	+ 40 ID Sluice valve
DN63	63/50	- - -	+ 40 ID Sluice valve

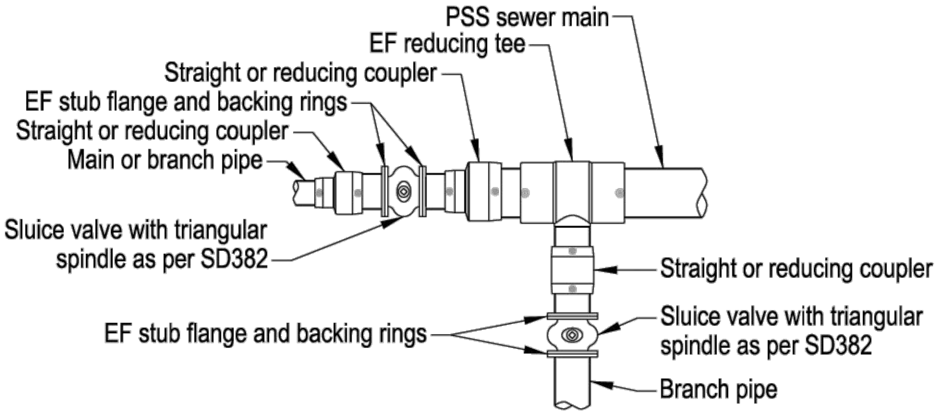
NOTES:

1. Saddles or self tapping joints may be used on pipes with an outside diameter (OD) of 90mm or greater.
2. Self-Tapping joints on branch pipes shall be at a depth of not less than 600mm.
3. For pipes less than DN90 (OD), only Electrofusion Tee joints shall be used.
4. Saddle joints **shall not** be used on pipes that are supplied in coils.
5. No brass fittings are to be used in any part of a pressure sewer system.
6. Mechanical couplers shall only be used on polyethylene pressure pipe DN90 (OD) or less for approved emergency repairs.



C MAIN / DN63 (OD) PSS SUBMAIN CONNECTION DETAILS

PE Tee and Reducer Summary			
DN63 PSS Submain Connections			
Main	*Tee*	*Reducer*	*Valve*
DN125	125/90	+ 90/63	+ 50 ID Sluice valve
DN90	90/63	- - -	+ 50 ID Sluice valve
DN63	63/63	- - -	+ 50 ID Sluice valve

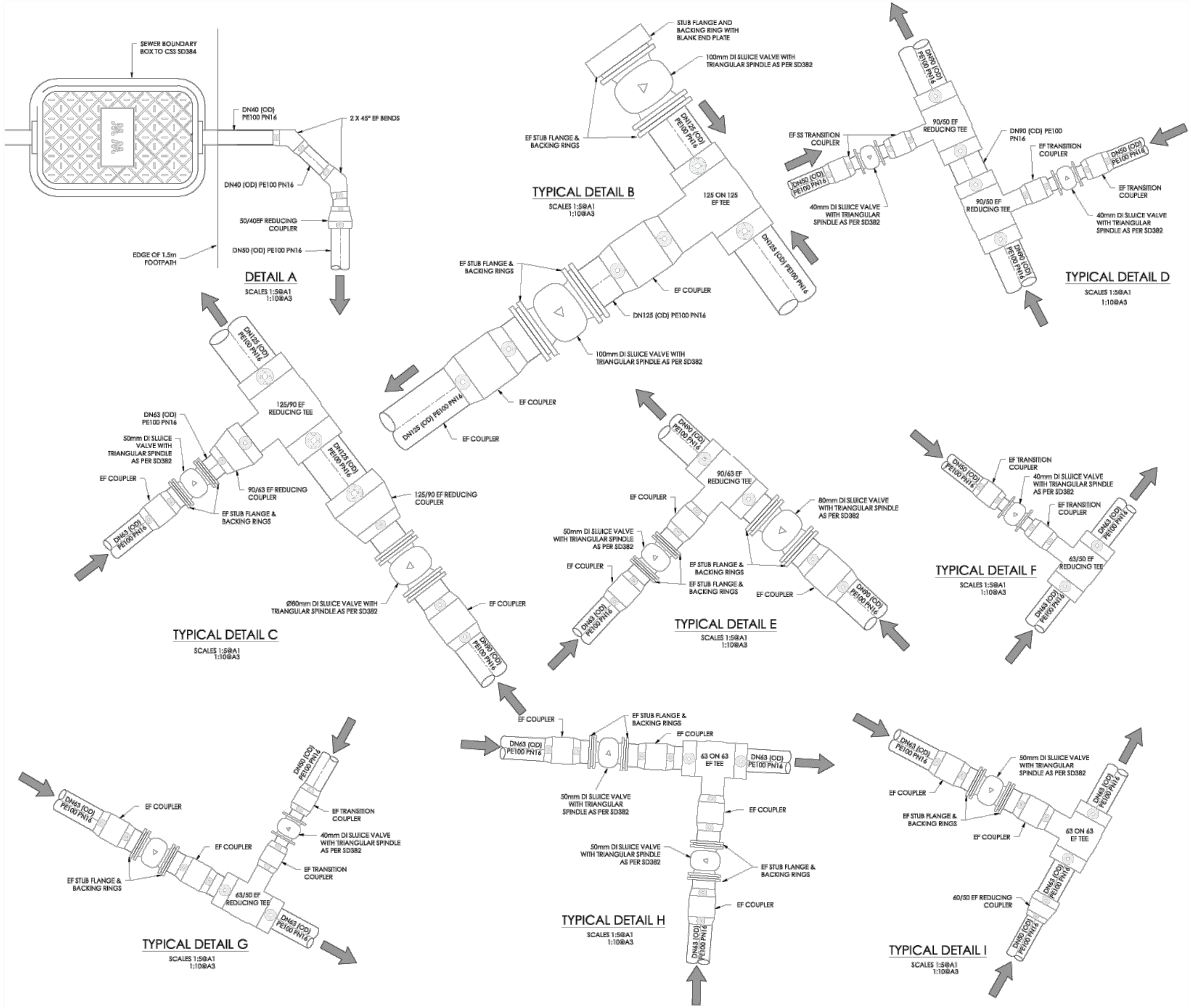


D ISOLATION VALVE CONNECTION DETAILS

PE Pipe / Sluice Valve Sizing	
PE Pipe	*Valve Size*
DN125	100 ID
DN90	75 ID
DN63	50 ID
DN50	40 ID

NOTES:

1. Saddles or self tapping joints may be used on pipes with an outside diameter (OD) of 90mm or greater.
2. Self-Tapping joints on branch pipes shall be at a depth of not less than 600mm.
3. For pipes less than DN90 (OD), only Electrofusion Tee joints shall be used.
4. Saddle joints **shall not** be used on pipes that are supplied in coils.
5. No brass fittings are to be used in any part of a pressure sewer system.
6. Mechanical couplers shall only be used on polyethylene pressure pipe DN90 (OD) or less for approved emergency repairs.



QLDC LDSC 2025
Standard Details

Revision: 000B
Rev Date: 10/02/2025

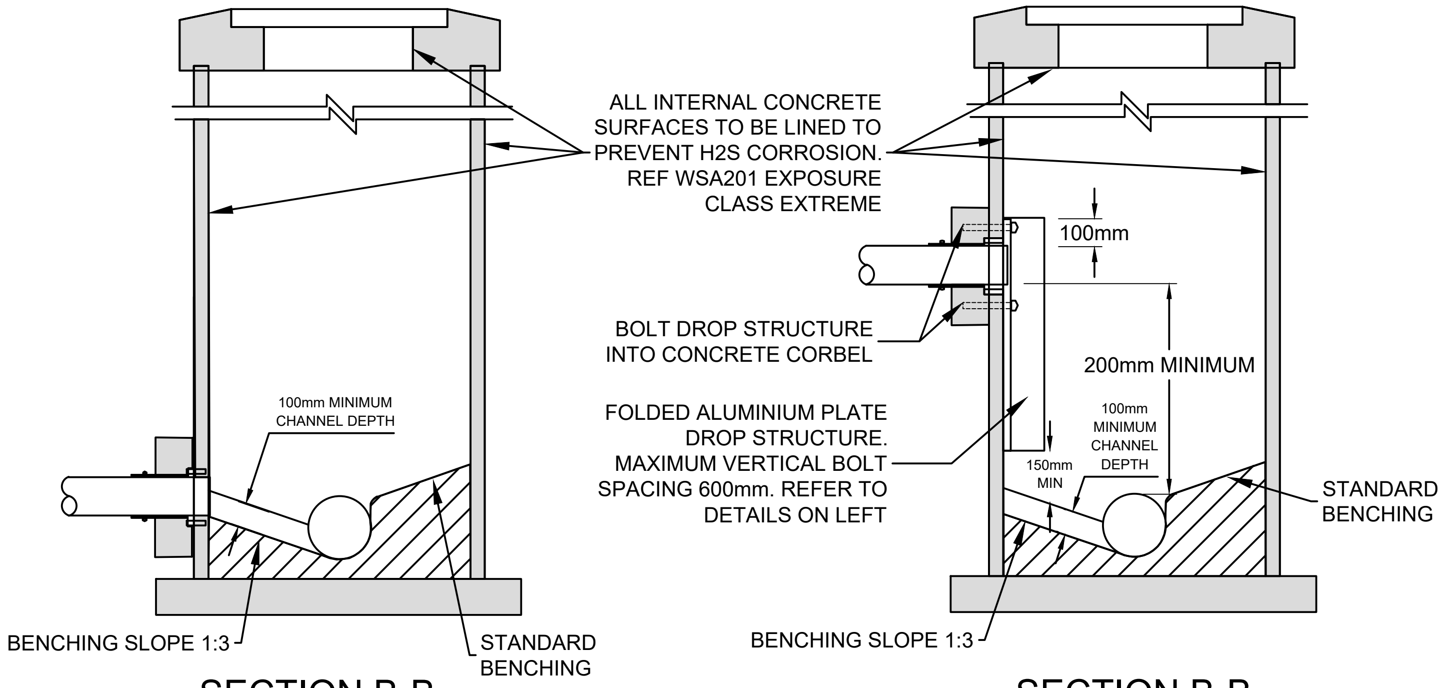
QUEENSTOWN LAKES DISTRICT COUNCIL

Drawing Title:

Sewer Details

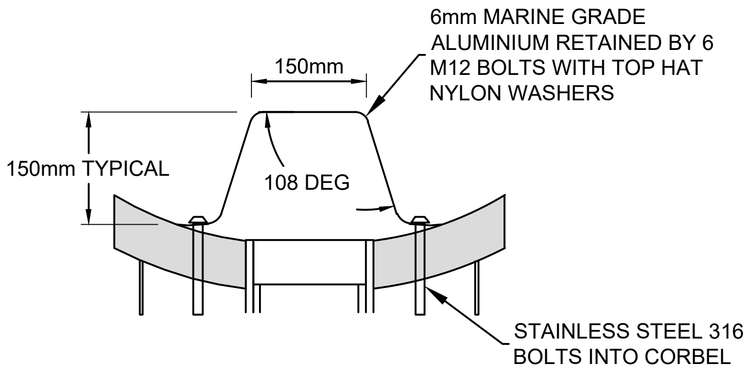
NOT TO SCALE

Drawing No.
B3-7

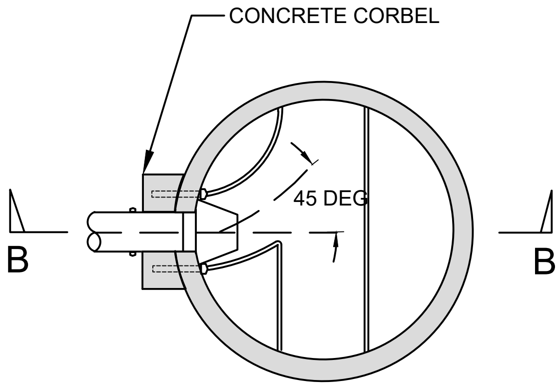


SECTION B-B
SHALLOW CIRCULAR PRECAST MANHOLE

SECTION B-B
DROP INSTALLATION CIRCULAR PRECAST MANHOLE



ALUMINIUM STRUCTURE



PLAN

NOTES

1. DROP STRUCTURES OVER DN180 REQUIRE SPECIAL DESIGN

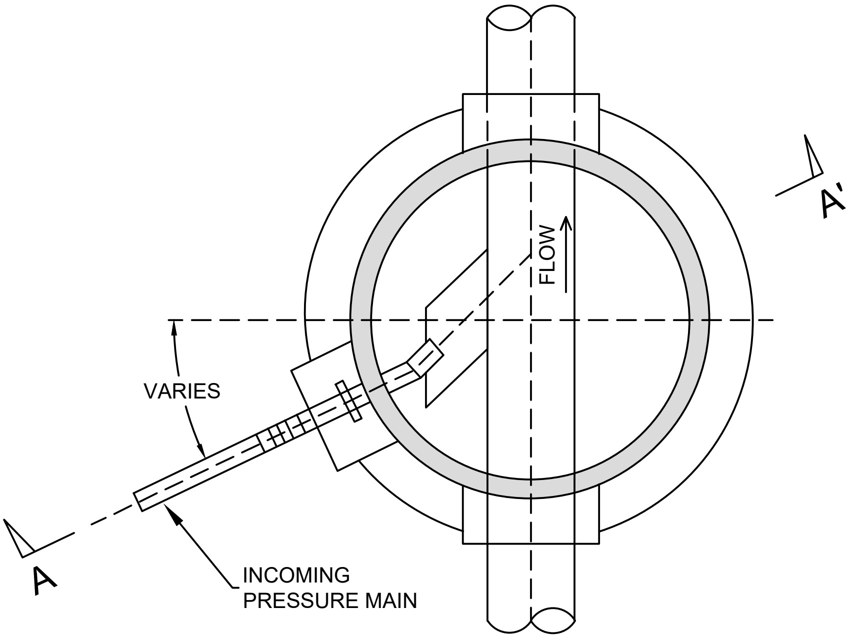
2. MANHOLES AND PIPE LAYING TO BE CONSTRUCTED AS DETAILED ON PLANS LD&S: APPENDIX B DRAWINGS B1-5 TO B1-7.

3. CHANNELLING IN NEW MANHOLES SHALL BE VERTICAL TO TOP OF MAIN SEWER AND BENCHING GRADED AT 1 IN 3 AS APPLICABLE

4. BENCHING AND CHANNELLING IN EXISTING MANHOLES SHALL BE REFORMED IN EASY CURVES

5. OPENING FOR MANHOLE STARTER AND CORBELL SHALL BE CLEAR OF ANY JOINT IN PRECAST MANHOLE BY AT LEAST 300mm

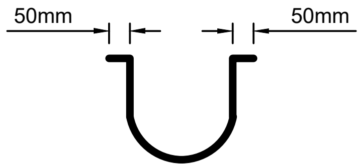
6. FOR PIPES LARGER THAN DN180, SPECIFIC DESIGN OF CONCRETE CORBEL AND CONCRETE DROP STRUCTURE TO BE APPROVED BY QLDC.



PLAN

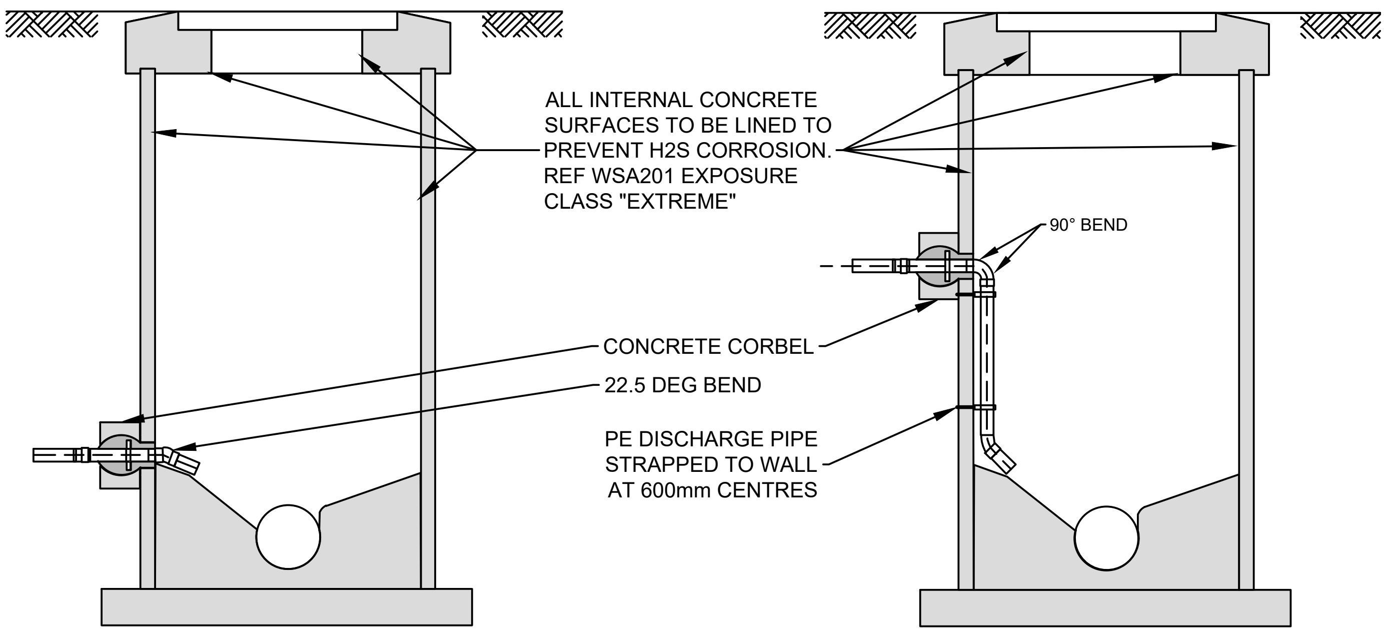
NOTES

1. ALL INTERNAL CONCRETE SURFACES TO BE LINED TO PREVENT H2S CORROSION.



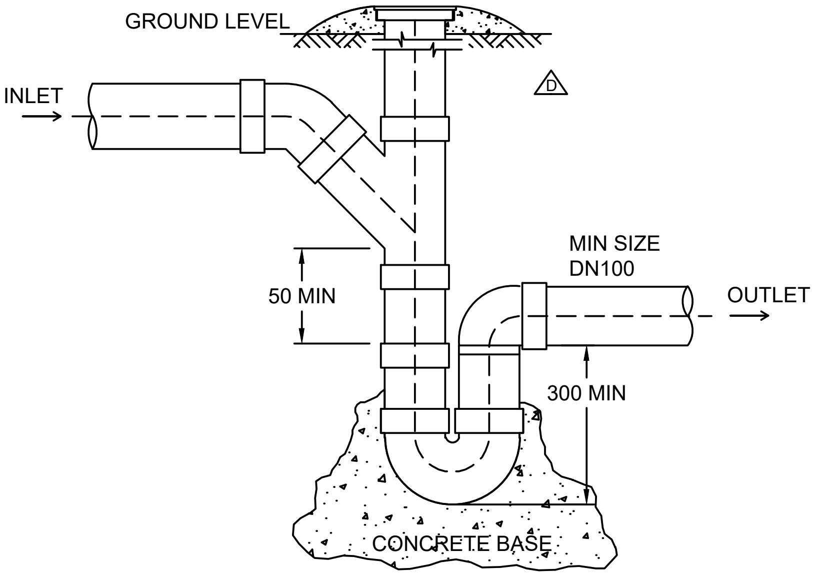
STRAP DETAIL

2. 25MM WIDE x 1.25MM 316 STAINLESS STEEL STRAP FIXED TO MANHOLE WALL WITH 2x M12 x 100MM 316SS THREADED STUDS. EPOXY ANCHOR WITH 50MM EMBEDMENT DEPTH

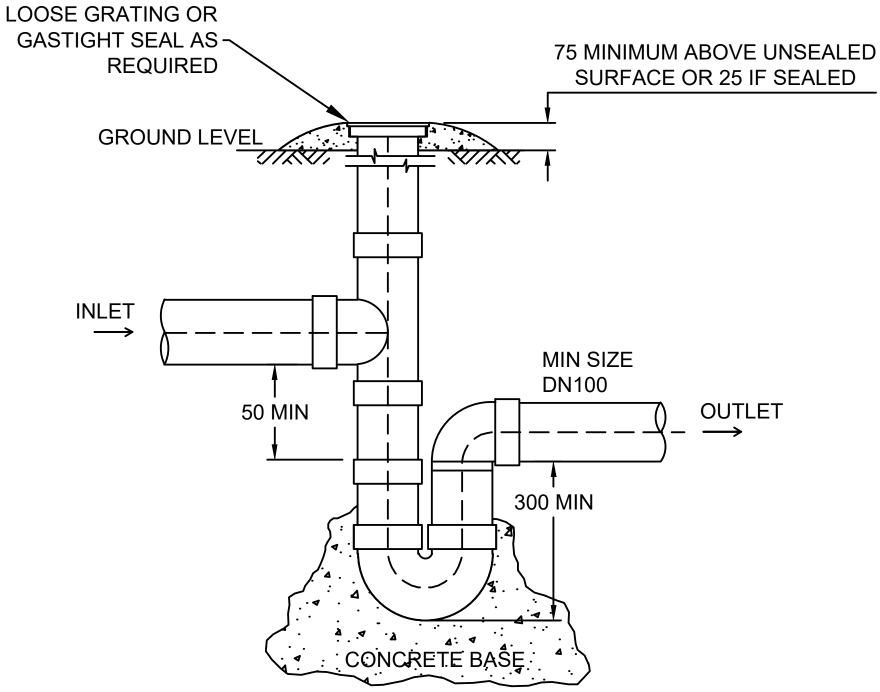


SECTION A-A'
FOR SHALLOW MANHOLES

SECTION A-A'
IF DROP STRUCTURE IS REQUIRED



SECTION
PUMPED DISCHARGE

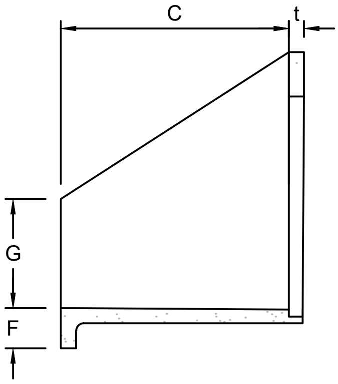


SECTION
GRAVITY DISCHARGE

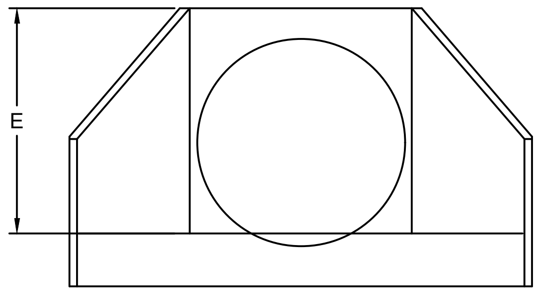
GUIDELINES

1. LOCATED IMMEDIATELY DOWNSTREAM OF ANY PRE-TREATMENT FIXTURE.
2. THE TRADE WASTE SAMPLING POINT SHALL BE POSITIONED AT ANY POSITION AS DIRECTED BY THE TRADE WASTE SECTION.
3. SAMPLING POINTS ARE TO BE PURPOSE MADE TO PROVIDE A MINIMUM DEPTH OF WATER OF 300MM.
4. MINIMUM SIZE OF SAMPLING POINT SHALL BE DN100.
5. SAMPLE POINTS SHALL NOT BE USED AS A RELIEF DISCONNECTOR GULLY.
6. IN THE CASE A BUSINESS IS REQUIRED TO BE MONITORED, DISCHARGES FROM ALL PROCESS AREAS / OR TREATMENT FACILITIES ARE TO BE DIRECTED THROUGH A SINGLE MONITORING POINT WHICH INCLUDES AN INDUSTRIAL WASTE SAMPLING POINT.
7. MINIMUM OF 50MM VERTICAL DIFFERENCE BETWEEN INLET INVERT LEVEL TO TOP OF WATER SEAL.
8. ALL MEASUREMENTS SHOWN ARE IN MILLIMETRES.
9. ALL ASSOCIATED PLUMBING WORK IS TO COMPLY WITH WATER SERVICES LICENSING (PLUMBERS LICENSING AND PLUMBING STANDARDS) REGULATIONS 2000 AND LATEST VERSIONS OF AS/NZS 3500.1 AND AS/NZS 3500.2.
10. SEALED TRADE WASTE SAMPLING POINTS MUST HAVE A MINIMUM OF A DN50MM VENT TO ATMOSPHERE
11. AIR ADMITTANCE VALVES ARE NOT TO BE USED

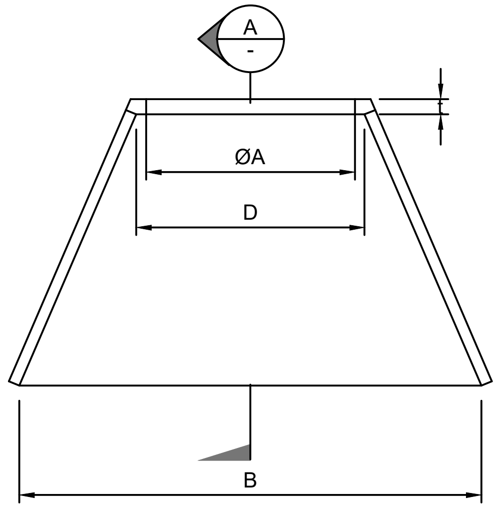
QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Trade Waste Sampling Point	NOT TO SCALE Drawing No. B3-10



CROSS SECTION A



FRONT ELEVATION

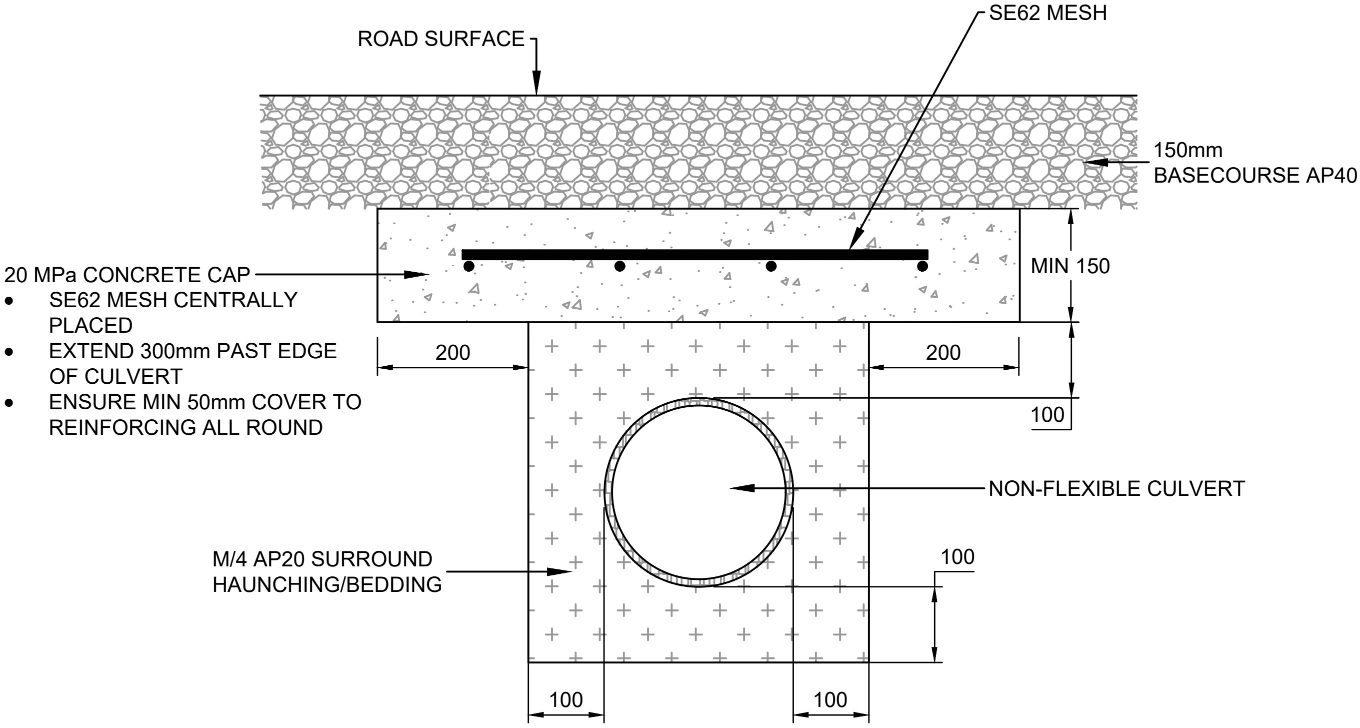


PLAN VIEW

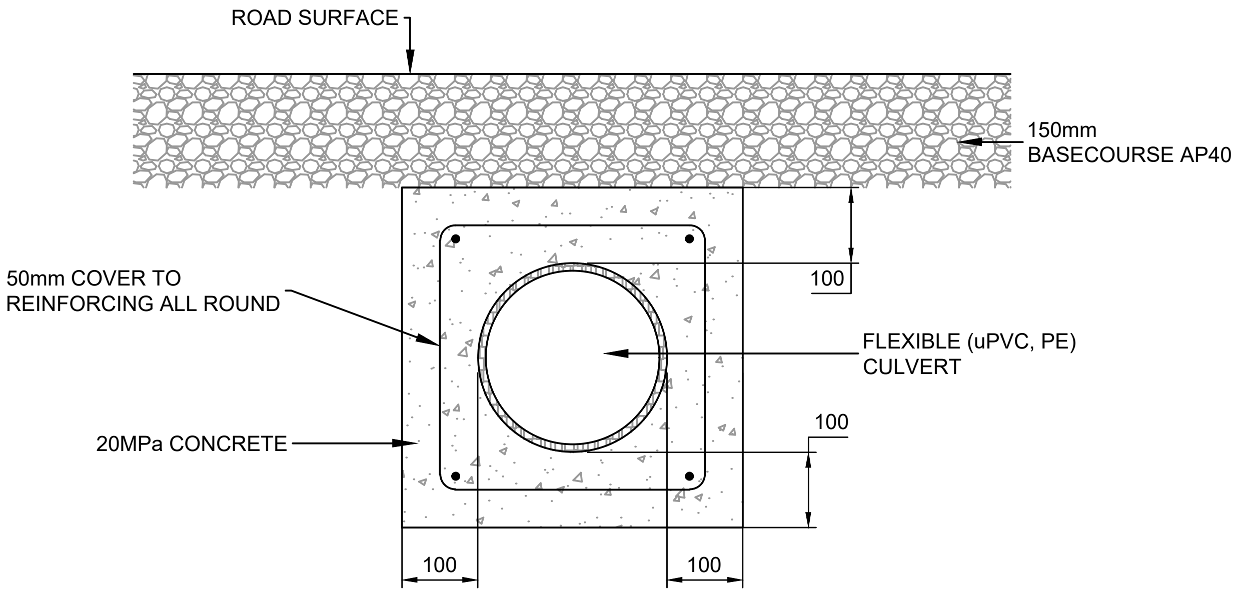
TABLE 1

PIPE DIA.	PRINCIPAL DIMENSIONS (mm)							
	A	B	C	D	E	F	G	t
150-300	190-390	1000	600	460	520	200	160	50
300-600	370-700	1900	1100	750	900	280	500	80
600-1050	720-1225	3000	100	1270	1675	345	600	100
1200-1350	1380-1540	4100	2400	1600	1975	425	750	125
1600-1800	1727-2040	4900	2400	2150	2265	450	750	150

NOTES:
1. REINFORCED FLOOR AND WALLS WITH
   150 TO 375 - 665 MESH (668 OR SIMILAR)
   450 TO 600 - 663 MESH OR EQUIVALENT OR 10Ø RODS @ 250 CRS
   675 TO 900 - 12Ø RODS @ 250 CRS
   1050 TO 1350 - 12Ø RODS @ 150 CRS
2. ALL REINFORCEMENT SHALL BE PLACED CENTRAL IN WALLS & FLOOR AND SHALL BE CONTINUOUS BETWEEN WALL AND FLOOR.
3. LAPS IN STRUCTURAL GRADE BARS TO BE 300mm MINIMUM.
4. THERE SHALL BE AT LEAST TWO BARS WHETHER MESH OR MILD STEEL, OVER THE TOP OF THE PIPE.
5. CONCRETE COMPRESSIVE STRENGTH IS TO BE 20MPa @ 28 DAYS.
6. BAFFLES ARE TO BE CONSTRUCTED AS SHOWN WHEN OUTLET VELOCITIES AND SOIL CONDITIONS DICTATE. IN EXTREME CASES SPECIFIC DESIGN MAY BE REQUIRED.
7. INLETS EXCEEDING 450mmØ TO HAVE ANTI-VERMIN SCREENS FITTED, EXCEPT WHEN THE PIPE IS LESS THAN 20m LONG.
8. TABLE 1 IS FOR FORMING INLET AND OUTLET STRUCTURES OUTSIDE MANUFACTURERS SPECIFICATIONS.



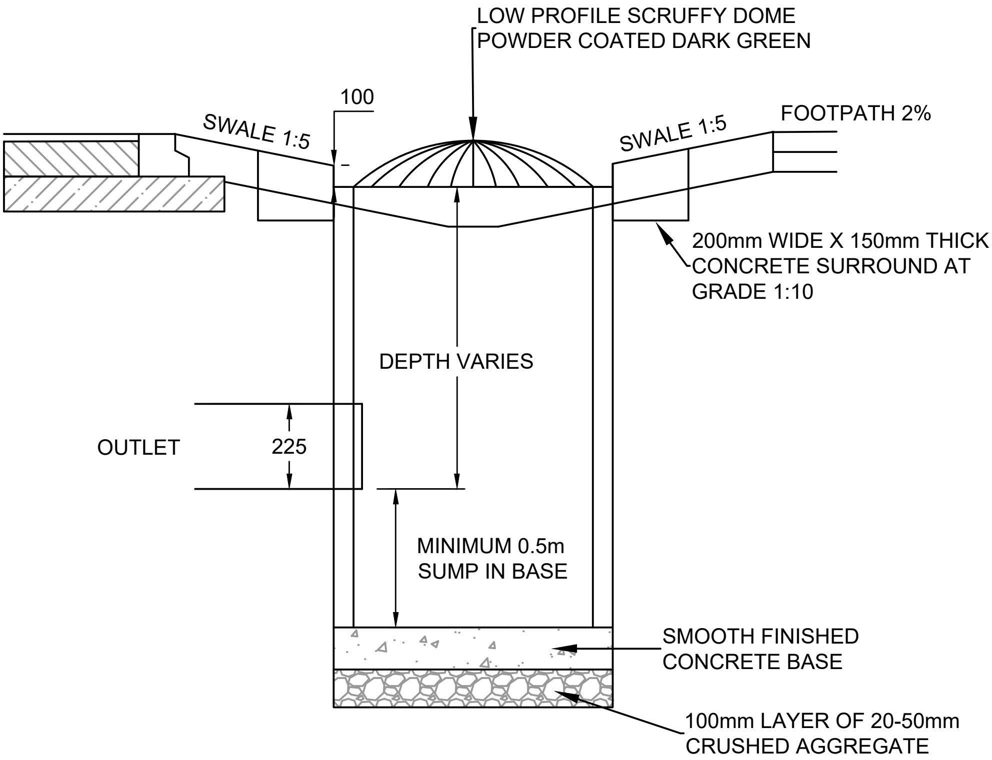
CONCRETE CAPPING DETAIL



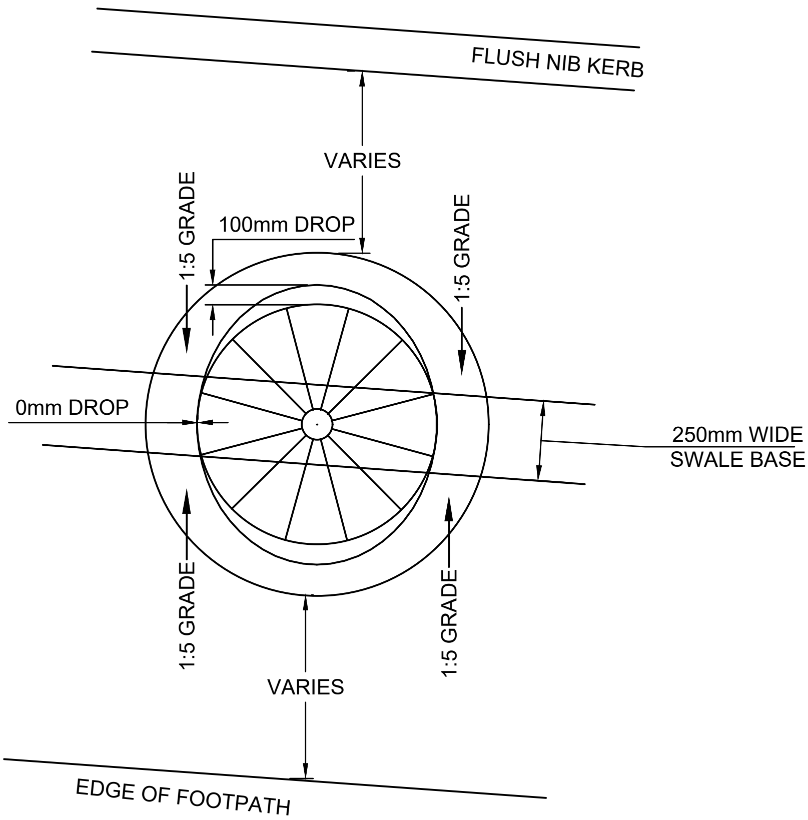
CONCRETE ENCASING DETAIL

NOTES:

1. WHERE COVER IS REDUCED FROM REQUIREMENTS, 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 TO BE SUBMITTED TO QLDC FOR APPROVAL. IF PIPE LOADING CAPACITY IS EXCEEDED, CONCRETE CAPPING OR ENCASING IS REQUIRED.
2. FOR NON-FLEXIBLE PIPE DIAMETERS GREATER THAN 450mm OR FLEXIBLE PIPE DIAMETERS GREATER THAN 300mm SPECIAL DESIGN APPLIES.
3. WITH FLEXIBLE PIPES PROTECTION TO BE USED UNLESS OTHERWISE SPECIFIED.
4. PIPES IN TRAFFICABLE AREAS WITH LESS THAN 1.0 m COVER SHALL BE CONCRETE CAPPED, AND PIPES WITH LESS 0.6 m COVER SHALL BE CONCRETE ENCASED. THE CONCRETE ENCASEMENT SHALL BE REINFORCED CONCRETE AND STRUCTURALLY DESIGNED FOR REQUIRED DESIGN LOAD BY A STRUCTURAL ENGINEER.

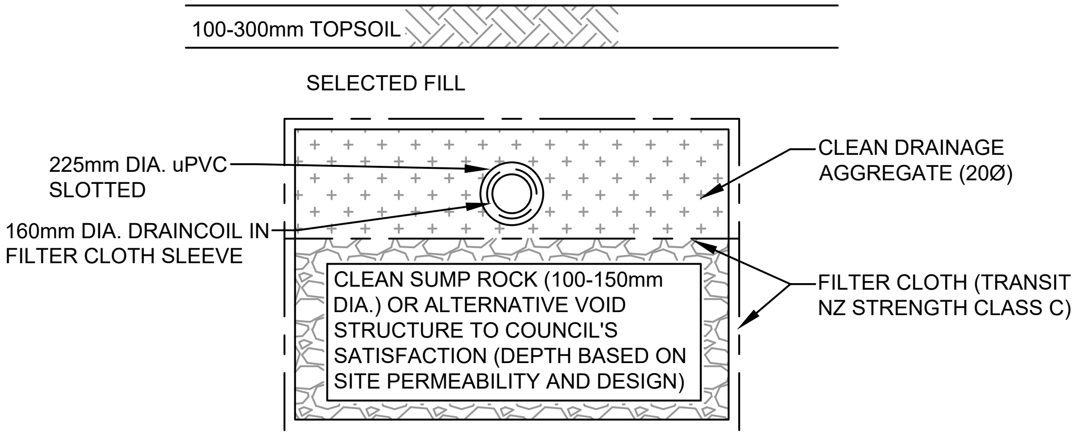


SIDE ELEVATION



PLAN

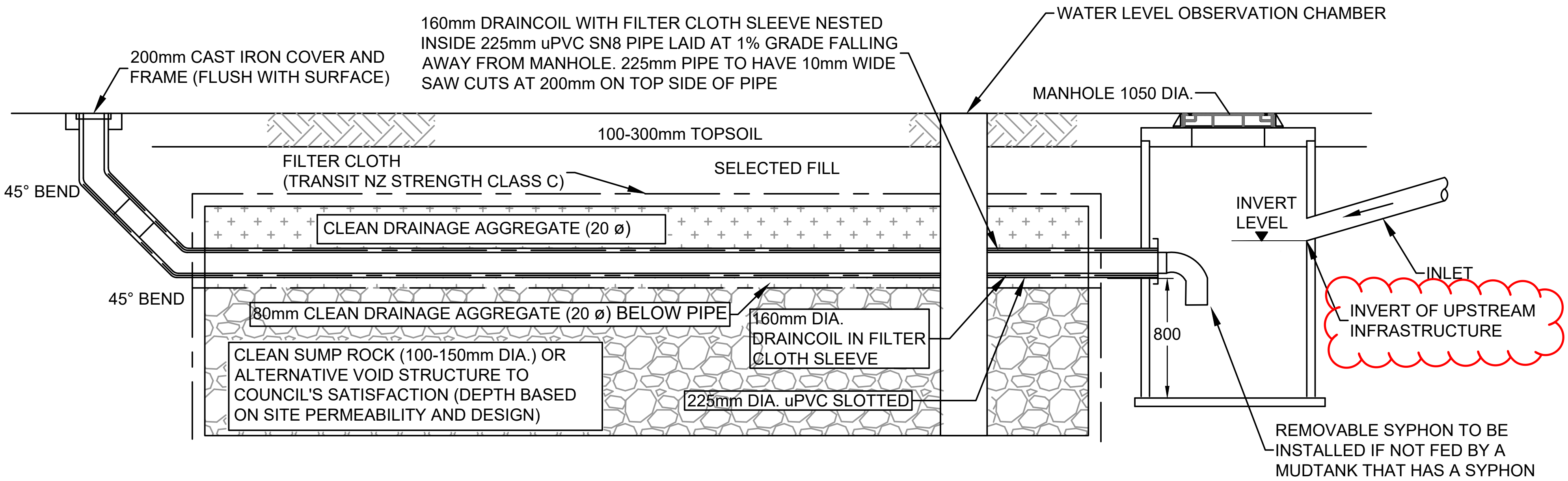
QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Scruffy Dome Detail	NOT TO SCALE Drawing No. B4-3



STORMWATER SOAKAGE PIT TYPICAL SECTION END ELEVATION (ROAD CONNECTIONS)

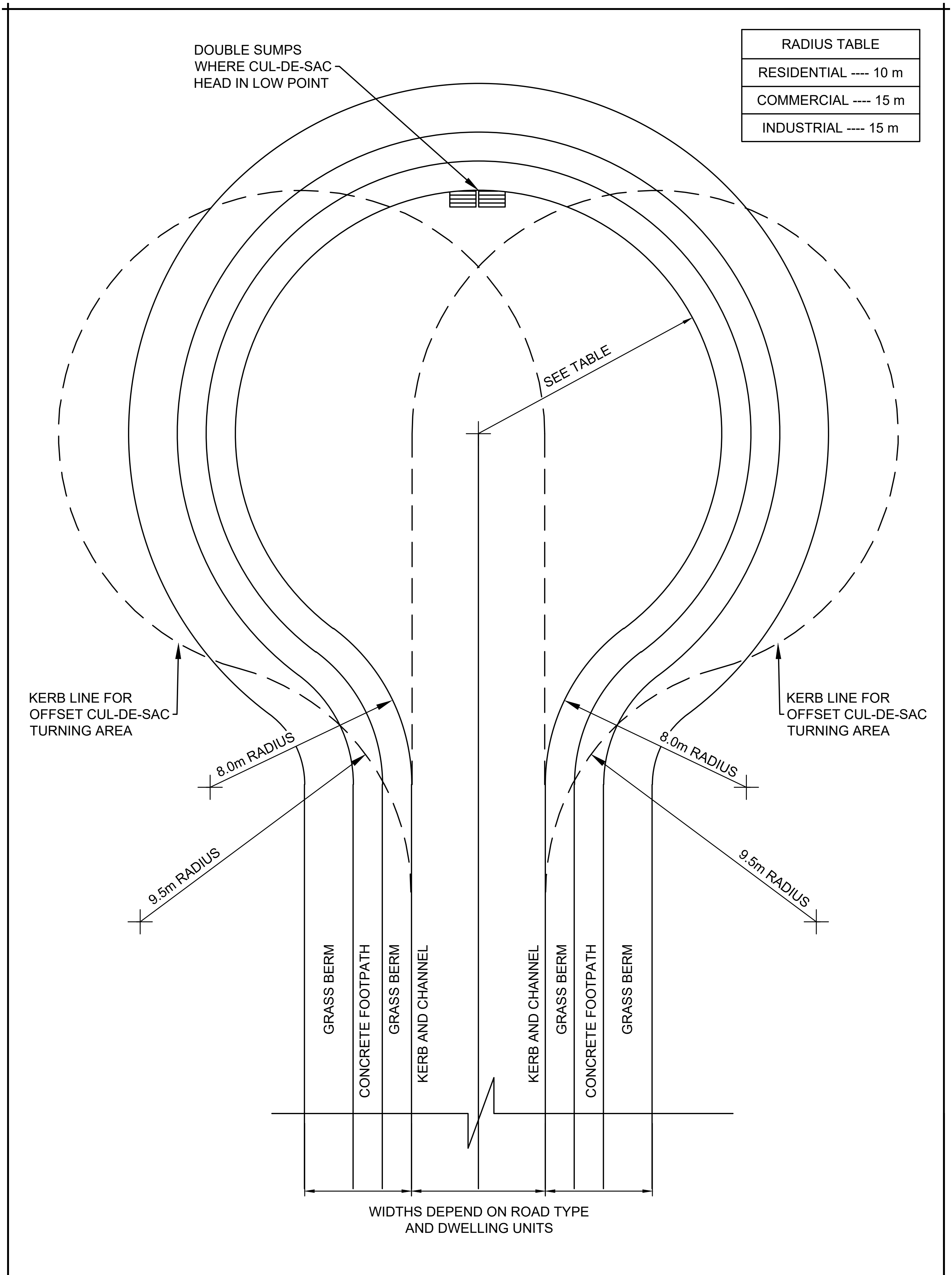
NOTES:

1. DRAINCOIL IS TO BE REMOVABLE FROM WITHIN THE 225mm PIPE, ENABLING CLEANING/REPLACEMENT OF THE PIPE AND FILTER SLEEVE AS REQUIRED. CLEANING EYE ALLOWS FOR FLUSHING FROM EITHER END OF THE SYSTEM.
2. SOAKPIT DIMENSIONS TO BE DETERMINED BASED ON GROUND CONDITIONS AND SPECIFIC DESIGN.



STORMWATER SOAKAGE PIT TYPICAL SECTION SIDE ELEVATION (ROAD CONNECTIONS)

QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Soak Pit	NOT TO SCALE Drawing No. B4-4



QLDC LDSC 2025
Standard Details

Revision: 000B
Rev Date: 10/02/2025

QUEENSTOWN LAKES DISTRICT COUNCIL

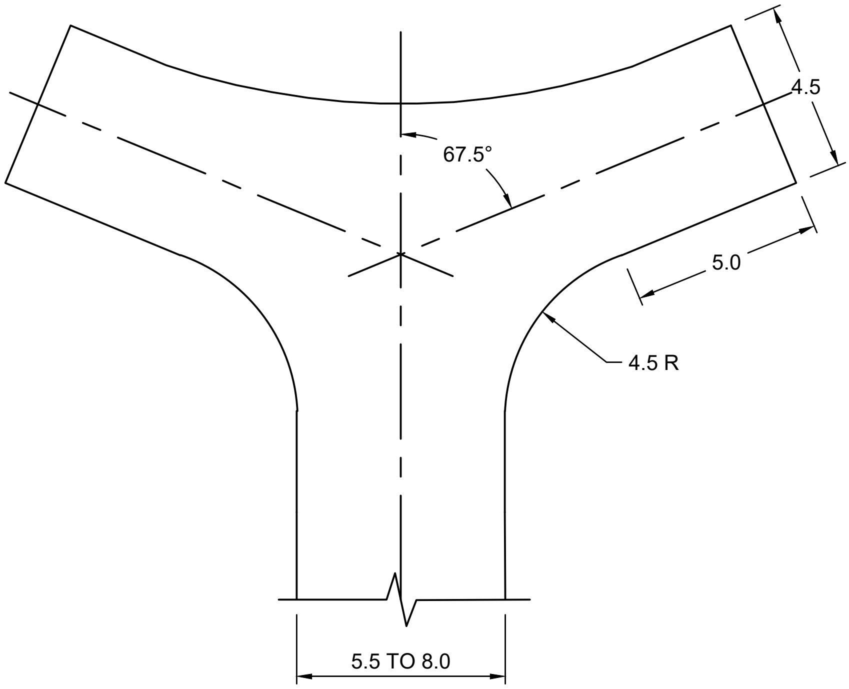
Drawing Title:

Dimensions of No-Exit Road Turning Areas

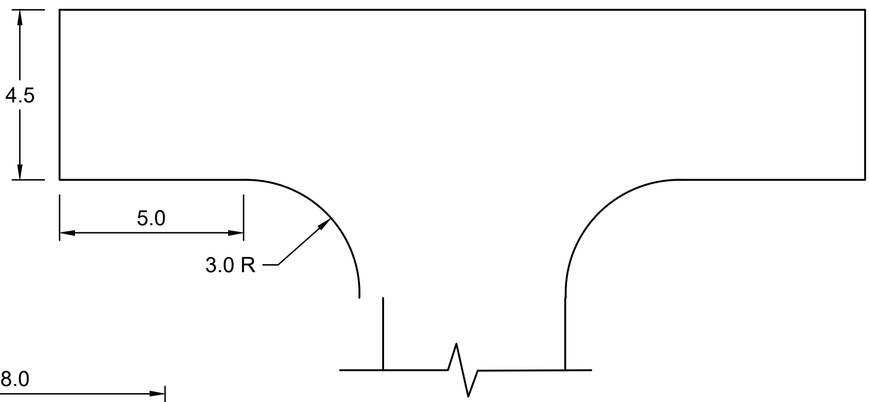
NOT TO SCALE

Drawing No.

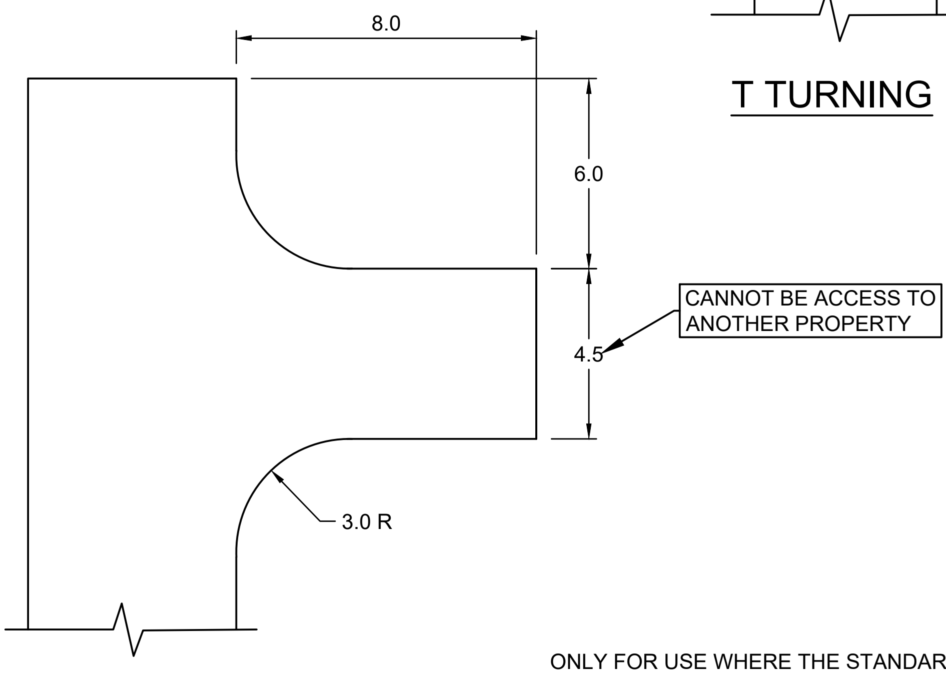
B5-1



Y TURNING



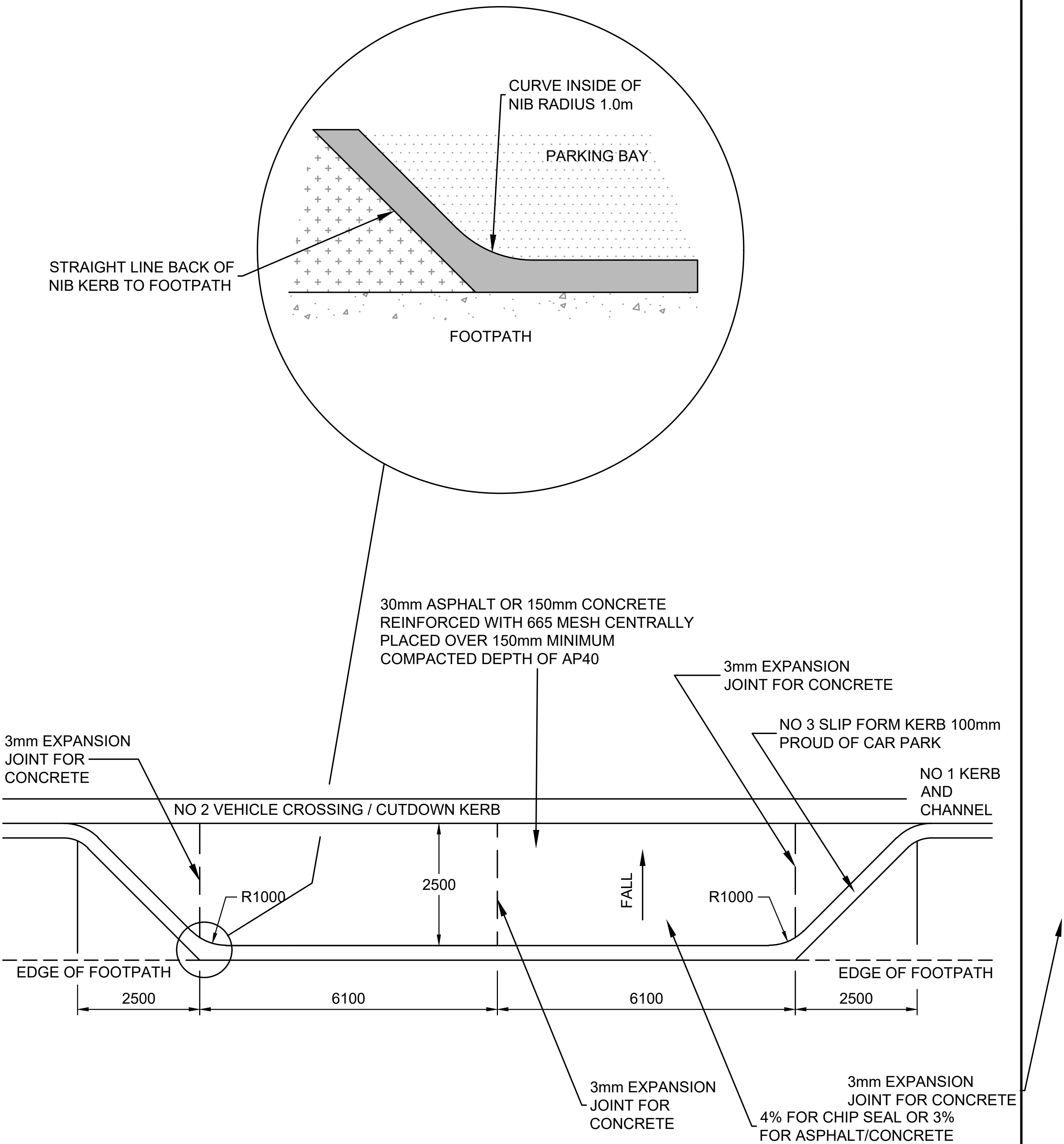
T TURNING



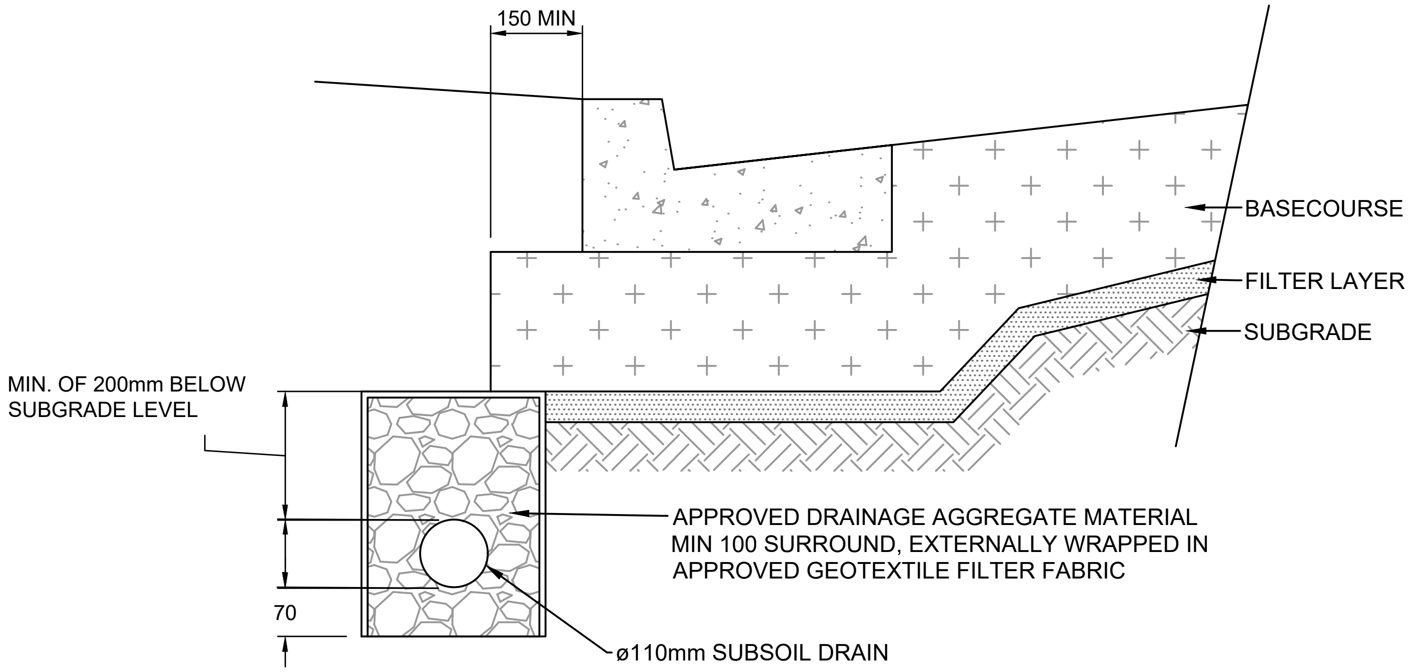
L TURNING

ONLY FOR USE WHERE THE STANDARD CIRCULAR HEAD IS UNSUITABLE OR WHERE APPROVED BY COUNCIL.

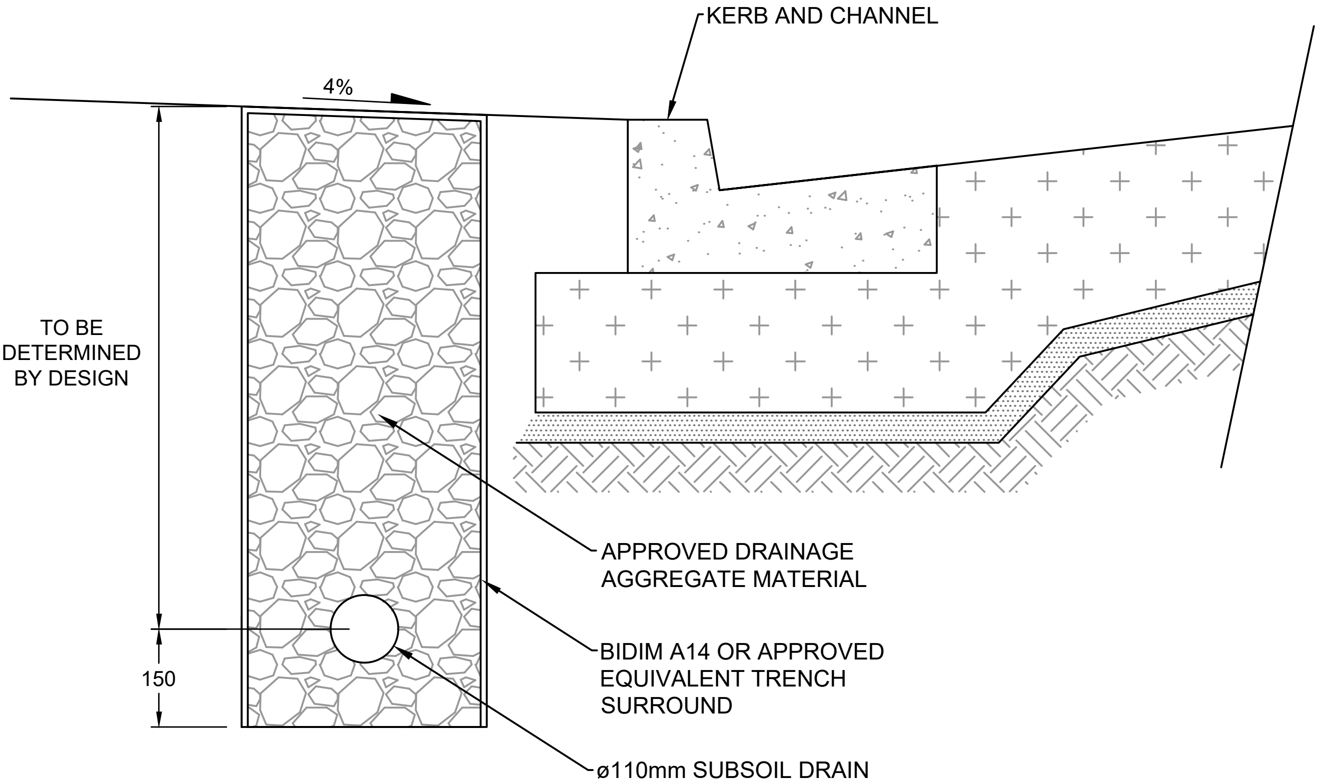
ALL DIMENSIONS ARE IN METRES.



QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Parking Bay	NOT TO SCALE Drawing No. B5-3



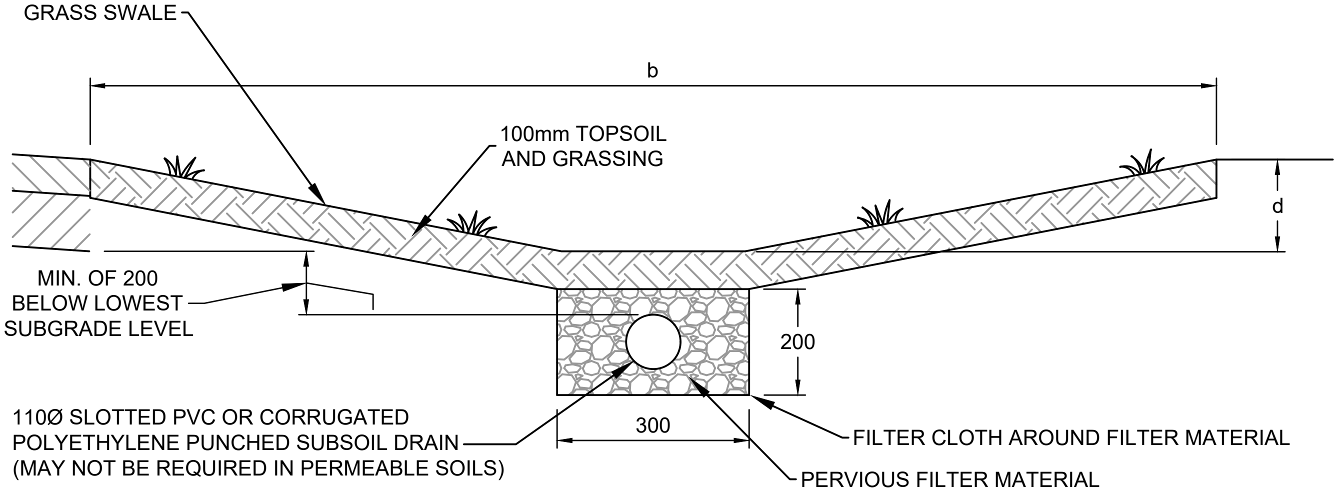
UNDER KERB DRAINAGE



SURFACE WATER CUT-OFF DRAIN

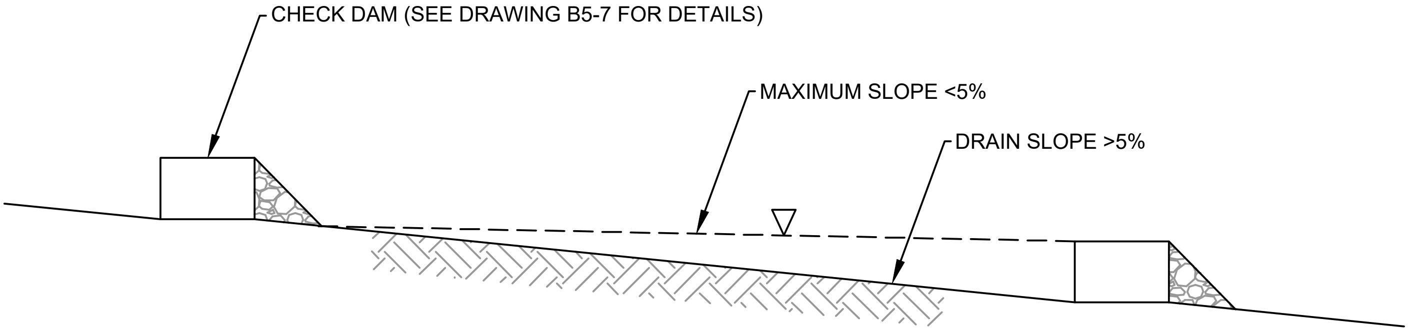
ALL DIMENSIONS ARE IN MILLIMETRES

QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Subsoil Drains - Roadside	NOT TO SCALE Drawing No. B5-4

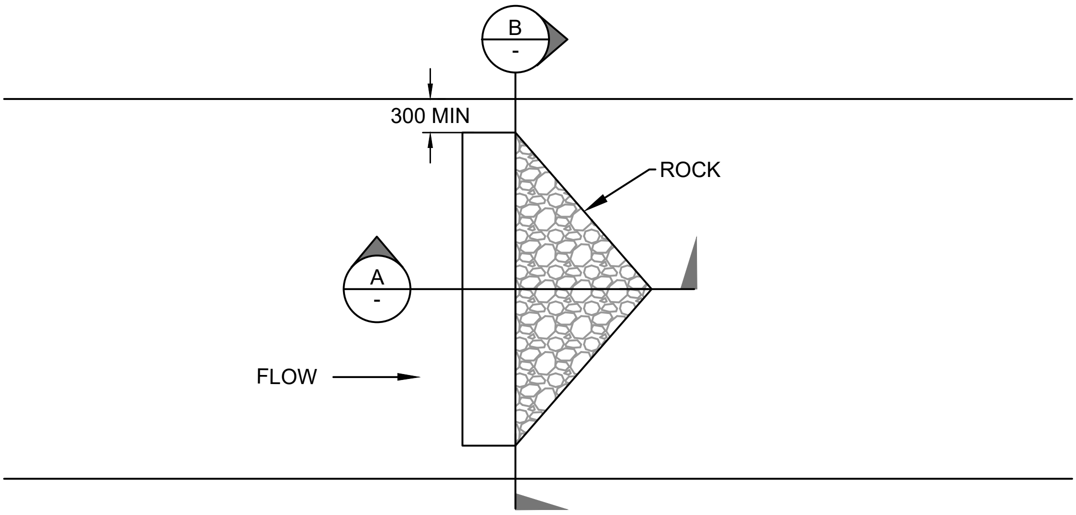


SWALE CROSS SECTION

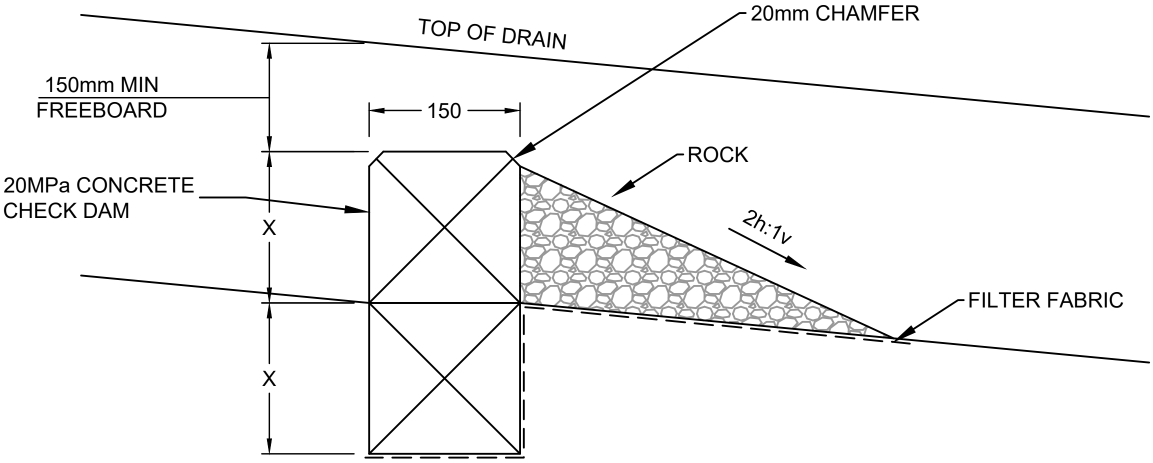
NOTES:
1. EFFECTIVE CATCHMENT AREA DRAINED = IMPERVIOUS AREA + 0.72 x PERVIOUS AREA.
2. MAXIMUM SWALE SLOPE UP TO 5%. STEEPER SWALES REQUIRE CHECK DAMS (SEE DRAWING B5-6 AND DRAWING B5-7).
3. DIMENSIONS 'b' AND 'd' TO BE SIZED FOR CONVEYANCE OF 5% AEP EVENT.
4. EXISTING GROUND IS REGRADED, COMPACTED, TOPSOILED (100mm DEPTH), AND GRASSED.
5. SIDE SLOPES NO STEEPER THAN 1v:4h IF PLANTED (NOT MOWN).
6. SIDE SLOPES NO STEEPER THAN 1v:5h IF GRASSED (MOWN).



LOCATION OF CHECK DAMS IN SWALES

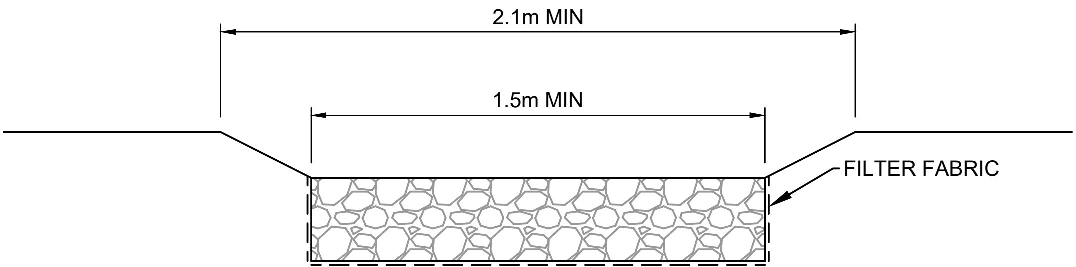


TYPICAL PLAN



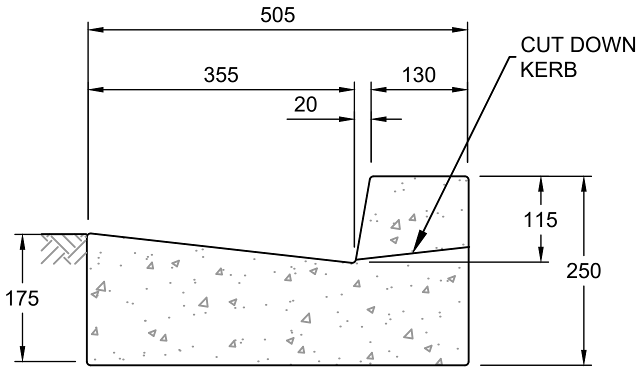
ELEVATION A

ROCK TO BE SCORIA GRADED CLEAN (SGC) 75-70 OR EQUIVALENT.
FILTER FABRIC TO BE BIDIM A14 OR EQUIVALENT.

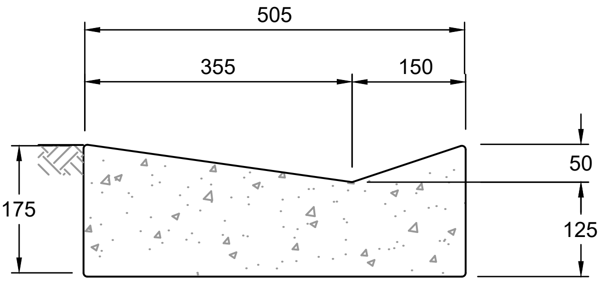


ELEVATION B

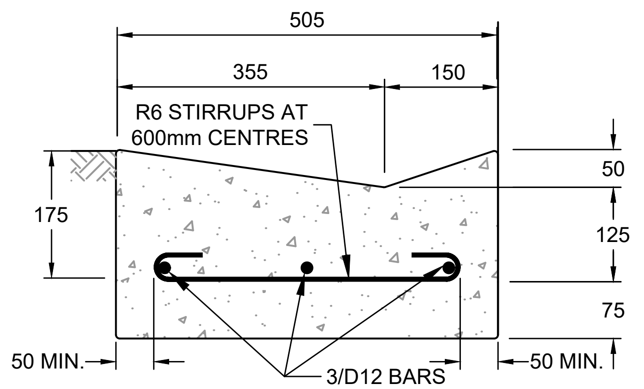
QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Typical Check Dam Detail	NOT TO SCALE Drawing No. B5-7



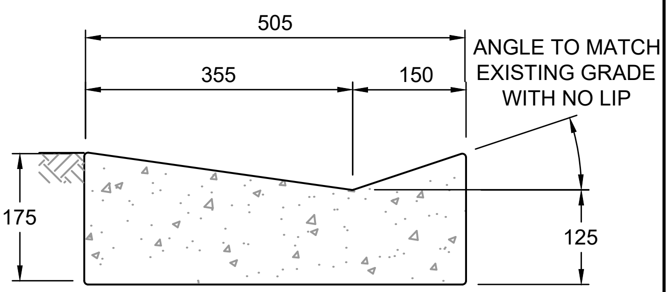
No. 1a KERB & CHANNEL



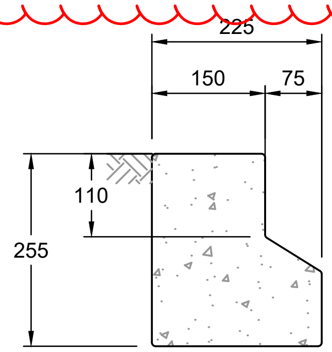
No. 2 VEHICLE CROSSING



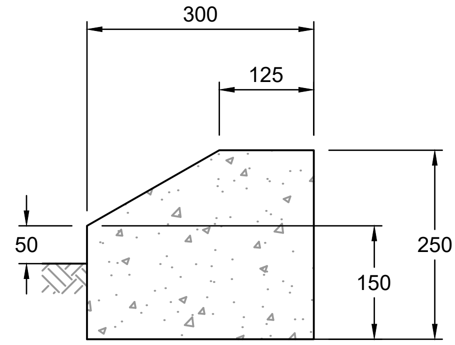
No. 2A COMMERCIAL VEHICLE CROSSING



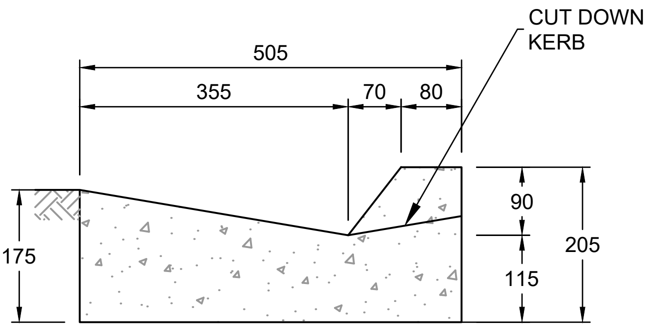
No. 2B CYCLIST/PRAM DROP DOWN



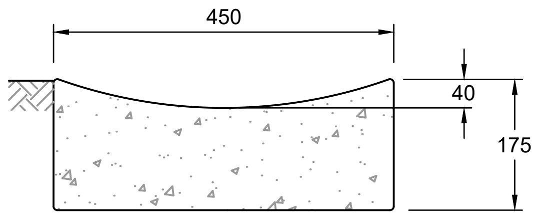
No. 3 SLIP FORM KERB



No. 5 MOUNTABLE KERB



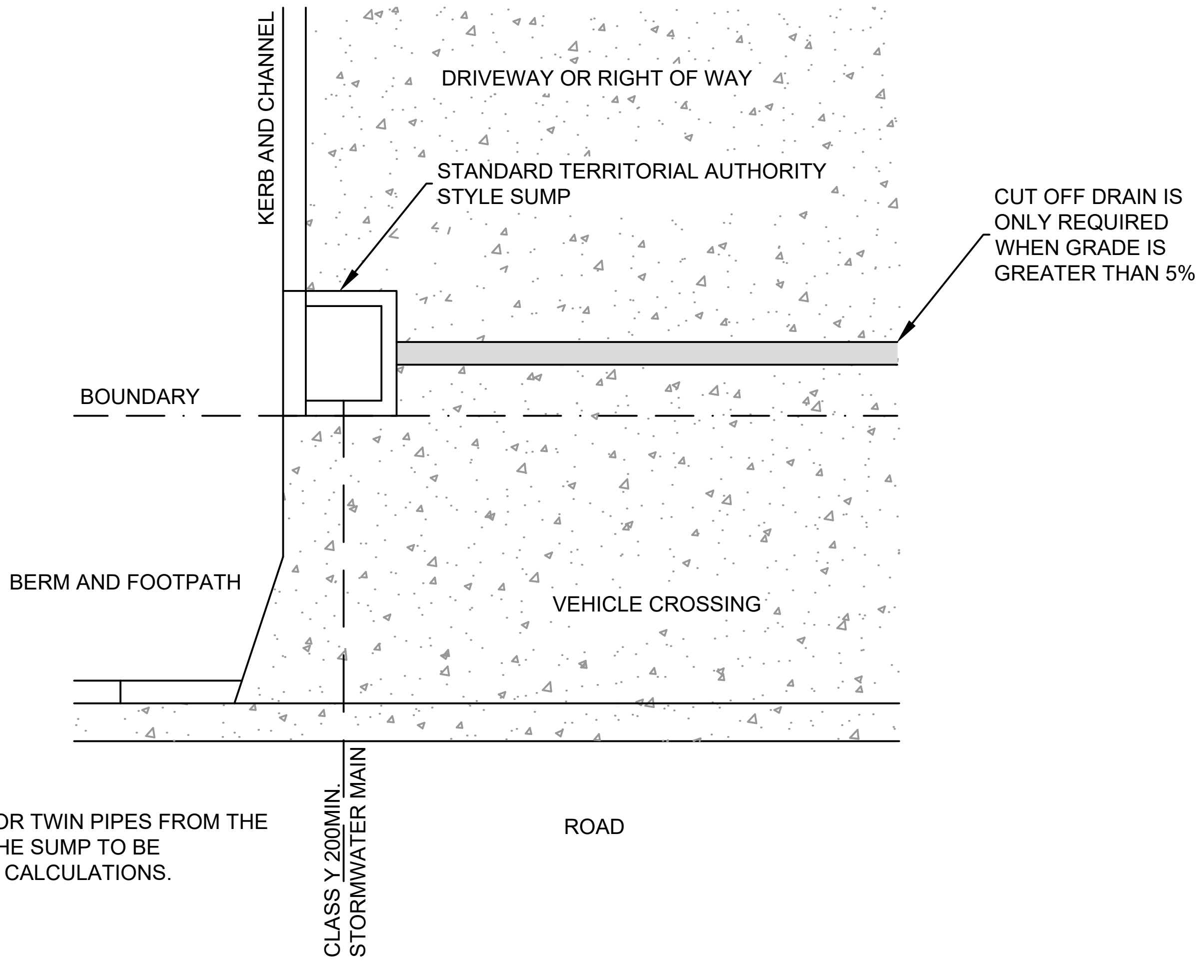
No. 8 MOUNTABLE KERB & CHANNEL



No. 16 DISH CHANNEL

NOTE: KERB AND CHANNELS TO HAVE 200mm MIN. DEPTH OF COMPACTED AP40 BASECOURSE OR GAP65 SUBBASE UNDER THEM

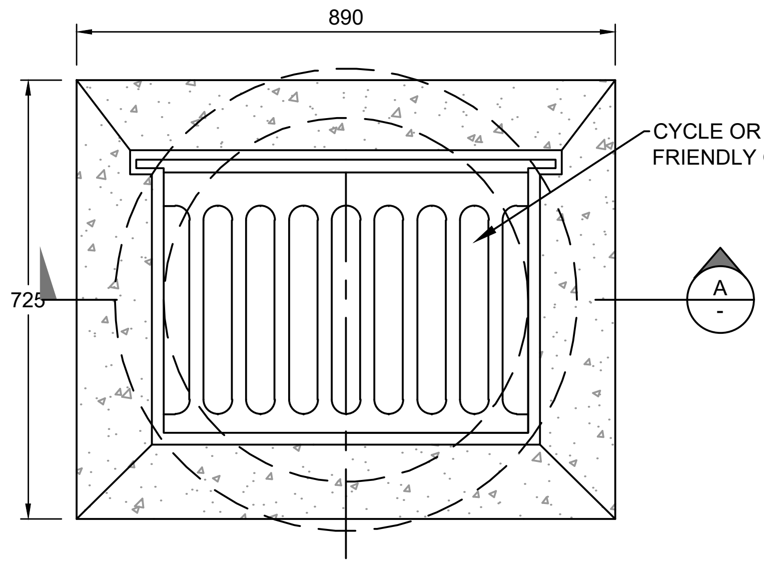
QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Kerbs and Dished Channels	NOT TO SCALE Drawing No. B5-8



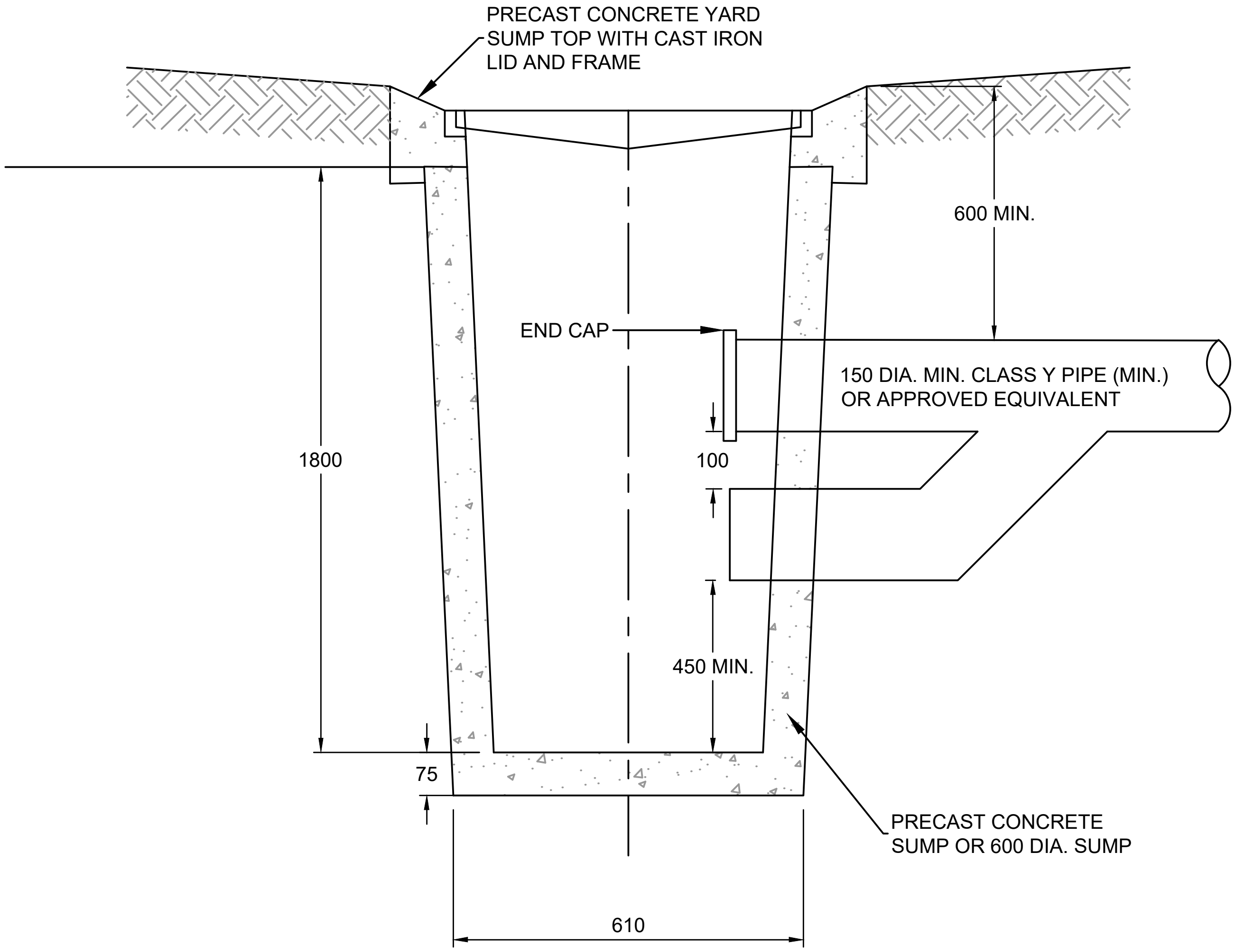
NOTES:

1. USE OF SINGLE OR TWIN PIPES FROM THE PROPERTY TO THE SUMP TO BE DETERMINED BY CALCULATIONS.

QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Typical Sump to Driveway or Right of Way	NOT TO SCALE Drawing No. B5-9



PLAN

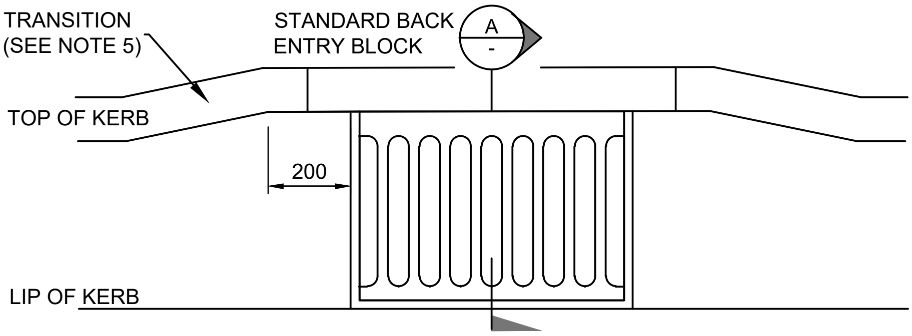


NOTE:

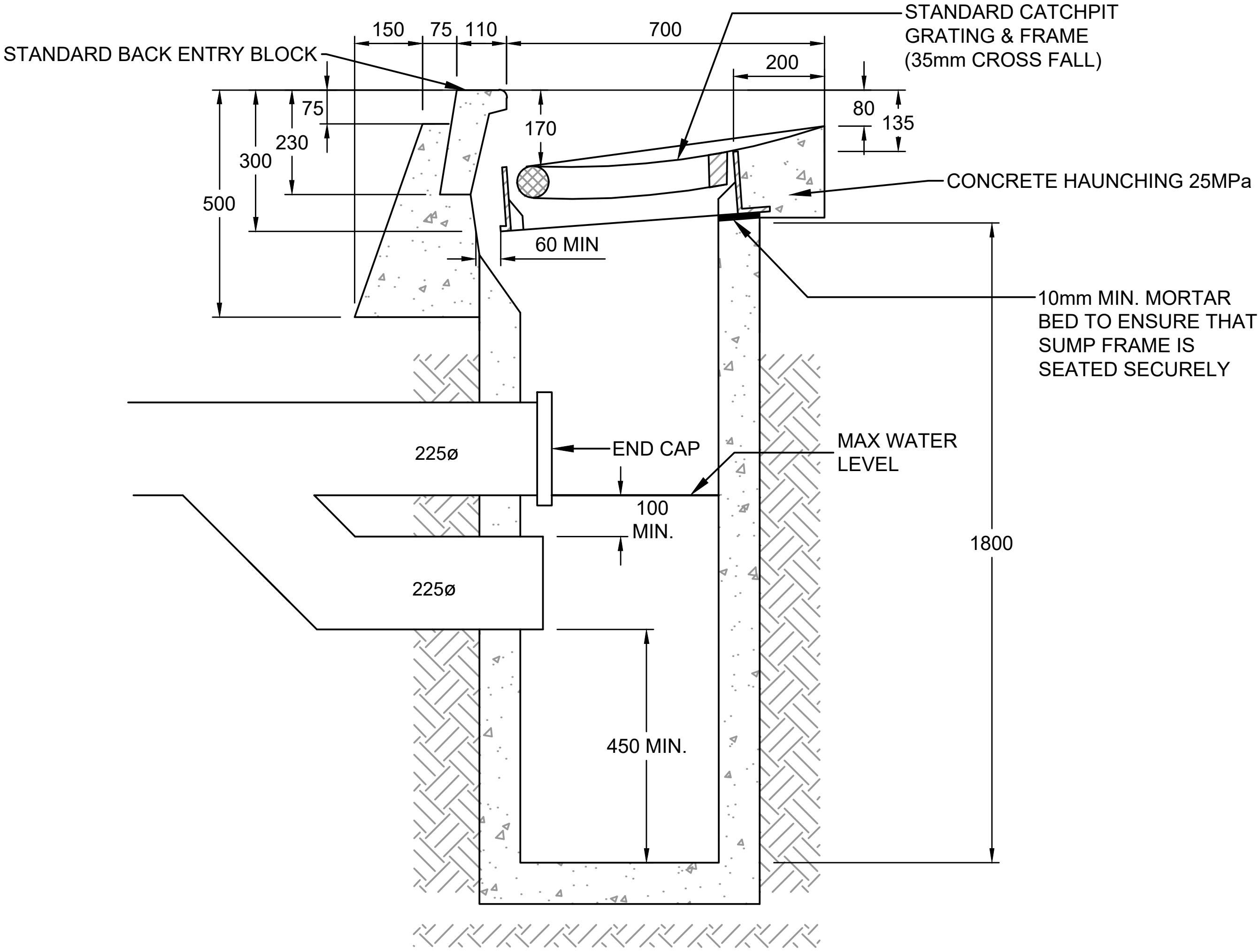
1. SUMP OUTLET MAY BE 150 DIA. IN PRIVATE PROPERTY
2. ALL DIMENSIONS ARE IN MILLIMETRES

SECTION A

QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Flat Channel or Yard Sump - Private Only	NOT TO SCALE Drawing No. B5-10



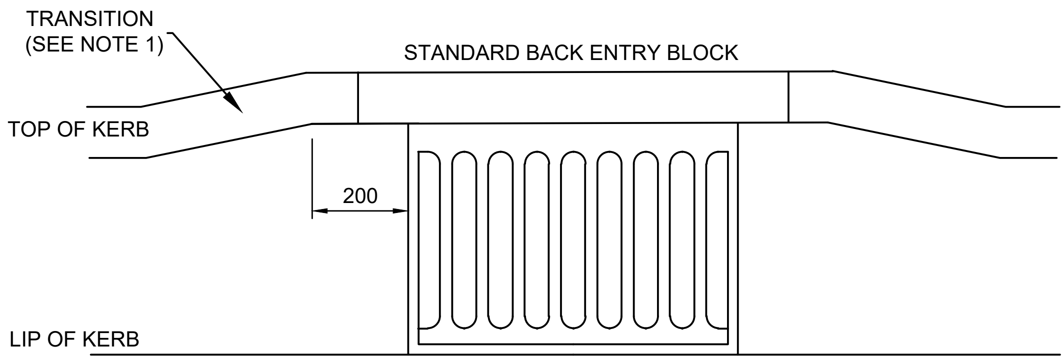
STANDARD SUMP IN CHANNEL



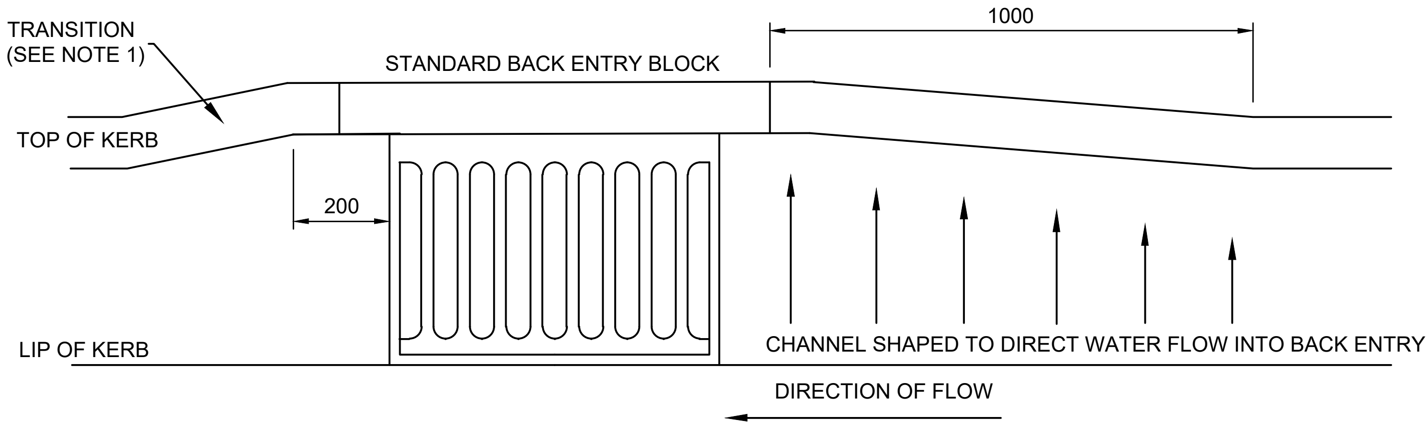
SECTION A

NOTE:

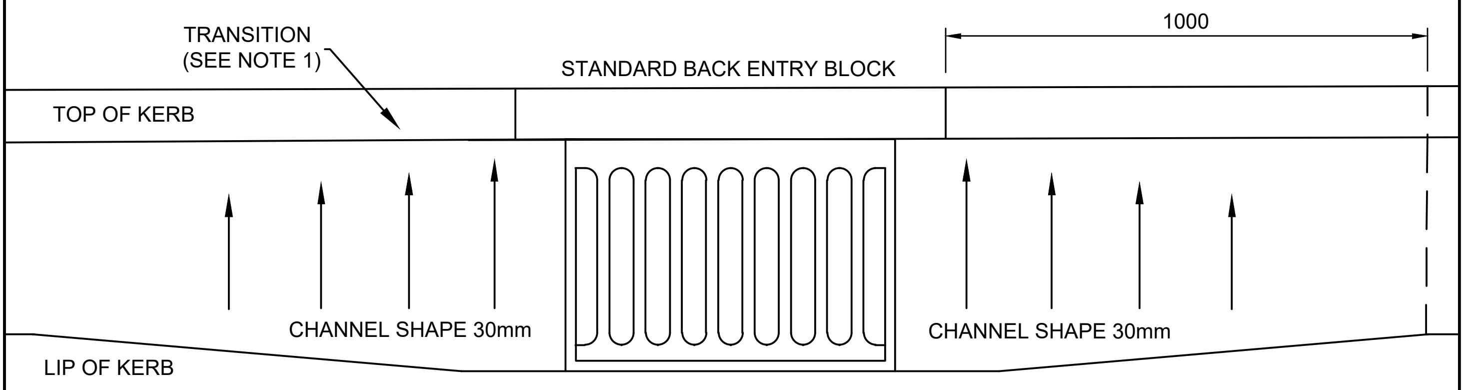
1. ROAD SUMPS TO BE PLACED AT 90m (MAX.) INTERVALS.
2. DOUBLE SUMPS TO BE INSTALLED IN PLACE OF SINGLE SUMPS:
   - A. UNDER VERTICAL CURVES IN ROADS
   - B. ON ALL ROADS WITH VERTICAL GRADIENTS EXCEEDING 10%.
     SPECIFIC DESIGN REQUIRED WHERE GRADIENT EXCEEDS 12%.
3. SUMP LEADS TO INTERSECT SIDE OR BACKWALL OF SUMP BOX AT 90°.
4. SITE-SPECIFIC DESIGN REQUIRED TO REDUCE SYPHON FROM 225ø DOWN TO 150ø.
5. WHERE GRADIENTS EXCEED 10%, CHANNEL TRANSITION INTO DOUBLE MUDTANK TO BE 800mm AND CHANNEL TO BE FORMED DIRECTLY INTO BACK ENTRY.
6. TO BE USED WHERE BACK OF KERB IS NOT DIRECTLY ADJACENT TO THE FOOTPATH.
7. ALL SUMPS SHOULD BE 1800mm DEPTH.
8. A MINIMUM SEDIMENT STORAGE DEPTH OF 450mm IS TO BE PROVIDED (TO INVERT OF PIPE).
9. REDUCED COVER WHERE THE LEADS LEAVE THE MUD SUMP IS ACCEPTABLE. THIS SHOULD NOT REDUCE BELOW A MINIMUM OF 600mm COVER TO PIPE.
10. THE LENGTH OF PIPE WITH REDUCED COVER SHOULD BE MINIMISED AND AVOID EXTENDING INTO THE WHEEL TRACKS AS FAR AS POSSIBLE.



STANDARD ROAD SUMP



ROAD SUMP IN HILLSIDE CHANNEL



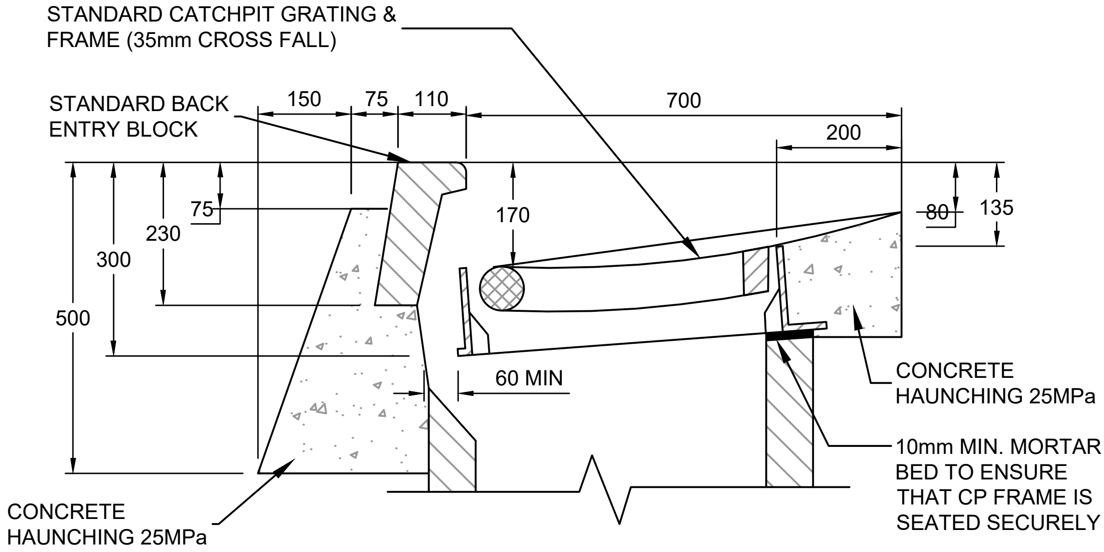
ROAD SUMP DETAIL WHERE NO VERGE

(BACK OF KERB AGAINST FOOTPATH)

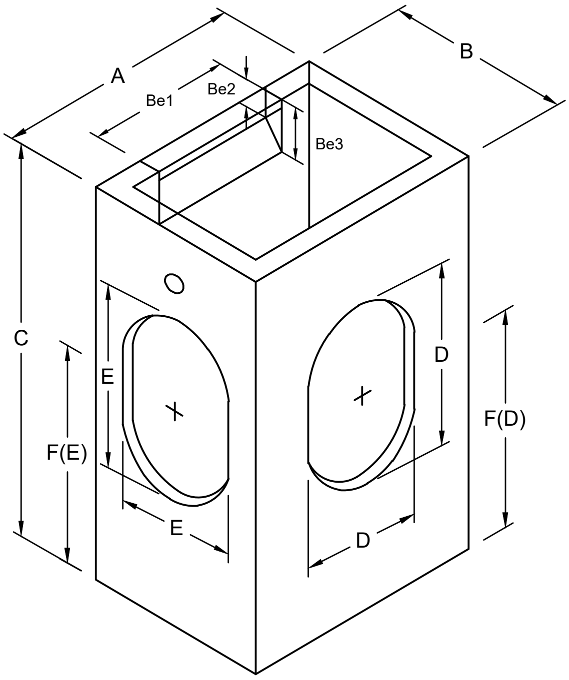
NOTE:

1. WHERE GRADIENTS EXCEED 10%, CHANNEL TRANSITION INTO DOUBLE MUDTANK TO BE 800MM AND CHANNEL TO BE FORMED DIRECTLY INTO BACK ENTRY.

QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Different Grate Layouts	NOT TO SCALE Drawing No. B5-12

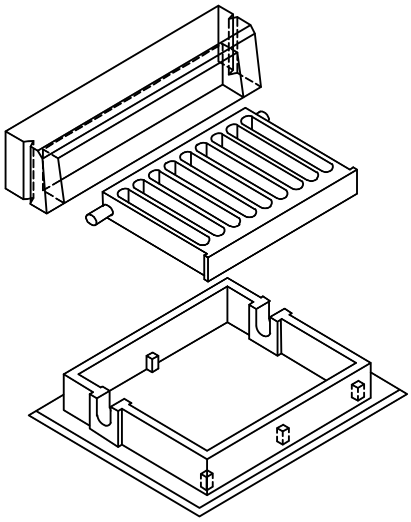


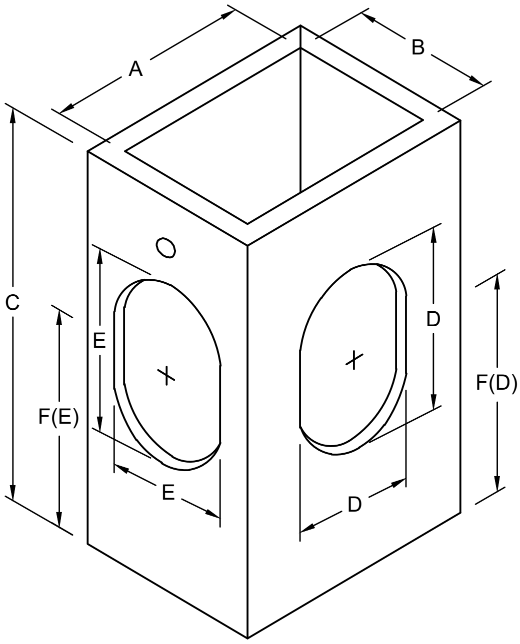
SECTION THROUGH GRATE



BACK ENTRY SUMP ISOMETRIC VIEW

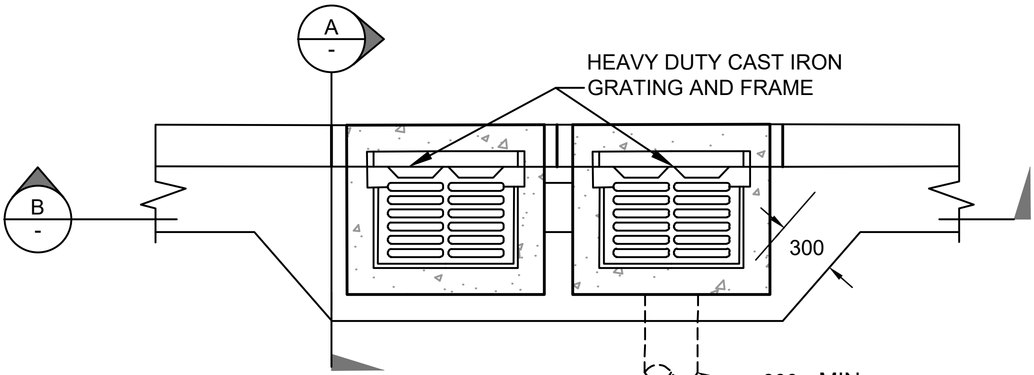
NOTES:
1. DIMENSIONS PER MANUFACTURER'S SPECIFICATIONS.
2. ALL SUMPS SHALL BE A MINIMUM OF 1800 DEPTH.



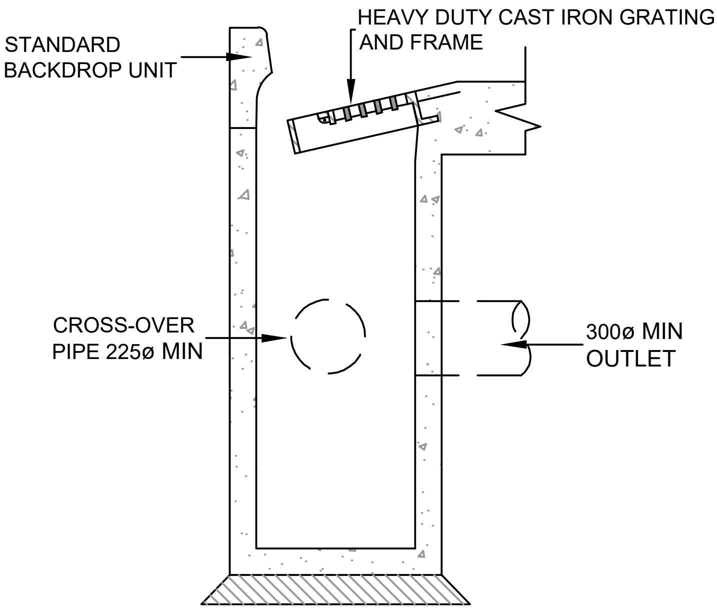


FLAT TOP SUMP ISOMETRIC VIEW

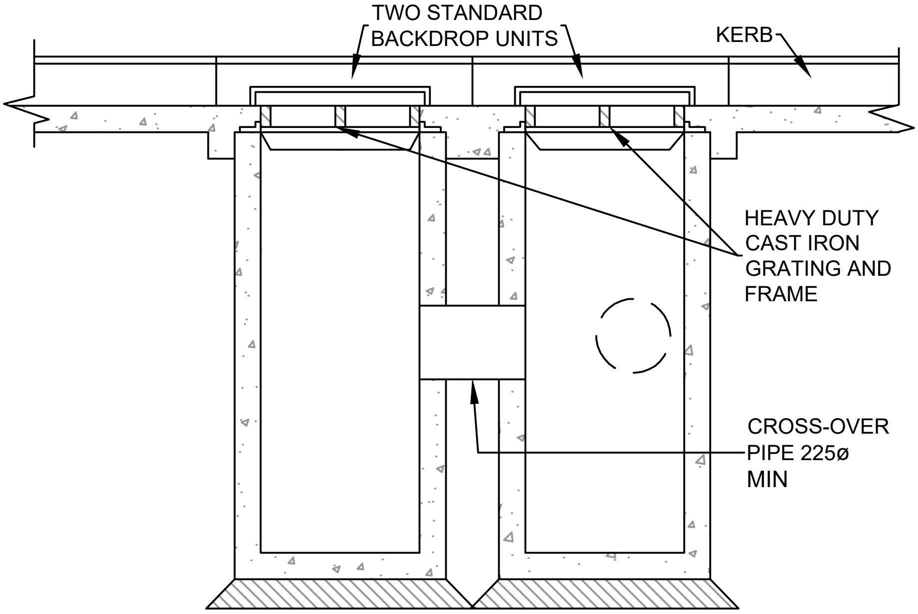
QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Standard Flat Top and Back Entry Sump	NOT TO SCALE Drawing No. B5-13



PLAN

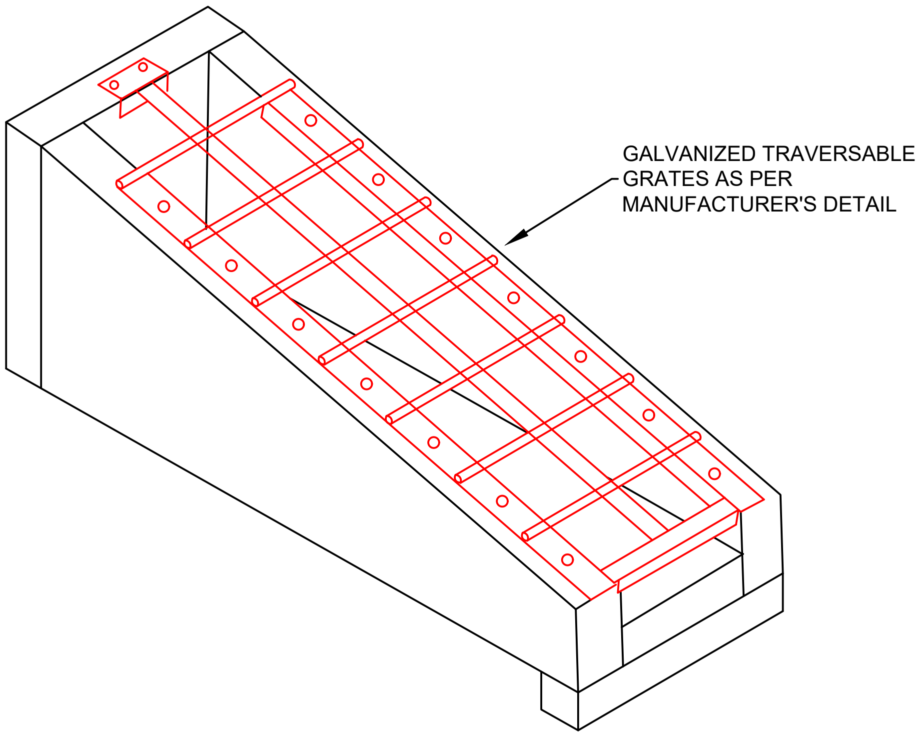


SECTION A



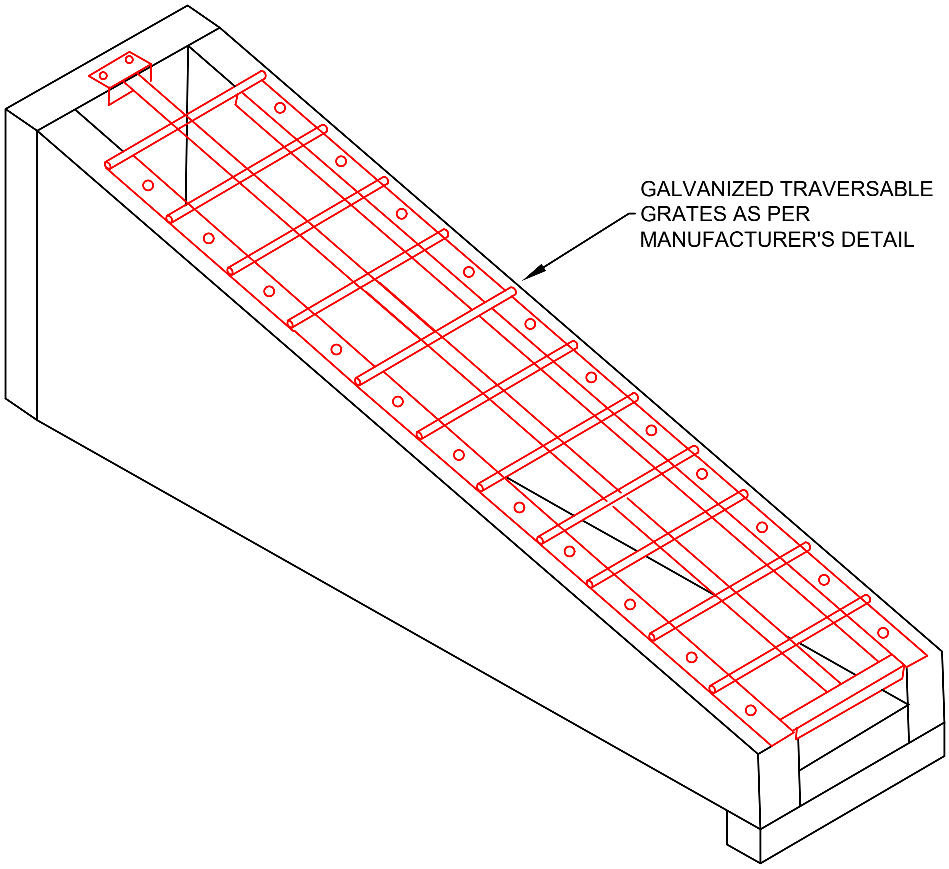
SECTION B

QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Double Back-Entry Sump for Road Low Points and Alternative	NOT TO SCALE Drawing No. B5-14



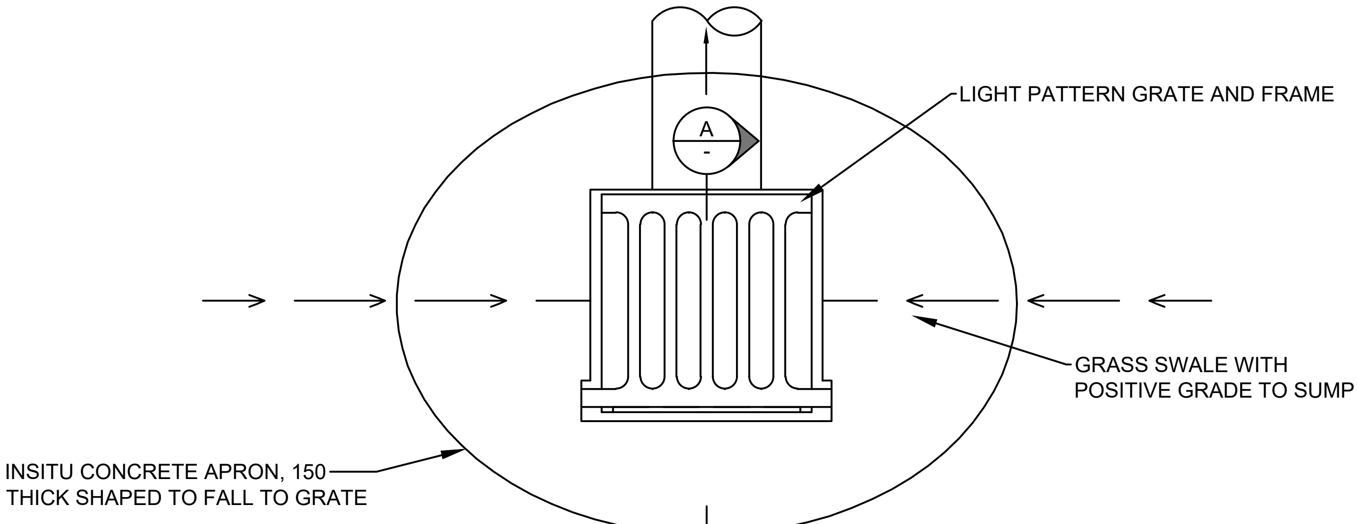
ISOMETRIC VIEW

NOTES:
1. IT IS RECOMMENDED THAT THE GRATES ARE SOURCED FROM THE MANUFACTURER OF THE PRECAST CULVERT HEADWALL TO ENSURE THE GRATE AND HEADWALL ARE COMPATIBLE. OTHERWISE GUIDANCE SHOULD BE SOUGHT FROM THE MANUFACTURER OF THE PRECAST CULVERT HEADWALL ON THE REQUIRED DIMENSIONS FOR ANY GRATES NOT SUPPLIED BY THEM.
2. THE CLEAR WIDTH BETWEEN SIDE WALLS OF PRECAST CULVERT HEADWALLS SHALL NOT EXCEED 600mm WHEN USING THIS GRATE.
3. MATERIAL SPECIFICATIONS FOR THE FOLLOWING ITEMS:
   STEEL GALVANIZED ANGLES - AS/NZS 3679.1:1996 HOT ROLLED BARS AND SECTIONS REINFORCING BARS - AS/NZS 4671:2001
   STEEL REINFORCING MATERIALS GALVANIZING - AS/NZS 4680:2006 HOT DIP GALVANIZING (ZINC) COATINGS ON FABRICATED FERROUS ARTICLES



ISOMETRIC VIEW

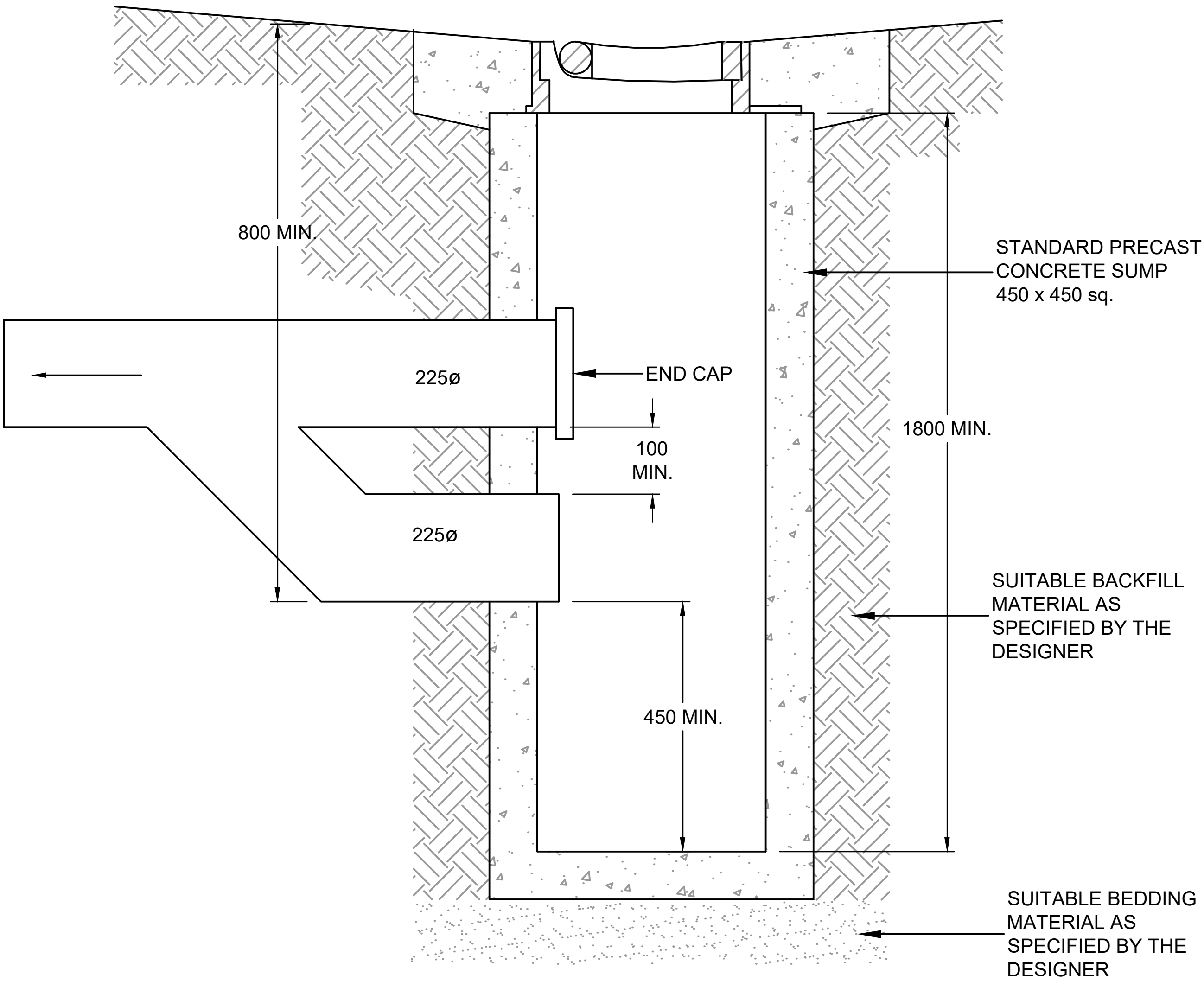
NOTES:
1. IT IS RECOMMENDED THAT THE GRATES ARE SOURCED FROM THE MANUFACTURER OF THE PRECAST CULVERT HEADWALL TO ENSURE THE GRATE AND HEADWALL ARE COMPATIBLE. OTHERWISE GUIDANCE SHOULD BE SOUGHT FROM THE MANUFACTURER OF THE PRECAST CULVERT HEADWALL ON THE REQUIRED DIMENSIONS FOR ANY GRATES NOT SUPPLIED BY THEM.
2. THE CLEAR WIDTH BETWEEN SIDE WALLS OF PRECAST CULVERT HEADWALLS SHALL NOT EXCEED 600mm WHEN USING THIS GRATE.
3. MATERIAL SPECIFICATIONS FOR THE FOLLOWING ITEMS:
STEEL GALVANIZING ANGLES - AS/NZS 3679.1:1996 HOT ROLLED BARS AND SECTIONS REINFORCING BARS - AS/NZS 4671:2001 STEEL REINFORCING MATERIALS GALVANIZING - AS/NZS 4680:2006 HOT DIP GALVANIZING (ZINC) COATINGS ON FABRICATED FERROUS ARTICLES.



NOTES:
ALL CONCRETE TO BE ORDINARY GRADE N.Z.S.S. 20MPa AT 28 DAYS.

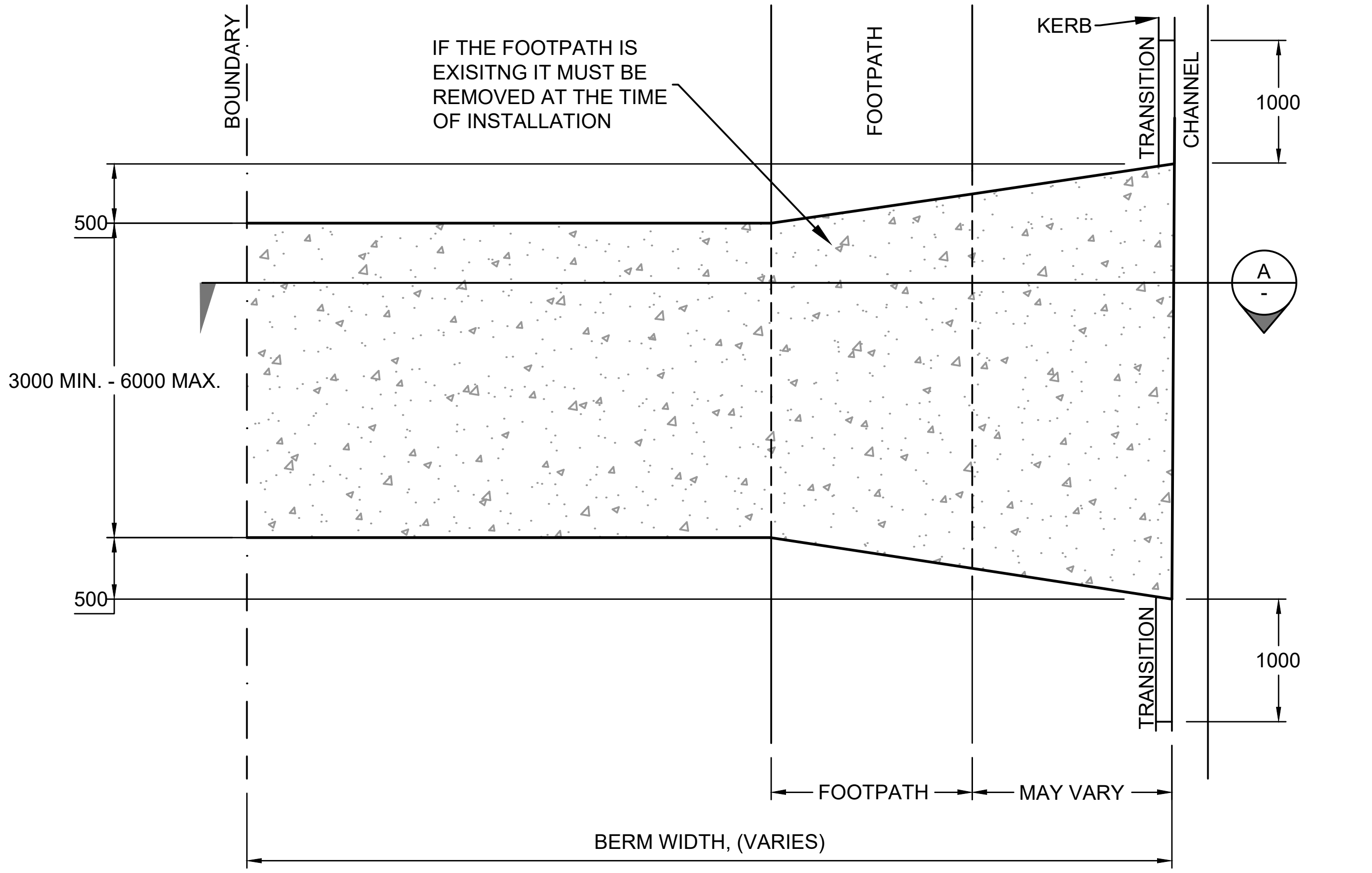
ALL PIPES TO BE FINISHED FLUSH WITH INSIDE WALL OF SUMP.

PLAN

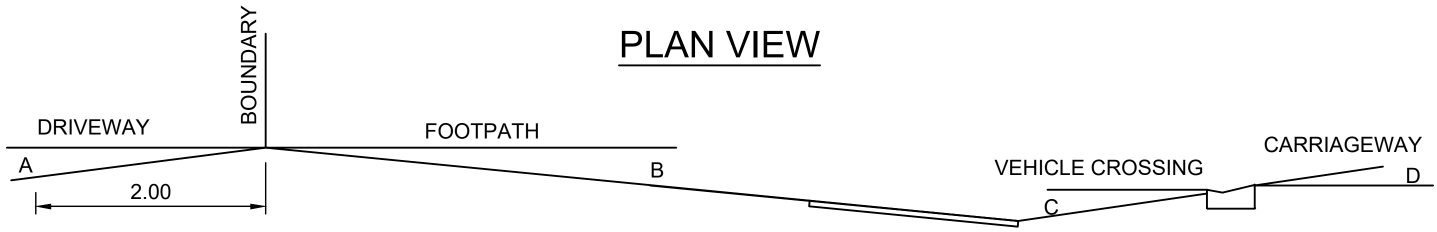


SECTION A

NOTES:
1. ALL SUMPS SHOULD BE 1800mm DEPTH.
2. A MINIMUM SEDIMENT STORAGE DEPTH OF 450mm IS TO BE PROVIDED (TO INVERT OF PIPE).

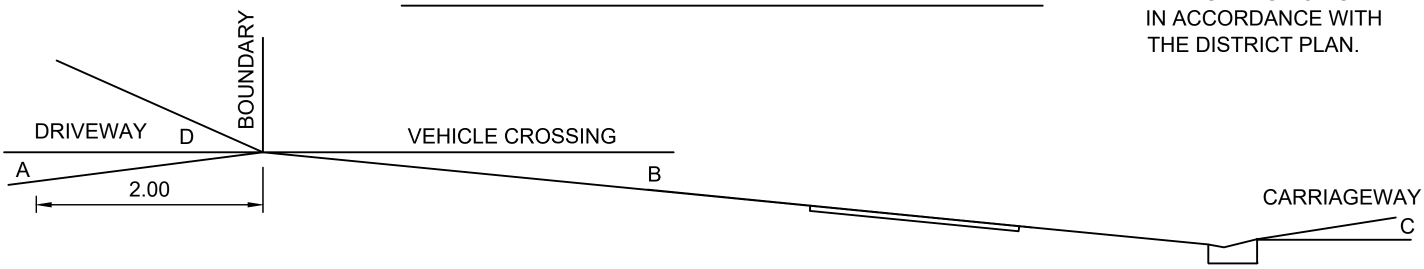


PLAN VIEW



SECTION A: LOW LEVEL FOOTPATH

MAX. CHANGE OF GRADE IN ACCORDANCE WITH THE DISTRICT PLAN.

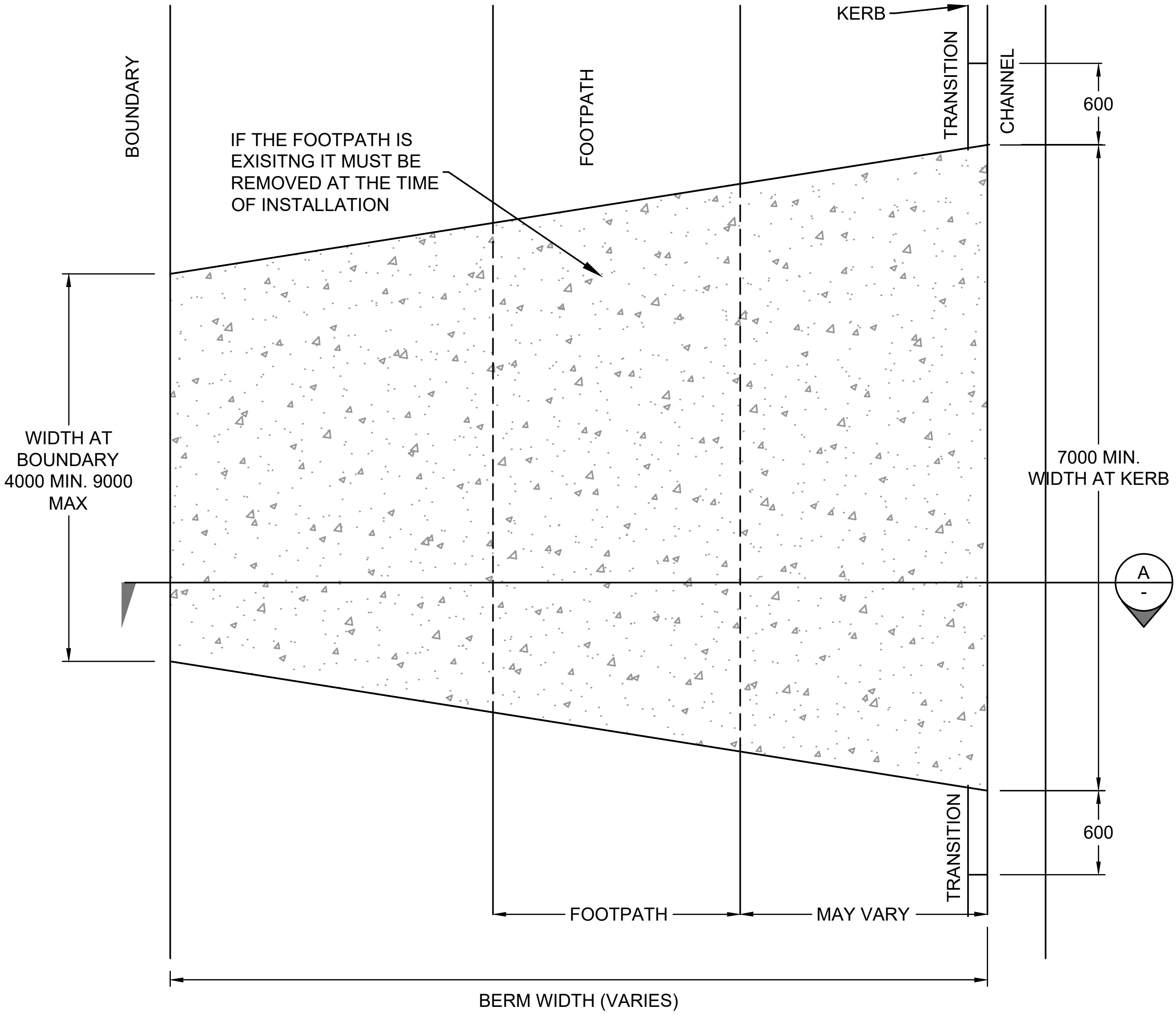


SECTION A: STANDARD FOOTPATH

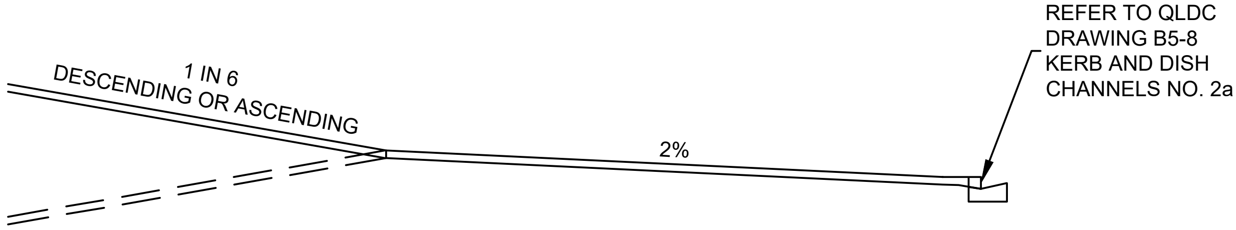
NOTES:

1. DESIGN OF ALL RESIDENTIAL CROSSINGS TO COMPLY WITH DISTRICT PLAN REQUIREMENTS.
2. CROSSING CONCRETE TO BE 125mm THICK REINFORCED WITH STRUCTURAL MESH, CENTRALLY PLACED.
3. SURFACING TO BE CONCRETE WITH A MINIMUM CRUSHING STRENGTH OF 20MPa AT 28 DAYS, OR 30mm DG7 ASPHALT (NZTA M10 Notes TABLE N3.3), OR 2 COAT SEAL.
4. BASECOURSE TO BE A MINIMUM 150mm COMPACTED DEPTH OF M4 AP40 CRUSHED GRAVEL, OR 150mm M4 AP40 FOR 2 COAT SEAL.
5. SUBGRADE TO BE TRIMMED AND COMPACTED TO ACHIEVE A MINIMUM CBR VALUE = 7.
6. MAXIMUM LONGITUDINAL GRADIENTS SHALL BE IN ACCORDANCE WITH THE DISTRICT PLAN.
7. A, B, C AND D REFER TO THE GRADIENTS EXPRESSED EITHER AS A PERCENTAGE OR IN DEGREES.
8. LOW SLUNG CARS WITH GROUND EFFECT FEATURES MAY NOT MEET THE CRITERIA ASSUMED IN THIS DESIGN GUIDE.

QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Vehicle Crossing - Residential	NOT TO SCALE Drawing No. B5-18



PLAN

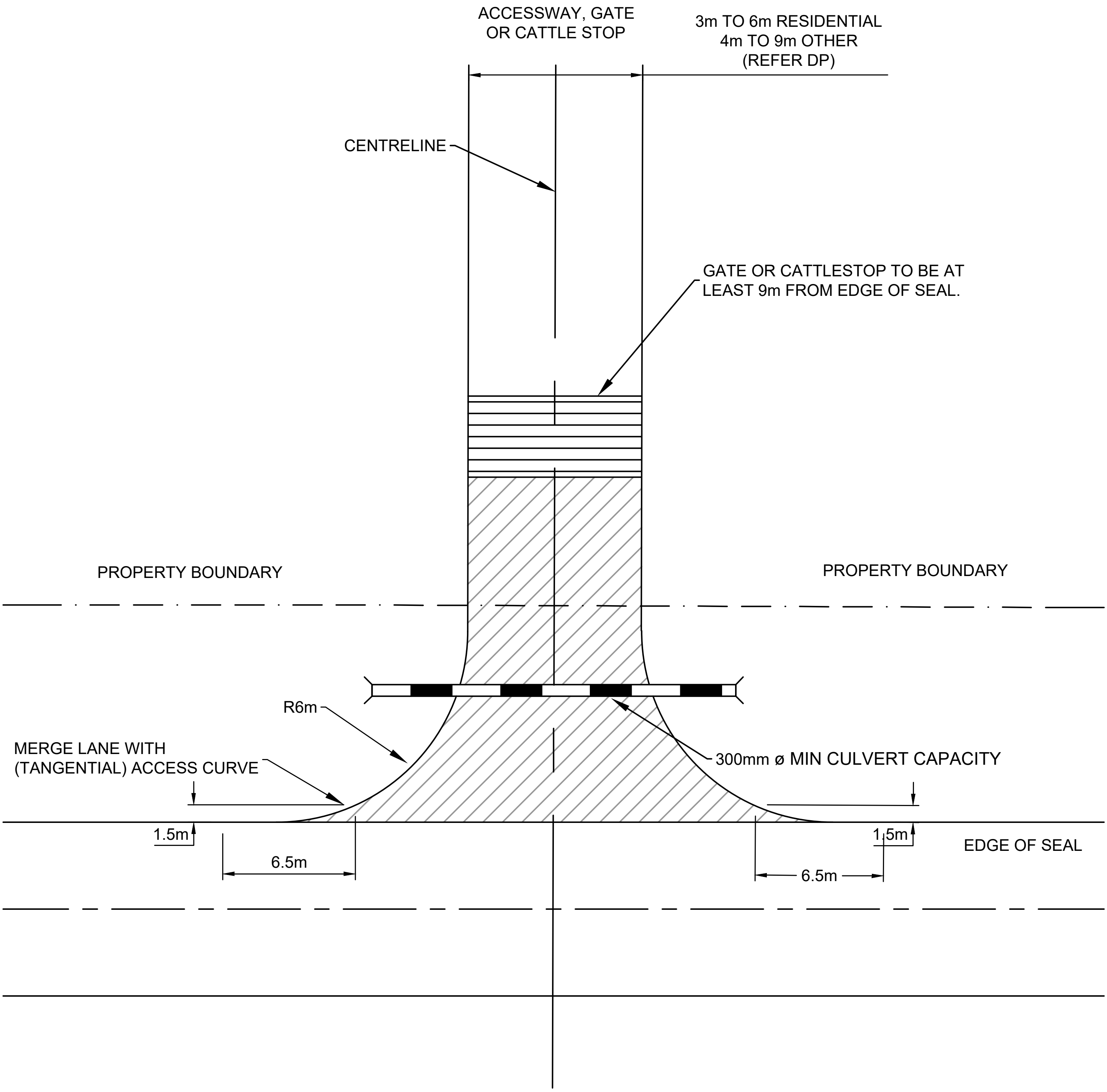


SECTION A

NOTES:

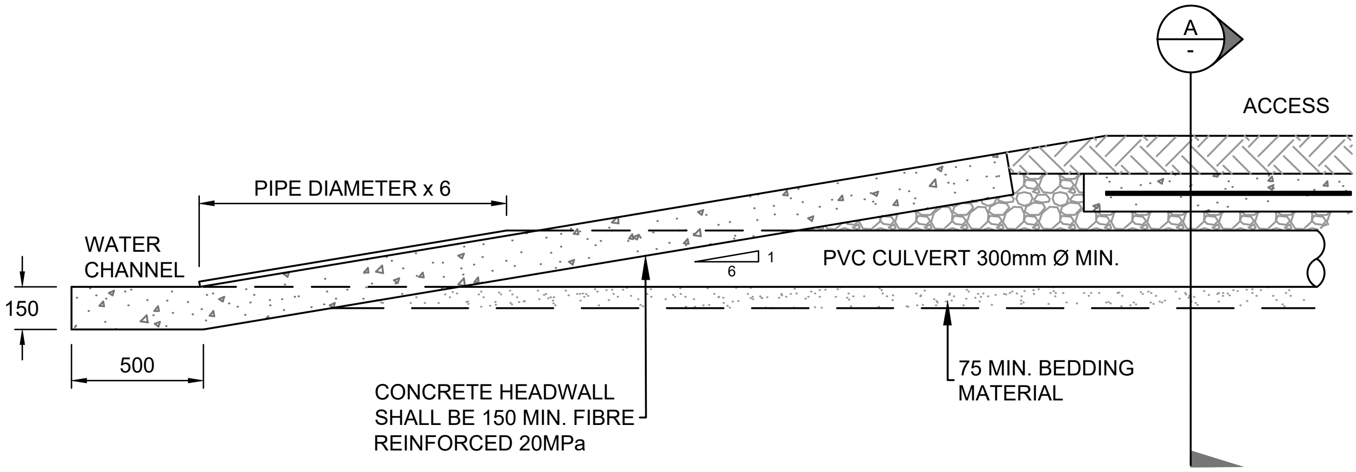
1. THE CONCRETE SHALL BE 150mm THICK AND REINFORCED WITH STRUCTURAL MESH, CENTRALLY PLACED.
2. THE CONCRETE SHALL HAVE A MINIMUM CRUSHING STRENGTH OF 30 MPa AT 28 DAYS AND SHALL COMPLY WITH NZS 3124.
3. CHANNEL CROSSING TO BE HEAVY DUTY, REINFORCED WITH 3 D12 BARS.
4. SUB-GRADE TO BE TRIMMED AND COMPACTED TO ACHIEVE A MIN. CBR VALUE OF > 7.
5. DESIGN OF ALL COMMERCIAL CROSSINGS TO COMPLY WITH THE DISTRICT PLAN.
6. MAXIMUM LONGITUDINAL GRADIENTS SHALL BE IN ACCORDANCE WITH THE DISTRICT PLAN.
7. ONLY CONCRETE IS PERMITTED (ASPHALT NOT PERMITTED).

QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Vehicle Crossing - Commercial / Industrial	NOT TO SCALE Drawing No. B5-19

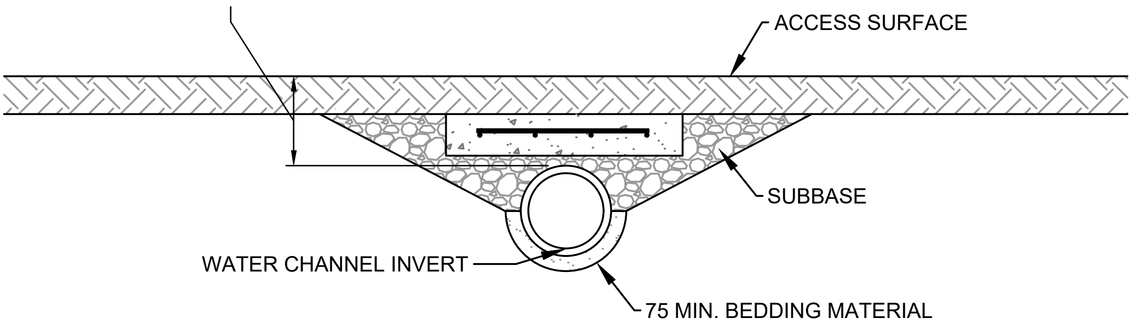


NOTES:

1. CROSSING TO BE MINIMUM 4.5m WIDE AT ENTRANCEWAY & INCORPORATE MIN. 6m RADIUS.
2. PAVEMENT CONSTRUCTION TO BE 150mm COMPACTED DEPTH M/4 AP40 BASECOURSE ON 200mm COMPACTED DEPTH OF AP65 SUBBASE ON COMPACTED SUB-GRADE WITH CBR > 7 (FOR ACCESSWAY INTERNAL TO SITE AS WELL AS LINKING SITE AND LEGAL ROAD).
3. WHERE THE CROSSING INTERCEPTS EXISTING SIDE DRAINAGE, A MIN. 300mm ø CULVERT IS TO BE INSTALLED.
4. IF THE APPLIED SURFACE IS CHIP SEAL A SECOND COAT SEAL IS REQUIRED TO BE PROGRAMMED AND CONSTRUCTED WITHIN 12 MONTHS FROM CONSTRUCTION OF THE FIRST COAT OR IN THE NEXT SUMMER SEASON, WHICHEVER COMES FIRST.
5. CULVERT TO BE FINISHED WITH CONCRETE HEADWALLS AS PER DRAWING B5-24: NON-PRECAST HEADWALL DETAIL OR DRAWING B5-16: TRAVERSABLE GRATES FOR PRECAST HEADWALLS 250mm TO 450mm CULVERTS.
6. MINIMUM DEPTH OF 450mm TO TOP OF CULVERT IS REQUIRED OR CONCRETE CAPPED/ENCASED IF THE ROAD DEPTH CANNOT BE ACHIEVED OR AS AGREED WITH THE T.A.



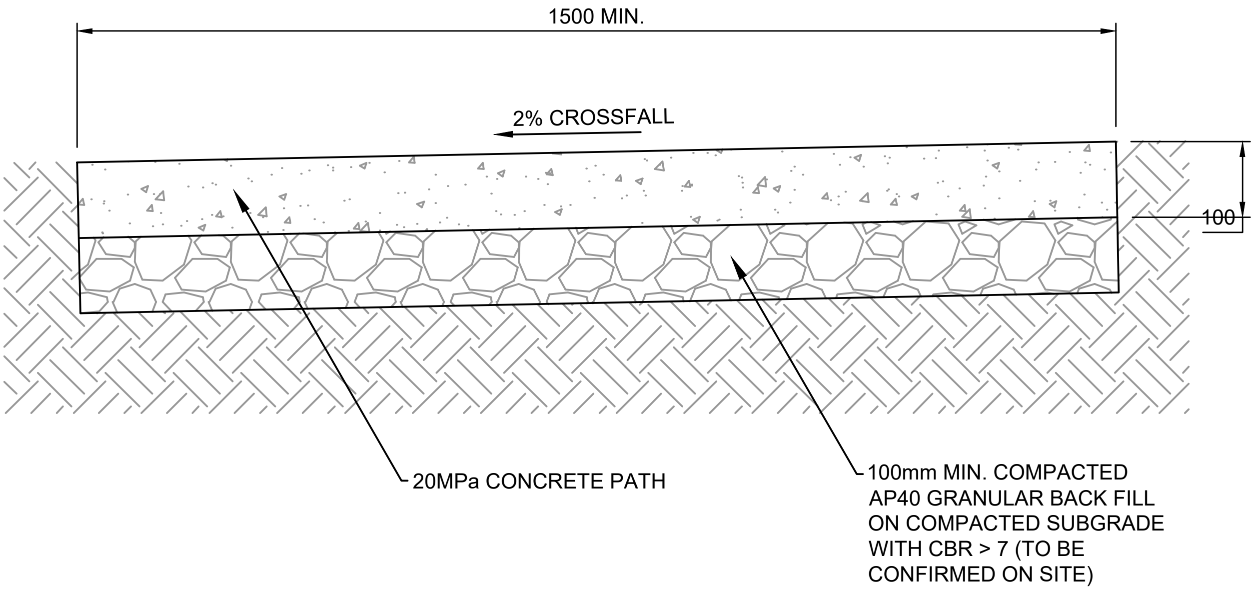
LONGITUDINAL ELEVATION: HEADWALL



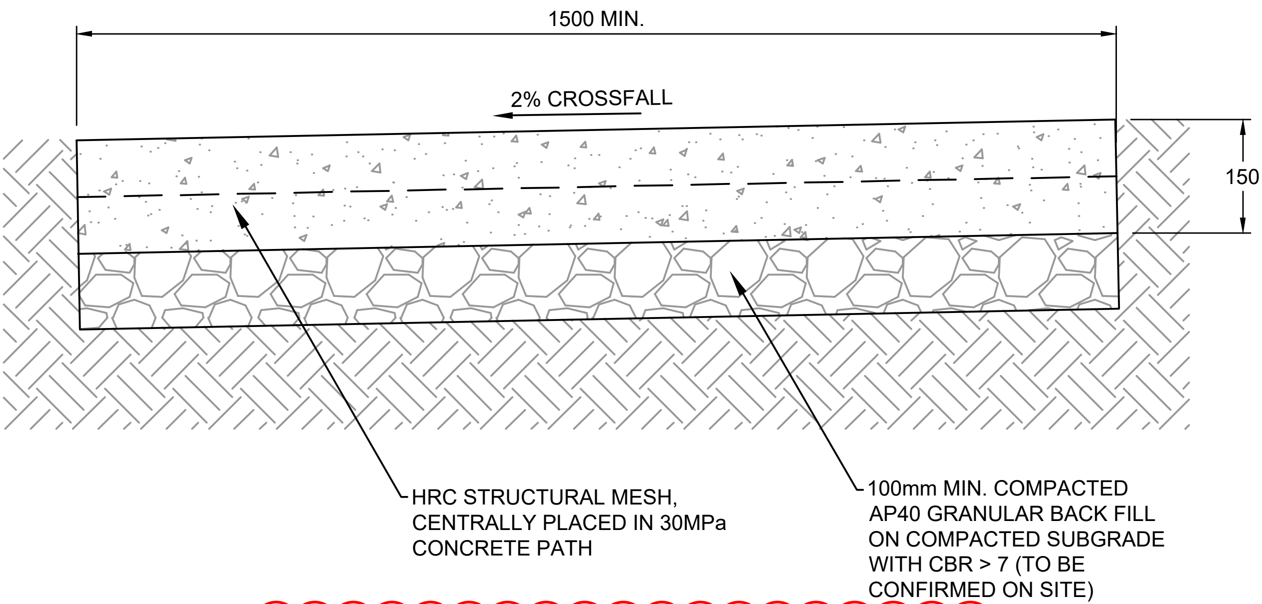
SECTION A: ACCESS PIPE BEDDING

NOTES:

1. WHERE THE ACCESS INTERCEPTS EXISTING SIDE DRAINAGE / WATER TABLE, A 300mm MIN. DIAMETER (OR MIN. DIAMETER OF UPSTREM CULVERT, WHICHEVER IS THE GREATER) CULVERT IS TO BE INSTALLED.
2. PIPE TO SN8 PVC OR CONCRETE WITH APPROPRIATE BEDDING.
3. COVER OVER CULVERT TO BE AS PER THE MANUFACTURERS INSTRUCTIONS, OR OTHERWISE CONCRETE CAPPED OR ENCASED IF AN APPROPRIATE DEPTH CANNOT BE ACHIEVED.
4. CULVERT ENDS TO BE MITRED TO A GRADIENT OF 1V:6H.
5. CONSTRUCT CONCRETE HEADWALL AND APRON AROUND PIPE ENDS AND CHANNEL INVERT.



CONCRETE FOOTPATH



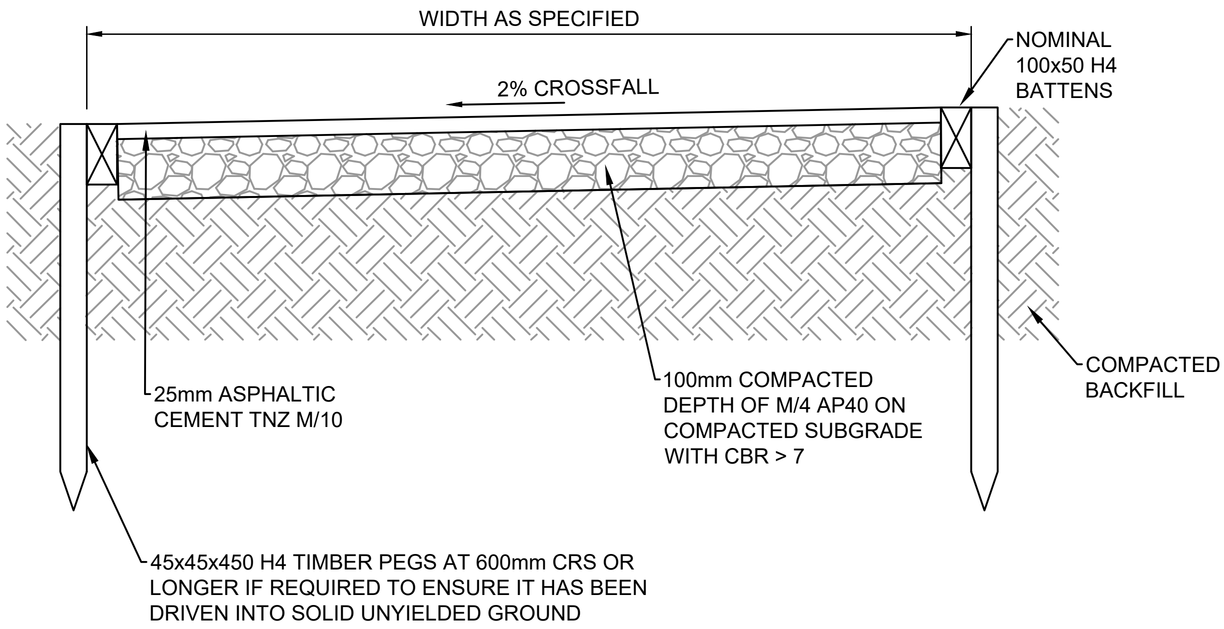
HEAVY DUTY CONCRETE FOOTPATH

TO BE USED FOR COMMERCIAL OR RESIDENTAIL CROSSINGS

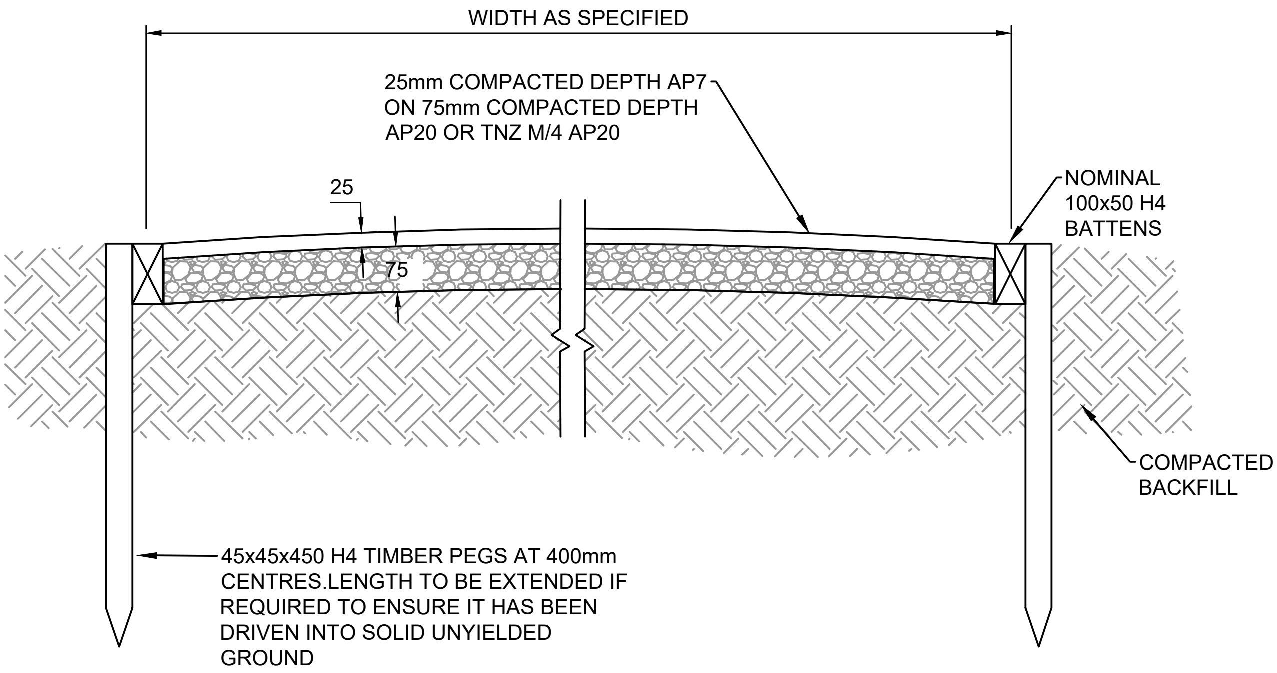
NOTES:

1. BRUSHED CONCRETE SURFACE TO BE USED FOR VESTED ROADS

QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Heavy Duty Footpath	NOT TO SCALE Drawing No. B5-22



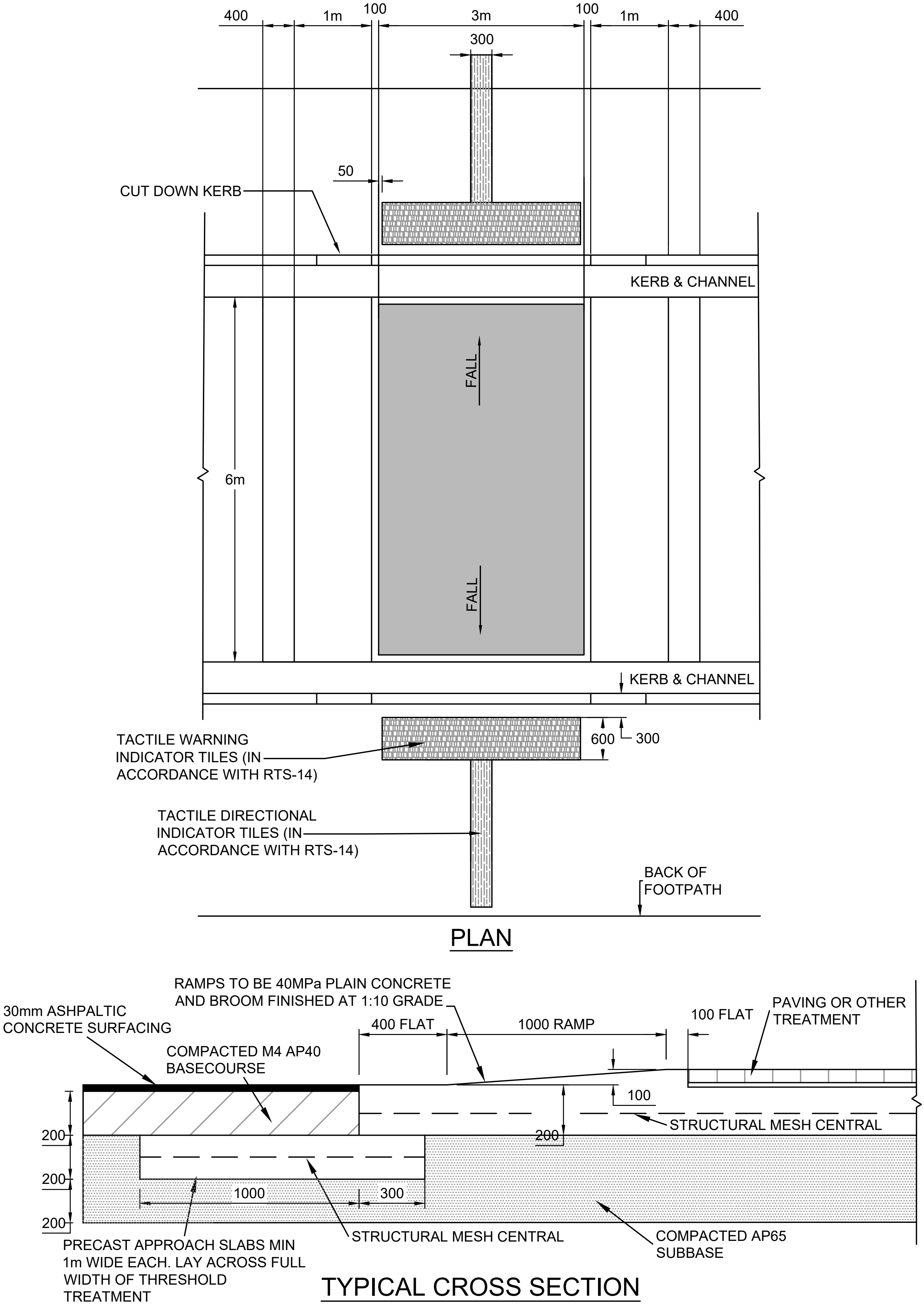
ASPHALT FOOTPATH



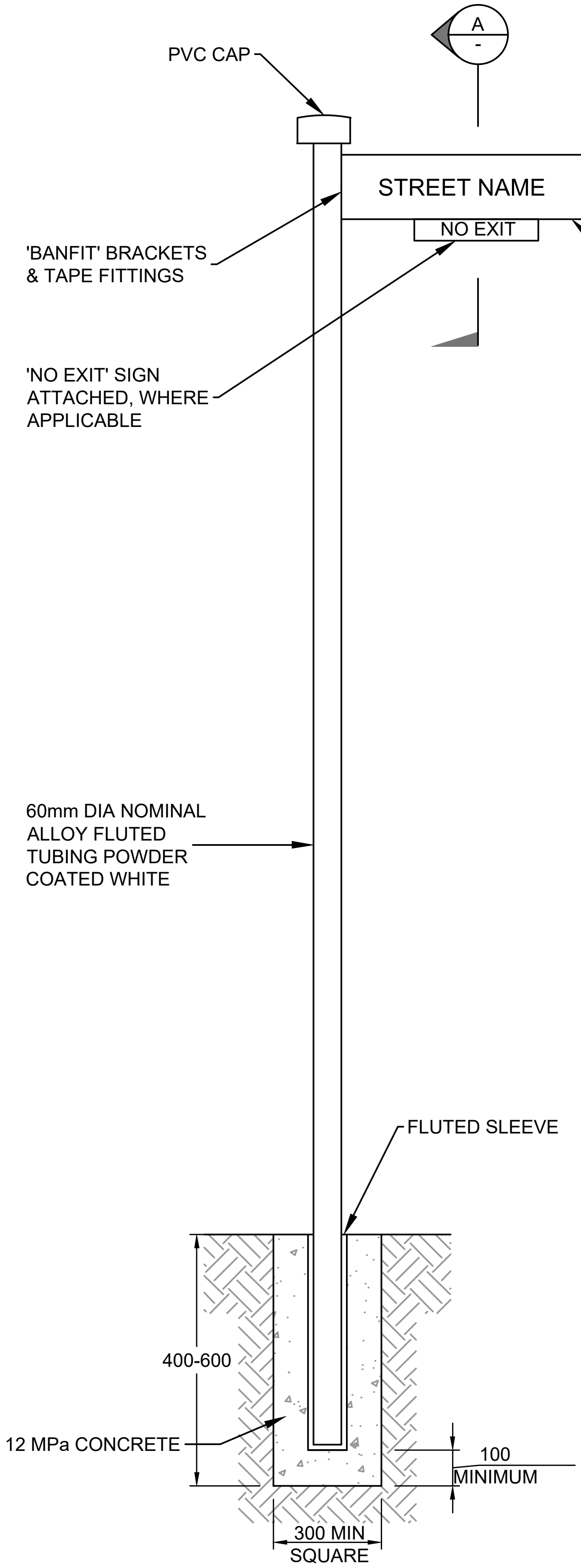
GRITTED FOOTPATH

NOTES:
1. RE. MIN. CBR OF 7 REQUIRED AND SUBBASE OF 75mm.
2. CROSSFALLS TO BE NOMINALLY 3% (CROWNED OR CONTINUOUS CROSSFALLS AS SPECIFIED).
3. SUBGRADE & METALCOURSE TO BE TREATED WITH APPROVED SOIL STERILANT.
4. PEGS CAN BE CUT OFF AT AN ANGLE, FLUSH WITH BOXING ON SIDE AND MINIMUM 5mm DOWN ON THE OTHER.
5. TRACKS AND TRAILS TO BE DESIGNED AND BUILT AS PER THE QLDC TRACKS AND TRAILS DESIGN GUIDE.

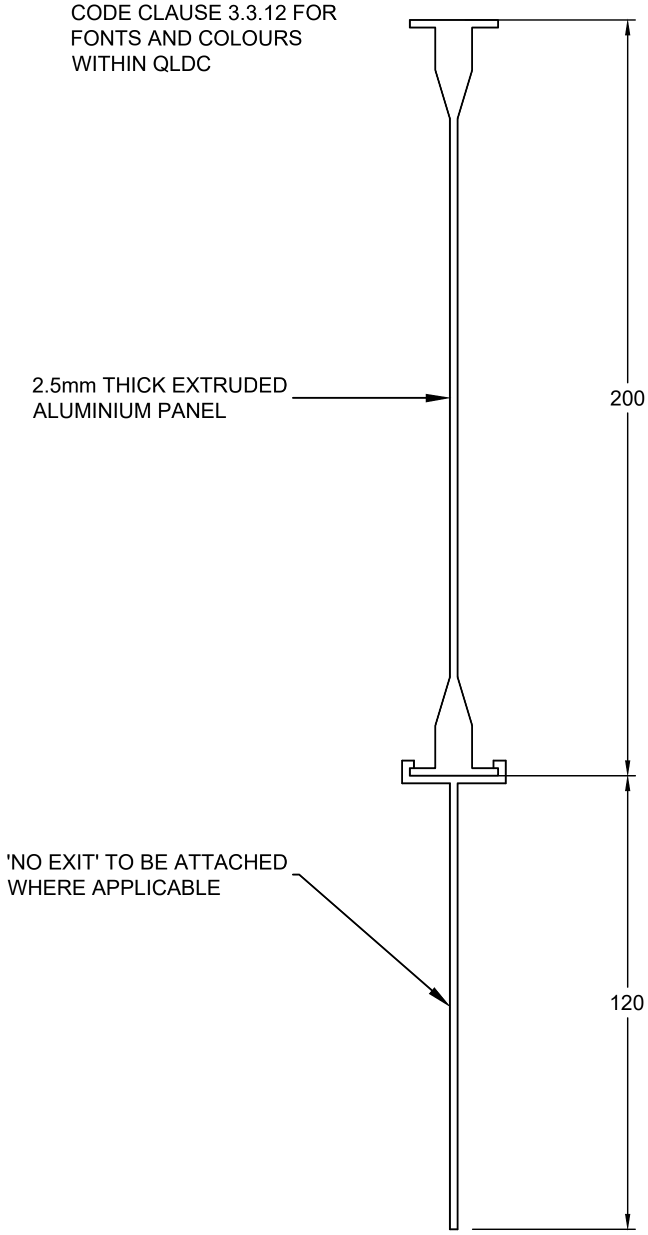
QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Footpath - Asphalt & Gritted Detail	NOT TO SCALE Drawing No. B5-23



QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Pedestrian Crossing Detail	NOT TO SCALE Drawing No. B5-24



STREET NAME AND POST



SECTION A

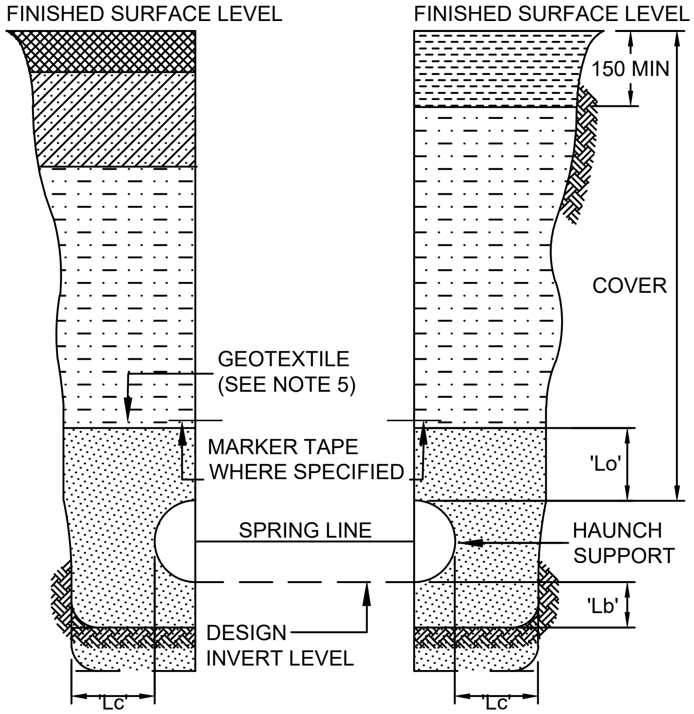
NOTE:
WHERE POLES ARE SUPPORTING MORE THAN 3 SIGNS, SPECIFIC APPROVAL OF BASE UNIT DESIGN IS REQUIRED.

QLDC LDSC 2025 Standard Details Revision: 000B Rev Date: 10/02/2025	QUEENSTOWN LAKES DISTRICT COUNCIL	Drawing Title: Street Sign: Pole Mount	NOT TO SCALE Drawing No. B6-1

MATERIAL: ROAD SURFACE	MATERIAL: NON ROAD SURFACES	ZONE	
ROAD SURFACE LAYER	TO MATCH EXISTING	SURFACE COURSE	
TO MATCH EXISTING ROAD BASE OR TO TERRITORIAL AUTHORITY REQUIREMENTS	TRENCH FILL MATERIALS TO BE SIMILAR WITH SNZ HB 2002 APPENDIX L OR TO TERRITORIAL AUTHORITY REQUIREMENTS OR INORGANIC FILL MATERIAL WITH 75 MAXIMUM STONE SIZE	ROAD BASE	
TRENCH FILL MATERIALS TO BE SIMILAR WITH SNZ HB 2002 APPENDIX L OR TO TERRITORIAL AUTHORITY REQUIREMENTS OR INORGANIC FILL MATERIAL WITH 75 MAXIMUM STONE SIZE		TRENCH FILL (AS SPECIFIED IN DESIGN DRAWINGS)	
EMBEDMENT MATERIAL IN ACCORDANCE WITH DESIGN DRAWINGS AND TERRITORIAL AUTHORITY (SEE NOTE 4)		OVERLAY	EMBEDMENT
		SIDE SUPPORT	EMBEDMENT
BEDDING MAY BE OMITTED IF TRENCH BASE IS GRANULAR SAND OR GRAVEL OF SUITABLE GRADING		BEDDING	EMBEDMENT
		OVER-EXCAVATION	

VEHICULAR LOADING

'Lo' - 100 mm MIN. NON TRAFFICABLE
'Lb' - 300 mm MIN. TRAFFICABLE
- REFER TO CM - 002



SPRING LINE TRENCH CLEARANCE

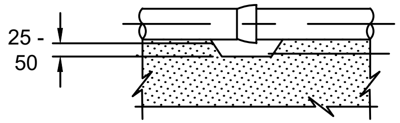
NOMINAL DIAMETER DN	MINIMUM CLEARANCE 'Lc'
≤150	100
>150 - ≤300	150
>300 - ≤450	200
>450 - ≤900	300
>900 - ≤1500	350

TRENCH WIDTH TO BE SUFFICIENT TO SAFELY LAY PIPE AND COMPACT THE SIDE SUPPORT ZONE

ZONE		MATERIAL
TOPSOIL OR PAVEMENT		ORIGINAL OR IMPORTED MATERIAL TO MATCH EXISTING
TRENCH FILL (AS SPECIFIED IN DESIGN DRAWINGS)		INORGANIC FILL MATERIAL WITH 75 MAXIMUM STONE SIZE
EMBEDMENT	OVERLAY	EMBEDMENT MATERIAL IN ACCORDANCE WITH DESIGN DRAWINGS AND TERRITORIAL AUTHORITY (SEE NOTE 4)
EMBEDMENT	SIDE SUPPORT	
EMBEDMENT	BEDDING	BEDDING MAY BE OMITTED IF TRENCH BASE IS GRANULAR SAND OR GRAVEL OF SUITABLE GRADING
OVER-EXCAVATION		

NO VEHICULAR LOADING

INCLUDES LOCATIONS WHERE OCCASIONAL VEHICLE LOADING OCCURS SUCH AS RESERVES AND FOOTWAYS



PROVIDE POCKETS IN BEDDING AT JOINTS PRIOR TO LAYING PIPES. FILL VOID DURING COMPLETION OF EMBEDMENT

PIPE JOINT BEDDING POCKETS

FOR JOINT PROJECTIONS (SOCKETS, FLANGES, AND SO ON)

NOTE:

1. ALL DIMENSIONS IN MILLIMETRES.
2. SPECIFY SPECIAL BEDDING TO SUIT THE CONDITIONS IF THE TRENCH FLOOR HAS:
   - IRREGULAR OUTCROPS OF ROCK OR
   - BEEN DISTURBED BY UNCONTROLLED GROUND WATER.
3. COMPACT AND EVENLY GRADE FINISHED TRENCH FLOOR.
4. EMBEDMENT, TRENCH FILL AND COMPACTION TO MEET THE REQUIREMENT OF DESIGN DRAWINGS OR SPECIFICATIONS.
5. USE GEOTEXTILE FILTER FABRIC WHERE SPECIFIED.
6. SIDES OF EXCAVATION TO BE KEPT VERTICAL TO AT LEAST 150 ABOVE THE PIPE.

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ORIGINAL SOURCE DRAWINGS: WATER SERVICES ASSOCIATION OF AUSTRALIA

NZS 4404:2010
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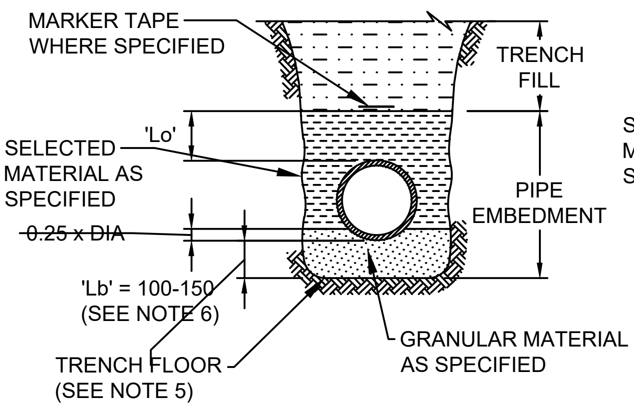
EMBEDMENT & TRENCHFILL TYPICAL ARRANGEMENT

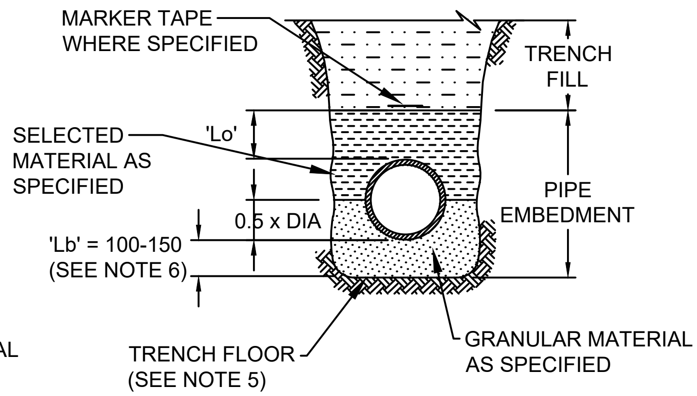
NOT TO SCALE

B7-1



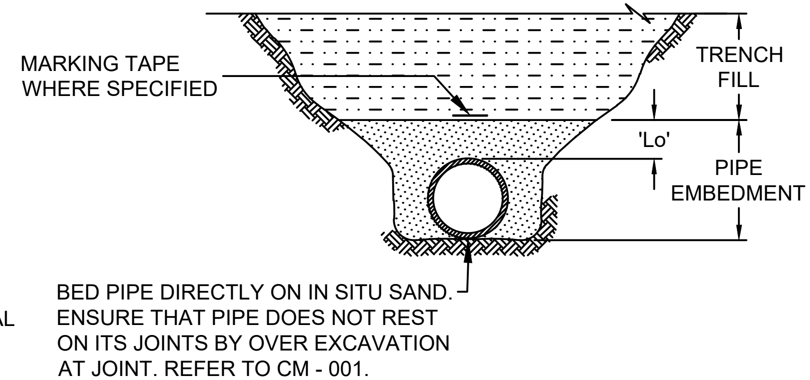
TYPE 1 SUPPORT

(SEE NOTE 9)

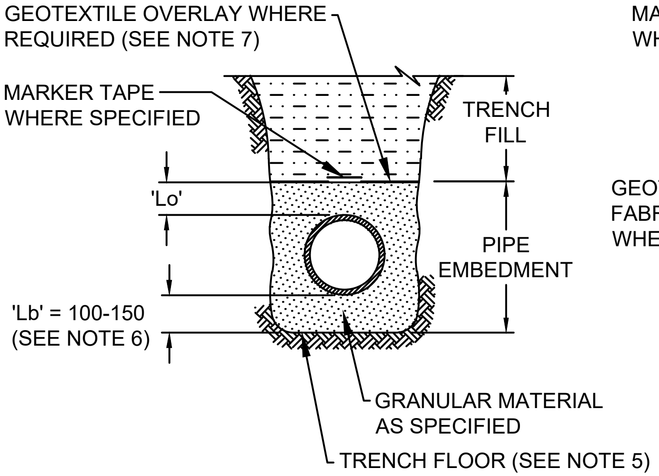


TYPE 2 SUPPORT

FOR RIGID PIPES ONLY (SEE NOTE 3)
(SEE NOTE 9)

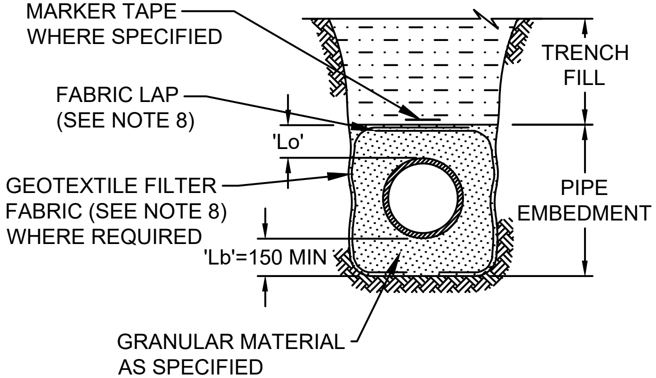


TRENCH IN SAND STRATA



TYPE 3 SUPPORT

FOR FLEXIBLE AND RIGID PIPES (SEE NOTE 3)



TYPE 4 SUPPORT

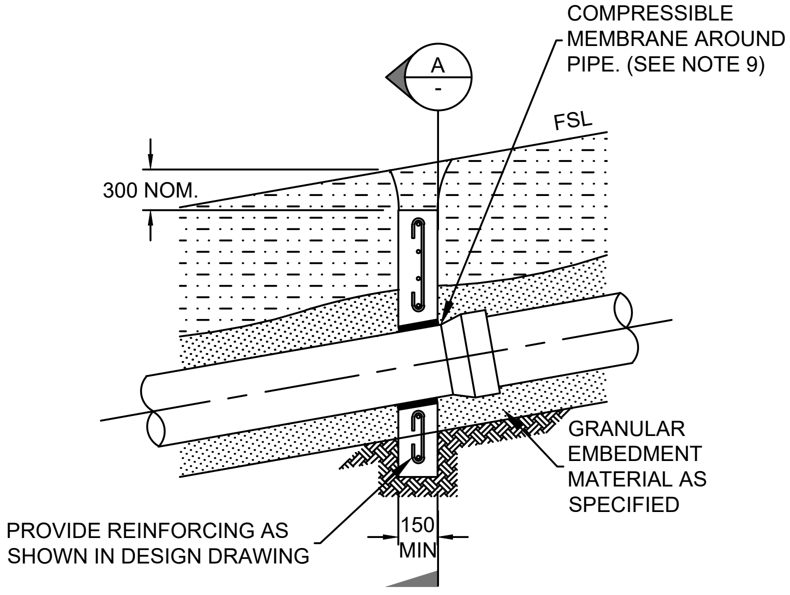
WITH GEOTEXTILE FOR FLEXIBLE
AND RIGID PIPES (SEE NOTE 3)

NOTES:

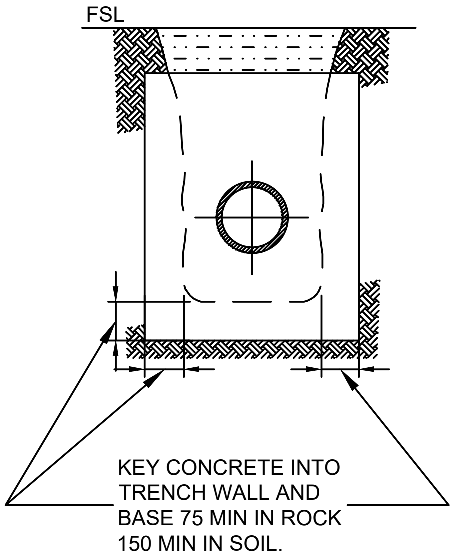
1. ALL DIMENSIONS IN MILLIMETRES.
2. THIS DRAWING TO BE READ IN CONJUNCTION WITH CM - 001.
3. PIPE CLASSIFICATION:
   (a) RIGID PIPES: VC, RC, STEEL AND DI
   (b) FLEXIBLE PIPES: PVC, GRP, AND PE.
4. PLACEMENT OF EMBEDMENT, TRENCHFILL, & COMPACTION TO MEET THE REQUIREMENTS OF DRAWINGS AND SPECIFICATIONS.
5. EXCAVATE OR COMPACT TRENCH FLOOR TO PROVIDE A FLAT FIRM BASE TO SUPPORT BEDDING MATERIAL AND MINIMISE PIPELINE SETTLEMENT. WHEN EXCAVATED, REPLACE WITH GRANULAR MATERIAL AS SPECIFIED FOR BEDDING OR ADOPT TYPE 1, 2, 3, OR 4 SUPPORT AS REQUIRED.
6. ENSURE BEDDING IS DEEP ENOUGH THAT PIPE JOINT PROJECTIONS (SOCKETS, FLANGES) DO NOT TOUCH TRENCH FLOOR -SEE CM-001.
7. TYPE 4 SUPPORT TO BE USED WHERE MIGRATORY NATIVE SOILS (SANDS & CLAYS) ARE ENCOUNTERED ADJACENT TO THE EMBEDMENT ZONE AND SINGLE SIZE AGGREGATE IS USED.
8. GEOTEXTILE OVERLAY IS REQUIRED FOR COARSE AGGREGATE EMBEDMENT > 5mm. LAY GEOTEXTILE FILTER FABRIC AGAINST TRENCH FLOOR AND WALLS SUCH THAT IT FULLY ENCASES THE EMBEDMENT.
   - PRESS FILTER FABRIC INTO THE VOIDS BEFORE INSTALLING EMBEDMENT TO PREVENT FABRIC TEARING.
   - PROVIDE A MINIMUM OF 250 OVERLAP AT ALL FILTER FABRIC JOINTS.
9. IN SOME AREAS LOCAL PRACTICE MAY ALLOW USE OF SELECTED EXCAVATED MATERIAL AS PIPE EMBEDMENT.
10. IN UNSUITABLE GROUND CONDITIONS SPECIFIC DESIGN IS REQUIRED. SEE WSA 03 & WSA 04 DRAWINGS FOR GUIDANCE.
11. CONCRETE PIPES SHOULD BE BASED ON FIGURES 11 - 13 IN AS/NZS 3725.

EMBEDMENT TYPES TO BE SPECIFIED IN DESIGN DRAWINGS

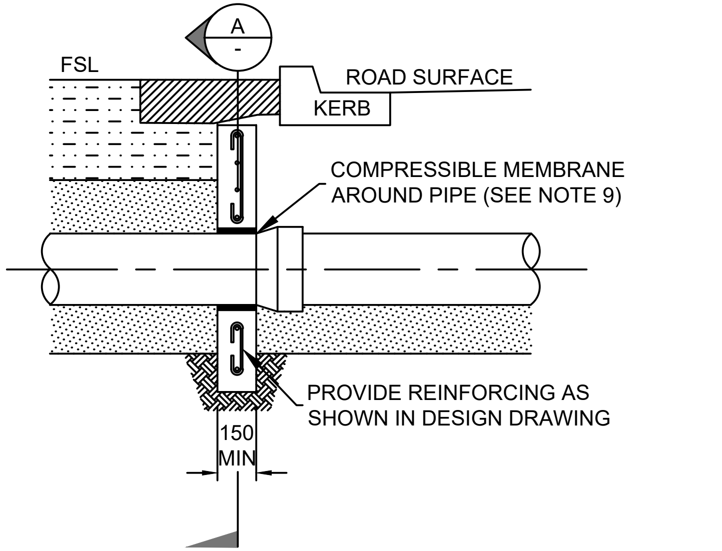
STANDARDS NEW ZEALAND PAEREWA AOTEAROA ORIGINAL SOURCE DRAWINGS: WATER SERVICES ASSOCIATION OF AUSTRALIA	NZS 4404:2010 LAND DEVELOPMENT AND SUBDIVISION INFRASTRUCTURE	NOT TO SCALE
	EMBEDMENT & TRENCHFILL TYPICAL ARRANGEMENT	B7-2



CONCRETE BULKHEAD DETAIL

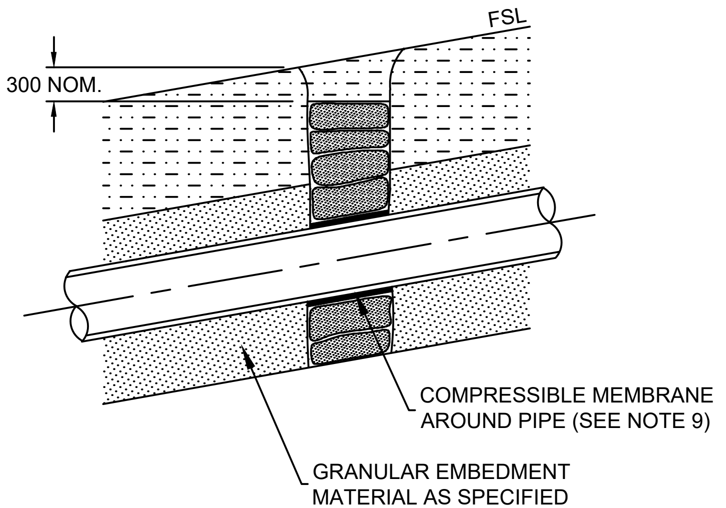


SECTION A

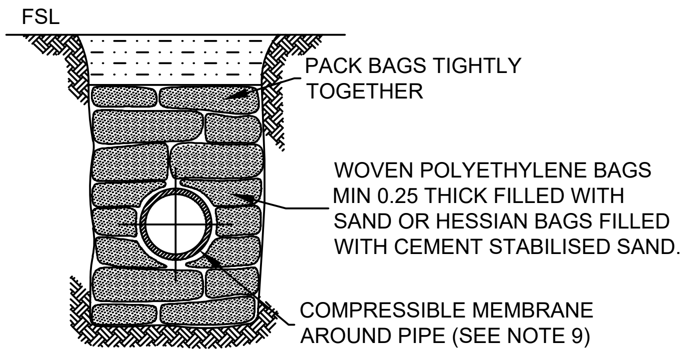


TYPICAL ROAD CROSSING BULKHEAD

NOTES:
1. ALL DIMENSIONS IN MILLIMETRES.
2. CONSTRUCT CONCRETE BULKHEADS AND TRENCH STOPS AT LOCATIONS SPECIFIED IN DESIGN DRAWINGS.
3. CONSTRUCT BULKHEAD ADJACENT TO KERB AND GUTTER SHOULDER OF SEALED ROADS.
4. BULKHEAD AT A RETAINING WALL TO BE UNDER THE WALL.
5. KEY CONCRETE BULKHEADS INTO SIDES AND BOTTOM OF TRENCH AGAINST A BEARING SURFACE OF UNDISTURBED SOIL.
6. CONCRETE TO BE 17.5 MPA.
7. DO NOT DEFORM PIPES DURING PLACEMENT OF CONCRETE OR BAGS.
8. SEAL BAGS TO PREVENT LEAKAGE OF CONTAINED MATERIAL.
9. COMPRESSIBLE MEMBRANE AROUND PIPE TO BE 10 THICK POLYSTYRENE FOR BULKHEADS ADJACENT TO KERBS AND 3 THICK RUBBER FOR BULKHEADS AND TRENCHSTOPS ON SLOPES.
10. FOR SLOPES >35% REFER TO TERRITORIAL AUTHORITY FOR REQUIREMENTS.

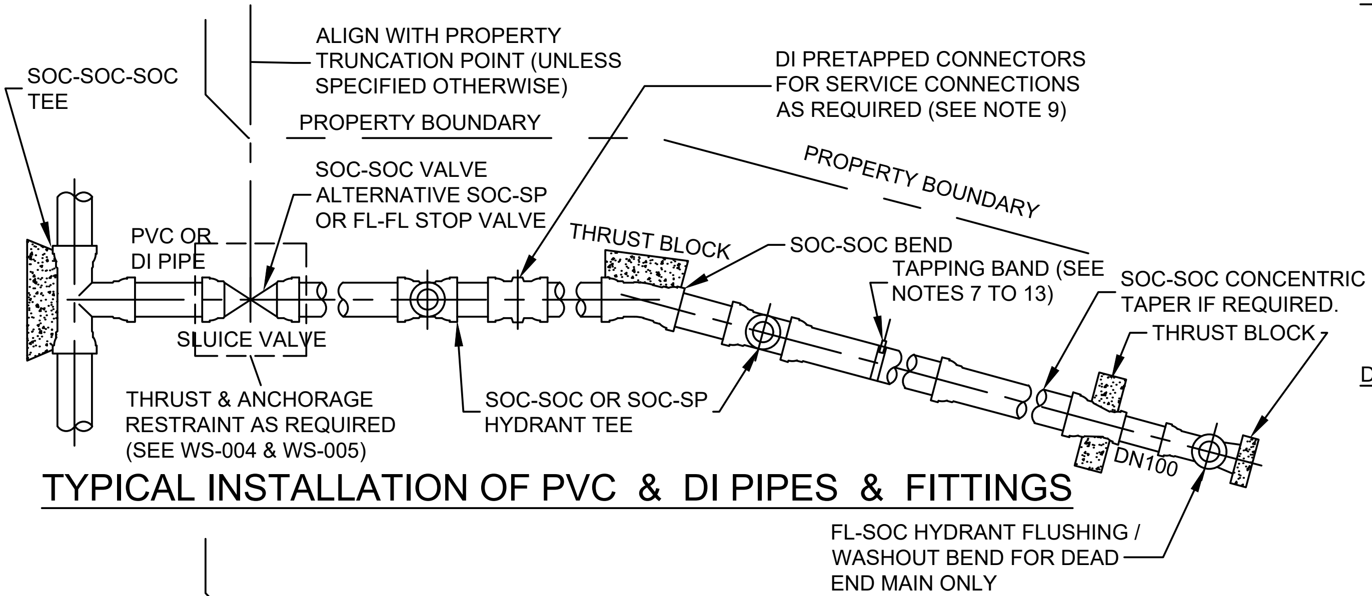


TRENCH STOP DETAIL

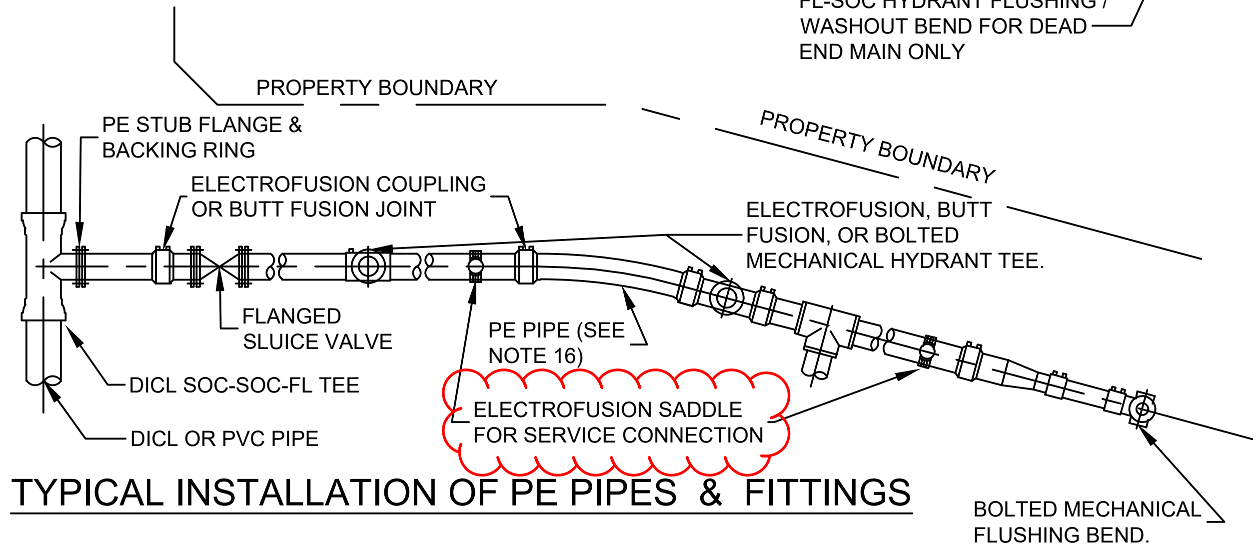


SECTION B

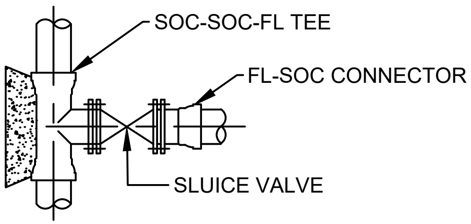
STANDARDS NEW ZEALAND PAEREWA AOTEAROA ORIGINAL SOURCE DRAWINGS: WATER SERVICES ASSOCIATION OF AUSTRALIA	NZS 4404:2010 LAND DEVELOPMENT AND SUBDIVISION INFRASTRUCTURE	NOT TO SCALE
	BULKHEADS & TRENCH STOP STANDARD DETAILS	B7-3



TYPICAL INSTALLATION OF PVC & DI PIPES & FITTINGS



TYPICAL INSTALLATION OF PE PIPES & FITTINGS



TYPICAL VALVE CONNECTION DIRECT TO NEW MAIN

NOTE-

1. ALL DIMENSIONS IN MILLIMETRES.
2. INSTALL PIPEWORK PARALLEL TO PROPERTY BOUNDARIES.
3. STAINLESS STEEL AND NYLON COATED (TO AS/NZS 4158)TAPPING BANDS DO NOT REQUIRE ADDITIONAL CORROSION PROTECTION.
4. WRAP BOLTED CONNECTIONS USING OTHER THAN NYLON COATED FITTINGS AND STAINLESS STEEL BOLTS WITH A PETROLATUM TAPE SYSTEM.
5. WHERE MAINS ARE 300 OR LARGER BYPASSES SHOULD BE INSTALLED FOR ALL MANUAL SLUICE VALVES.
6. ALL VALVES AND FITTINGS SHALL BE COATED WITH A THERMAL BONDED POLYMERIC COATING APPLIED IN ACCORDANCE WITH AS/NZS 4158.

DI & PVC PIPE

7. DUCTILE IRON FITTINGS MAY BE USED WITH DI & PVC PIPE.
8. FITTINGS SHALL BE NYLON COATED AND LINED OR CEMENT LINED WITH A BITUMINOUS EXTERNAL COATING. DO NOT USE PVC FITTINGS WITH DI PIPE.
9. USE PRE TAPPED CONNECTORS ON DN 100 & DN 150 NEW MAIN INSTALLATIONS (UNLESS SPECIFIED OTHERWISE BY THE TERRITORIAL AUTHORITY.
10. USE TAPPING BANDS FOR CONNECTIONS TO EXISTING MAINS AND NEW MAINS >DN 150.
11. ELECTRICALLY ISOLATE COPPER SERVICES FROM DICL PIPE.

PVC PIPE

12. TAPPING BANDS ON PVC PIPE TO BE FULL CIRCLE CLAMPING.
13. WHERE PVC FITTINGS ARE USED, A PROTECTIVE MEMBRANE IS REQUIRED BETWEEN FITTING AND THRUST BLOCK. PVC FITTINGS TO BE USED ONLY ON PVC PIPE. DI SPIGOTS NOT TO BE INSERTED INTO PVC SOCKETS.
14. MAXIMUM SIZE OF DRILLED HOLES FOR SERVICE CONNECTIONS IN PVC PIPE TO BE 30% DN OR 50 (LOWER VALUE TO BE USED) LARGER HOLES CAN BE USED FOR UNDER PRESSURE TAPPING.

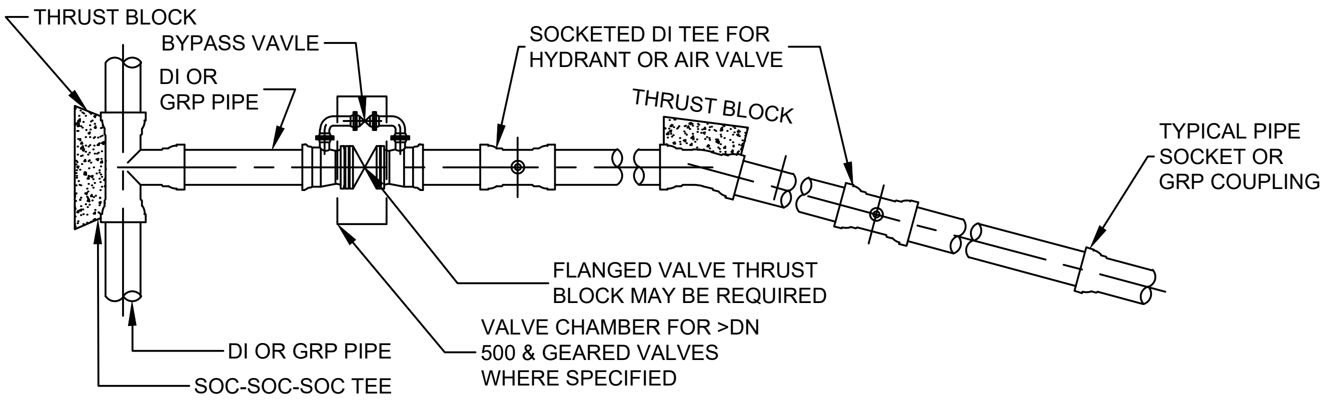
DI PIPE

15. DIRECT TAPPING OF >DN 200 DICL MAY BE AUTHORISED BY TERRITORIAL AUTHORITY.

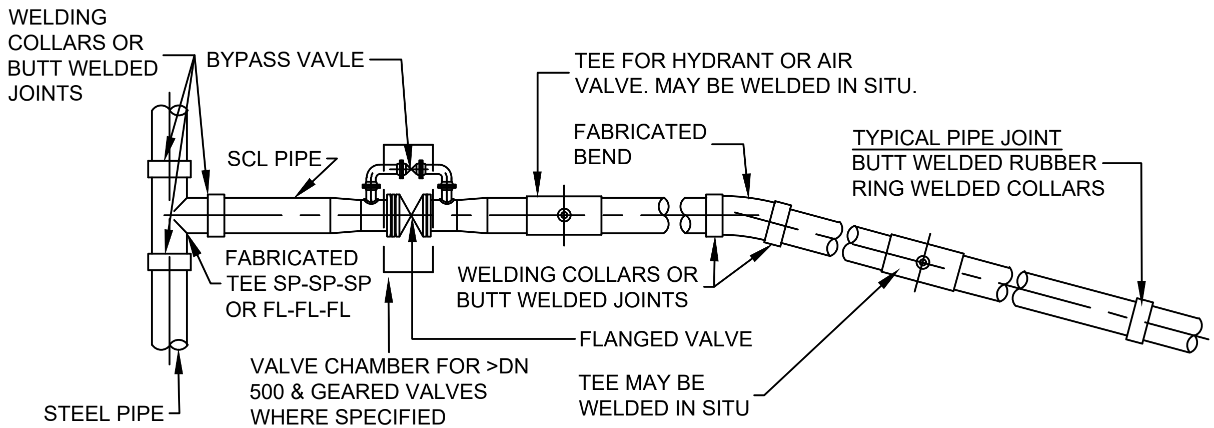
PE PIPE

16. PE PIPE MAY BE COLD BENT TO MINIMUM RADIUS OF 25 X (OD)STAKES OR OTHER SOURCES OF POINT LOADS SHALL NOT BE USED TO ASSIST IN BENDING THE PIPE.
17. MAKE ALLOWANCE DURING CONSTRUCTION FOR EXPANSION AND CONTRACTION OF PE PIPE DUE TO TEMPERATURE CHANGES.
18. BUTT WELDING IN ACCORDANCE WITH WSA-01 (POLYETHYLENE CODE) BUTT WELDING IN TRENCHES IS NOT PERMITTED.
19. ALL MECHANICAL COUPLINGS TO BE SELF-RESTRAINING.

STANDARDS NEW ZEALAND PAEREWA AOTEAROA ORIGINAL SOURCE DRAWINGS: WATER SERVICES ASSOCIATION OF AUSTRALIA	NZS 4404:2010 LAND DEVELOPMENT AND SUBDIVISION INFRASTRUCTURE	NOT TO SCALE
	TYPICAL MAINS CONSTRUCTION - RETICULATION MAIN ARRANGEMENTS	B7-4

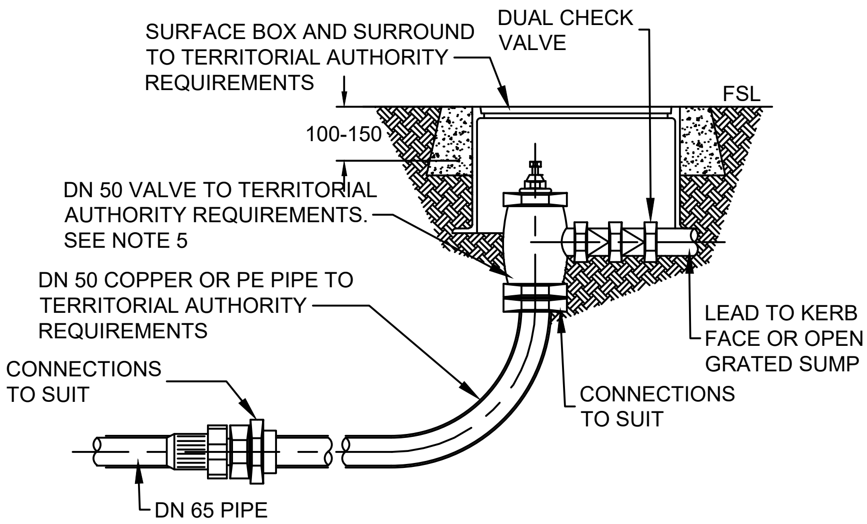


TYPICAL INSTALLATION OF DI AND GRP MAINS



TYPICAL INSTALLATION OF STEEL MAINS

THRUST BLOCKS REQUIRED WHERE NON-RESTRAINING RUBBER RING JOINTS USED



FLUSHING POINT

NOTES:

1. ALL DIMENSIONS IN MILLIMETRES.
2. WHERE POSSIBLE USE A SINGLE LENGTH OF PE PIPE.
3. THRUST BLOCKS TO BE IN ACCORDANCE WITH TERRITORIAL AUTHORITY REQUIREMENTS.
4. PVC PIPE MAY BE USED AS SHROUD PIPE, CUT AS REQUIRED TO CLEAR HYDRANT FLANGE.
5. FIT THE FLUSHING POINT VALVE IN SUCH A WAY AS TO PREVENT MOVEMENT OR ROTATION OF THE VALVE BODY. PROVIDE A SUITABLE PLUG OR CAP TO KEEP OUT DIRT AND GRAVEL.
6. PROVIDE CORROSION PROTECTION FOR ALL NON COATED METALLIC SURFACES IN ACCORDANCE WITH TERRITORIAL AUTHORITY REQUIREMENTS.
7. SERVICE CONNECTIONS NOT PERMITTED ON DISTRIBUTION MAINS WITHOUT TERRITORIAL AUTHORITY APPROVAL.

STANDARDS NEW ZEALAND
PAERENGA AOTEAROA

ORIGINAL SOURCE DRAWINGS: WATER SERVICES ASSOCIATION OF AUSTRALIA

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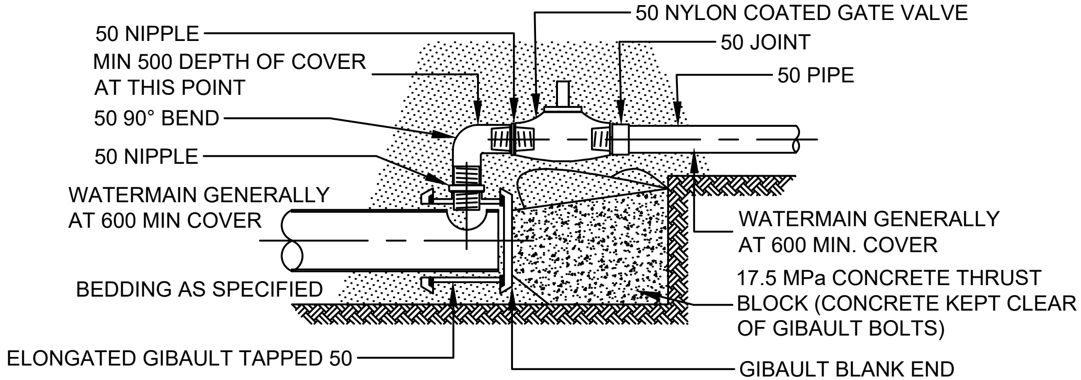
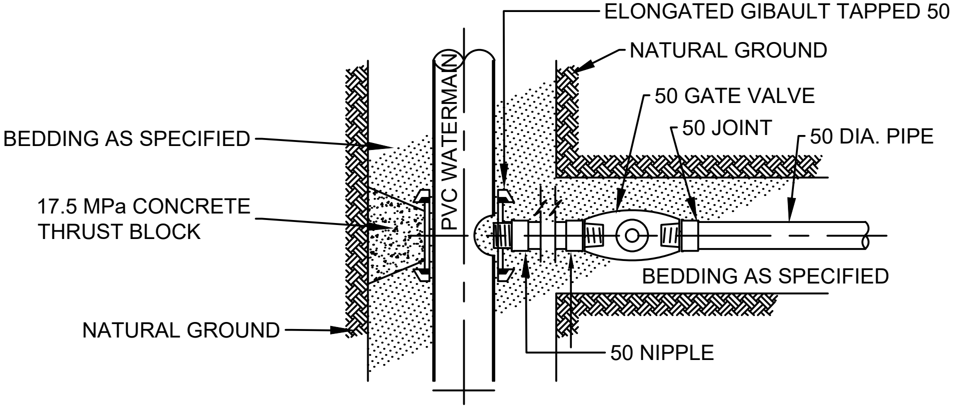
NOT TO SCALE

TYPICAL MAINS CONSTRUCTION - DISTRIBUTION AND TRANSFER MAINS

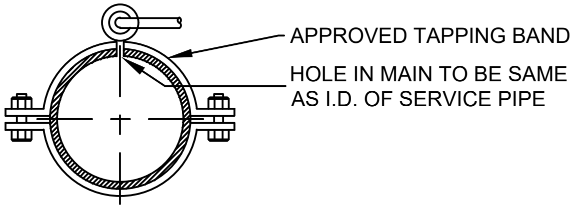
B7-5



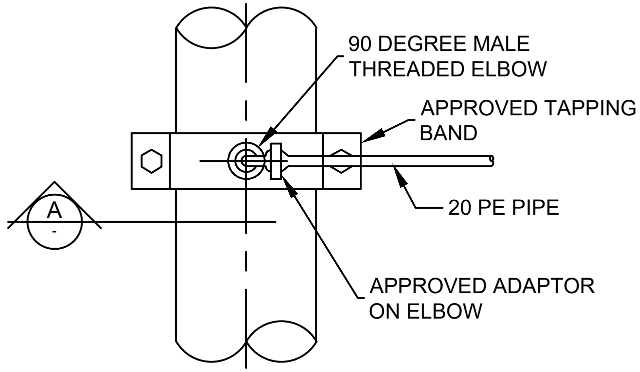
STRAIGHT LINE CONNECTION - METHOD 1 - ELEVATION



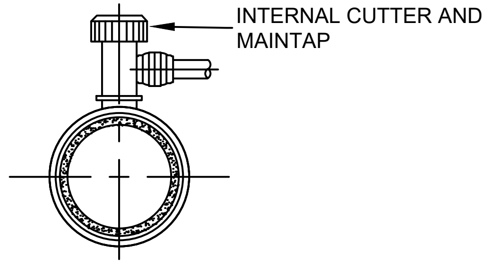
90° CONNECTION - PLAN
RIDER MAIN CONNECTIONS



SECTION A



PLAN
STANDARD TAPPING METHODS



ELECTROFUSION TAPPING SADDLE
PE PIPE

NOTE:
1. ALL DIMENSIONS IN MILLIMETRES.
2. USE METAL GATE VALVE ON 20 CONNECTIONS WHERE REQUIRED BY T.A. OR WHERE SHUTTING DOWN MAIN TO REPAIR SERVICE WOULD CAUSE SIGNIFICANT INTERRUPTION TO SUPPLY.
3. USE PROPRIETARY IN LINE METAL VALVES APPROVED BY T.A. WHEN MAIN IS TAPPED UNDER PRESSURE.
4. WHERE POSSIBLE, LAY SERVICE CONNECTIONS AND RIDER CONNECTIONS TO PRINCIPAL MAIN. WHERE NOT POSSIBLE INSTALL METALLIC TAPE ON TOP OF CONNECTION.
5. RIDER MAINS AND SERVICE CONNECTIONS TO PRINCIPAL MAIN USE ELONGATED GIBAULT, PROPRIETARY TEE (RIDER MAIN ONLY) OR APPROVED PROPRIETARY TAPPING BANDS.

STANDARDS NEW ZEALAND PAEREWA AOTEAROA ORIGINAL SOURCE DRAWINGS: WATER SERVICES ASSOCIATION OF AUSTRALIA	NZS 4404:2010 LAND DEVELOPMENT AND SUBDIVISION INFRASTRUCTURE	NOT TO SCALE
	PROPERTY SERVICES - CONNECTION TO AN EXISTING PVC MAIN	B7-6

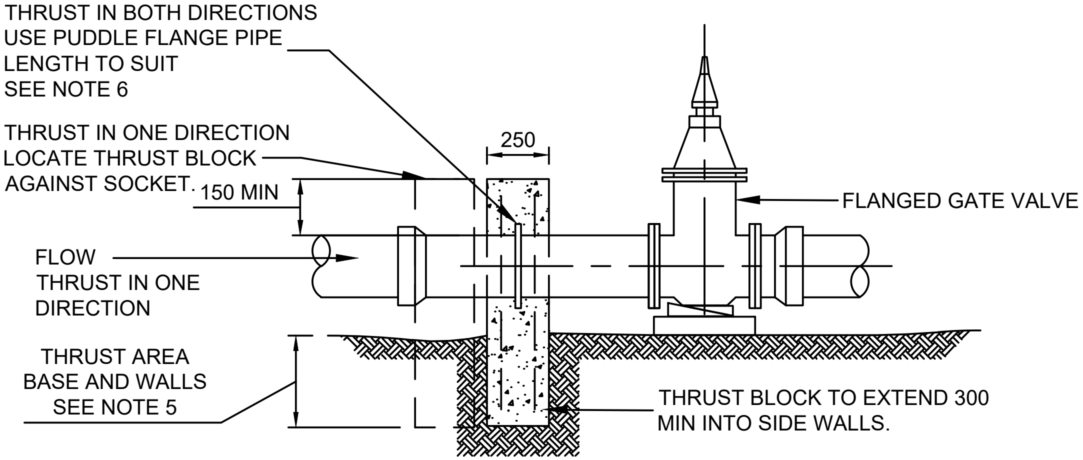
MINIMUM BLOCK VOLUME FOR ANCHORAGE

VERTICAL BENDS
FOR TEST PRESSURE OF 1000kPa (SEE NOTE 2)

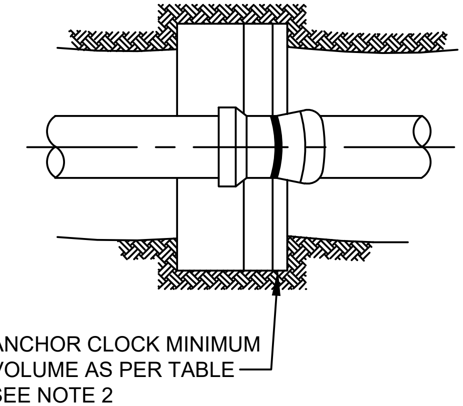
PIPE DN	CONCRETE VOLUME M^3		
	11.25° BEND	22.25° BEND	45° BEND
100	N	N	0.3
150	N	0.3	0.6
200	0.2	0.5	1.1
225	0.3	0.6	1.4
250	0.3	0.7	2.5
300	0.4	1.1	3.8
375	0.7	1.8	5.8
450	DETAILED DESIGN REQUIRED (ALTERNATIVE METHODS TO BE CONSIDERED)		
500			
600			
750			

'N' - NO ADDITIONAL RESTRAINT REQUIRED (COMPACTED TRENCHFILL SUFFICIENT)

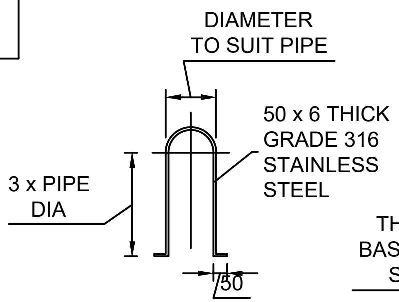
ANCHOR BLOCK CONSTRUCTION NOTES:
- LOCATE ANCHOR BLOCK CENTRALLY AROUND BEND.
- KEY ANCHOR BLOCK INTO BASE OF TRENCH A MINIMUM DEPTH OF 250.
- POUR CONCRETE AGAINST A SOLID EXCAVATION FACE.
- USE GRADE 17.5 MPa CONCRETE.
- KEEP CONCRETE CLEAR OF ALL BOLTS, NUTS, AND PIPE JOINTS.



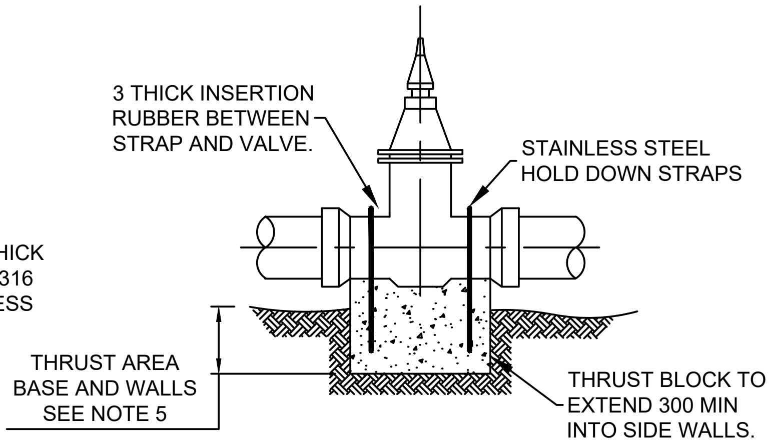
FLANGED VALVES



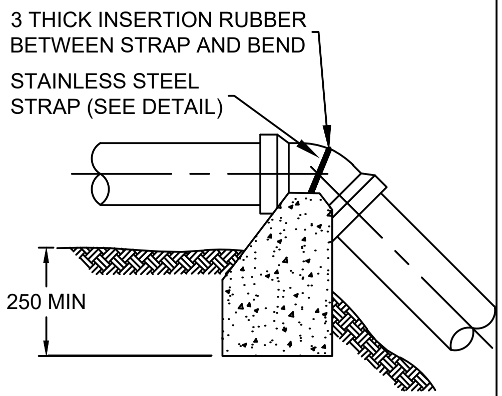
PLAN



TYPICAL SS STRAP



SOCKETED VALVES



ELEVATION
VERTICAL BENDS

NOTE:
1. ALL DIMENSIONS IN MILLIMETRES, UNLESS SHOWN OTHERWISE.
2. ANCHOR BLOCKS IN THE TABLE ARE DESIGNED FOR A TEST PRESSURE OF 1000 kPa (100 m HEAD)ADJUST CONCRETE VOLUME TO SUIT ACTUAL TEST PRESSURE.
3. WHERE DI PIPES AND FITTINGS WITH RESTRAINED JOINTS ARE USED THRUST BLOCKS ARE NOT REQUIRED.
4. THRUST BLOCK REINFORCEMENT AS SPECIFIED IN DESIGN DRAWINGS.
5. WHERE SPECIFIED PROVIDE CONCRETE THRUST BLOCKS FOR SOC-SOC VALVES. THRUST AREA TO BE AS FOR DEAD ENDS AS SHOWN IN WS-004.
6. INSTALL PUDDLE FLANGES ON CLASS K12 DICL PIPE.

STANDARDS NEW ZEALAND PAEREWA AOTEAROA
ORIGINAL SOURCE DRAWINGS: WATER SERVICES ASSOCIATION OF AUSTRALIA

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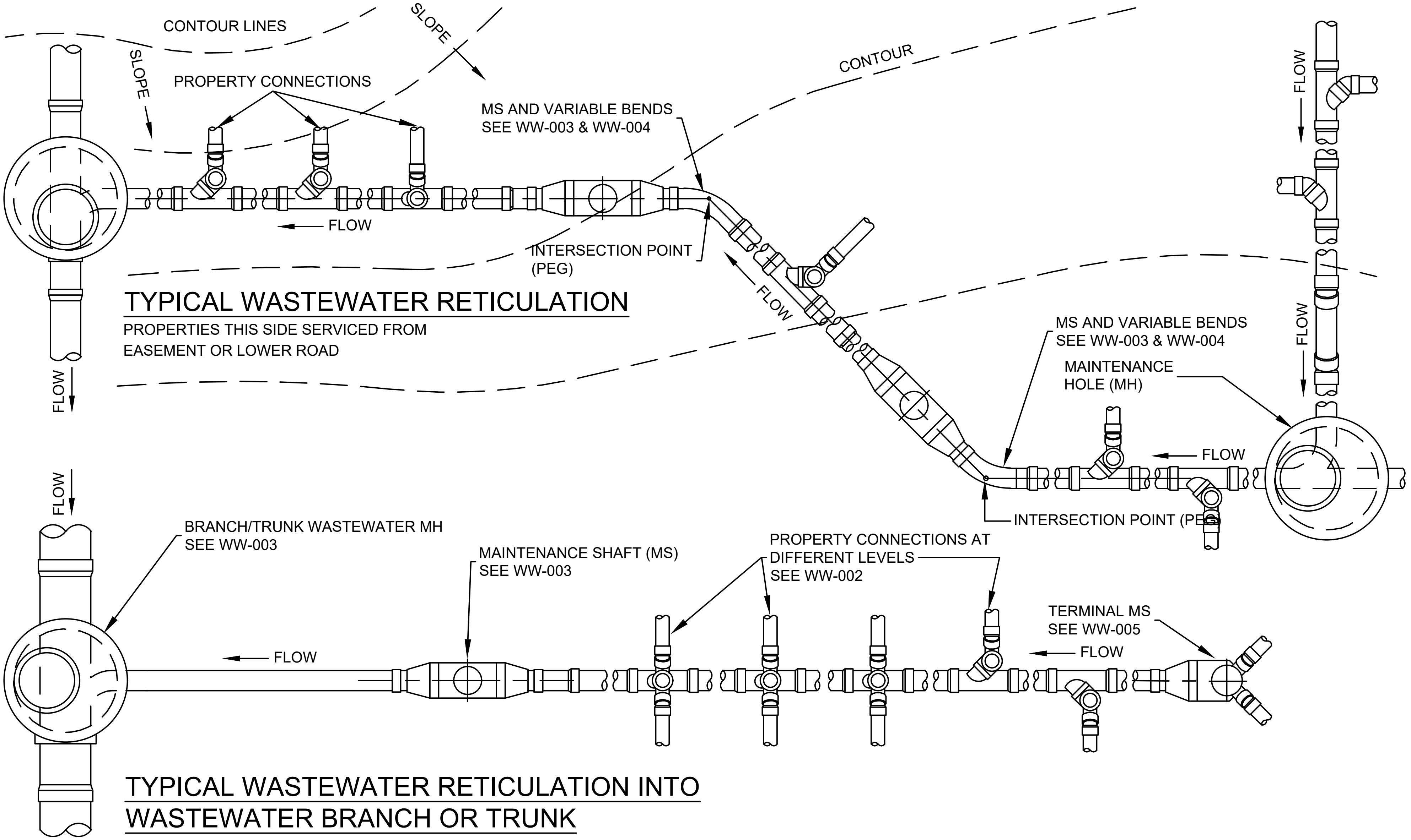
LAND DEVELOPMENT AND SUBDIVISION INFRASTRUCTURE

THRUST AND ANCHOR BLOCKS - GATE VALVES AND VERTICAL BENDS IF REQUIRED

NOT TO SCALE

B7-7



TYPICAL WASTEWATER RETICULATION

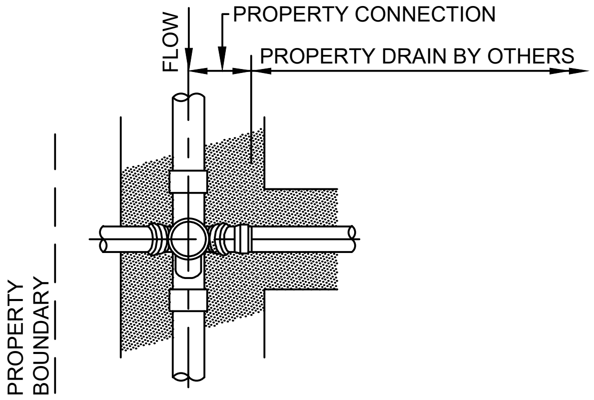
PROPERTIES THIS SIDE SERVICED FROM
EASEMENT OR LOWER ROAD

TYPICAL WASTEWATER RETICULATION INTO WASTEWATER BRANCH OR TRUNK

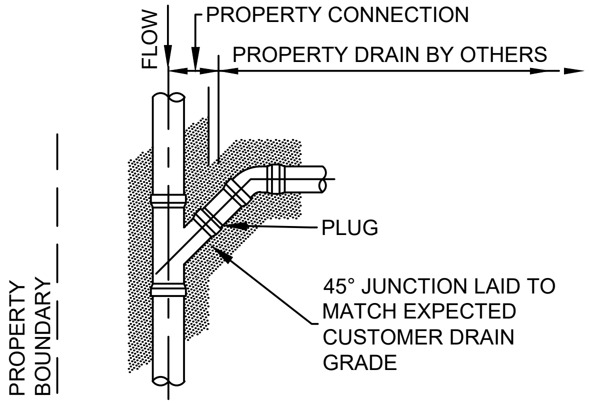
NOTE:

1. GRADE WASTEWATER EVENLY BETWEEN MH/MS TO LEVELS SHOWN IN DESIGN DRAWINGS.
2. LAY PIPES AND FITTINGS WITH SOCKETS UPSTREAM WHEREVER PRACTICABLE.

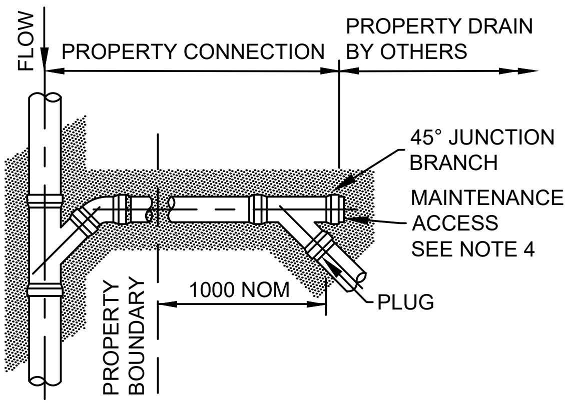
STANDARDS NEW ZEALAND PAEREWA AOTEAROA ORIGINAL SOURCE DRAWINGS: WATER SERVICES ASSOCIATION OF AUSTRALIA	NZS 4404:2010 LAND DEVELOPMENT AND SUBDIVISION INFRASTRUCTURE	NOT TO SCALE
	PIPELAYING - TYPICAL ARRANGEMENTS	B7-8



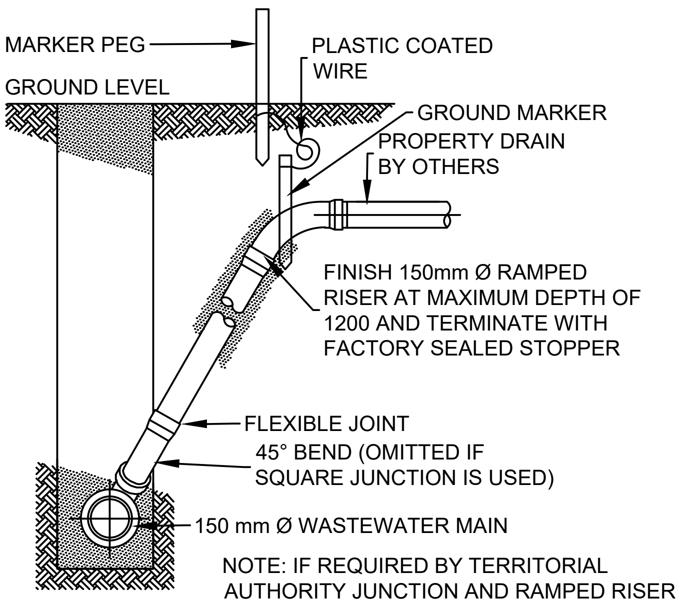
PLAN
WASTEWATER WITHIN PROPERTY



PLAN
WASTEWATER WITHIN PROPERTY

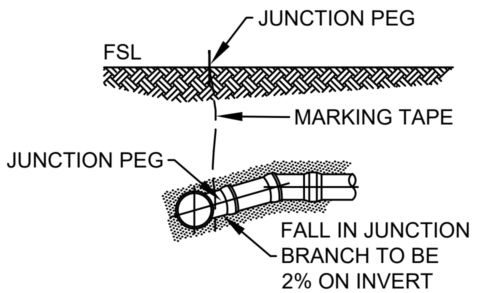


PLAN
WASTEWATER WITHIN PROPERTY

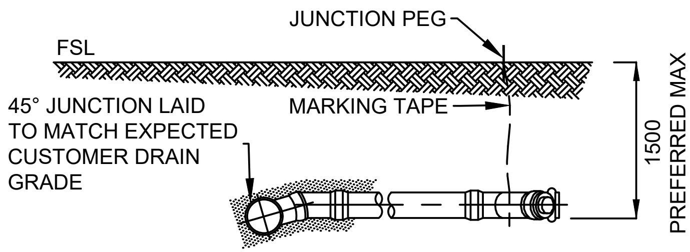


NOTE: IF REQUIRED BY TERRITORIAL AUTHORITY JUNCTION AND RAMPED RISER TO BE SURROUNDED BY MIN 150 mm THICKNESS OF 17.5 MPa CONCRETE DISCONTINUOUS AT PIPE JOINTS.

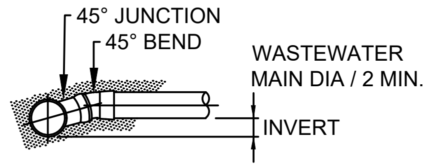
ELEVATION
Y JUNCTION RAMPED RISERS



ELEVATION
STANDARD CONNECTION



ELEVATION
EXTENDED CONNECTION
MAY ALSO BE INSTALLED AS A SLOPED CONNECTION



MINIMUM LEVEL
STANDARD CONNECTION

NOTE:
1. ALL DIMENSIONS IN MILLIMETRES.
2. ALL CONNECTION TYPES SHOWN IN THIS DRAWING ARE APPLICABLE TO VC, PVC.
3. LAY PROPERTY DRAIN CONNECTION AT DEPTH AS SHOWN IN DESIGN DRAWINGS.
4. PROVIDE RODDING POINTS WHERE REQUIRED BY TERRITORIAL AUTHORITY.
5. GRADE OF PROPERTY CONNECTION WASTEWATER PIPE TO BE NOT LESS THAN: DN 100 1.65%
DN 150 1.2%

STANDARDS NEW ZEALAND PAEREWA AOTEAROA

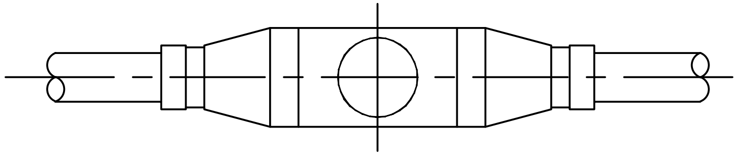
ORIGINAL SOURCE DRAWINGS: WATER SERVICES ASSOCIATION OF AUSTRALIA

NZS 4404:2010
LAND DEVELOPMENT AND SUBDIVISION INFRASTRUCTURE

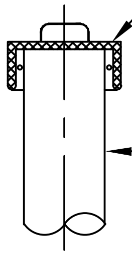
NOT TO SCALE

PROPERTY CONNECTION - BURIED INTERFACE METHOD

B7-9



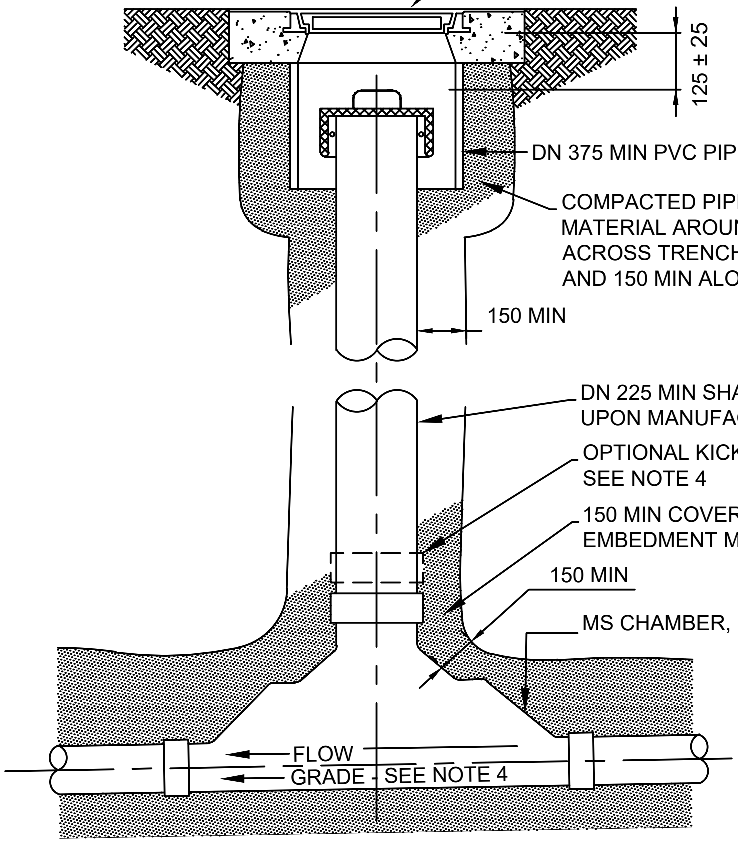
PLAN



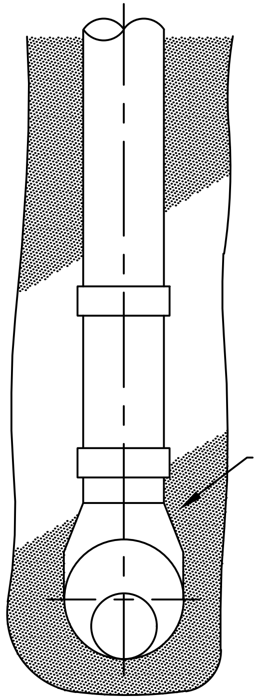
RISER SHAFT CAP

NOTE:

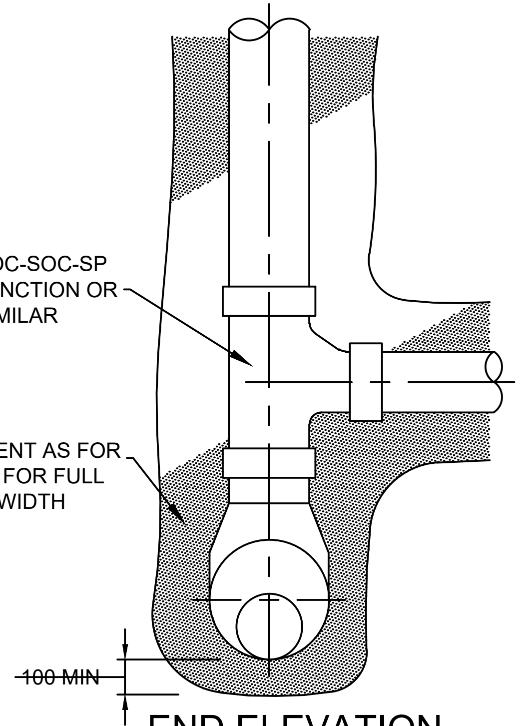
1. ALL DIMENSIONS IN MILLIMETRES.
2. MS MAY BE MANUFACTURED USING VARIOUS MATERIALS AND JOINTING SYSTEMS AS AUTHORISED BY TERRITORIAL AUTHORITY.
3. MAXIMUM DEPTH TO INVERT 3000.
4. ADJUST MS TO PIPE GRADE BY TILTING MS CHAMBER. MAX DEVIATION FROM VERTICAL OF THE RISER TO BE 1:10 OR A MAXIMUM OF 300 AT SURFACE. USE KICKER BEND IF REQUIRED TO ADJUST RISER TO VERTICAL.
5. ACCESS COVER, FRAME, AND SUPPORT SLAB TO BE AS AUTHORISED BY TERRITORIAL AUTHORITY.



END ELEVATION MAINTENANCE SHAFT



END ELEVATION PLAIN RISER SHAFT



END ELEVATION DROP JUNCTION

STANDARDS NEW ZEALAND PAEREWA AOTEAROA

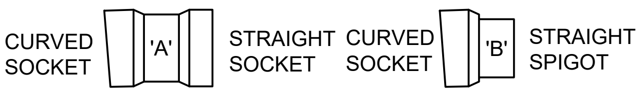
ORIGINAL SOURCE DRAWINGS: WATER SERVICES ASSOCIATION OF AUSTRALIA

NZS 4404:2010
LAND DEVELOPMENT AND SUBDIVISION INFRASTRUCTURE

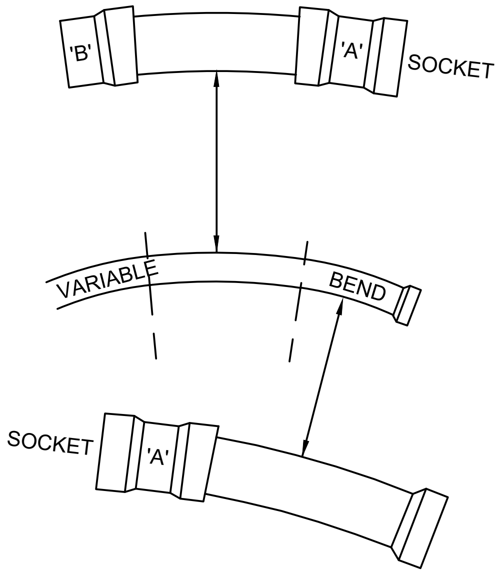
NOT TO SCALE

MAINTENANCE SHAFTS - TYPICAL INSTALLATION

B7-10

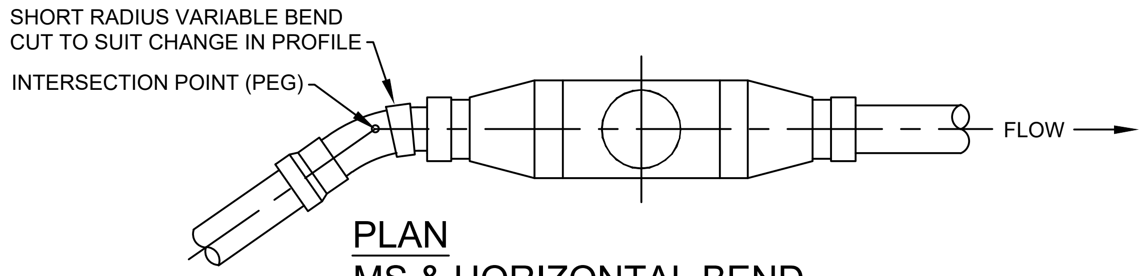


LEGEND

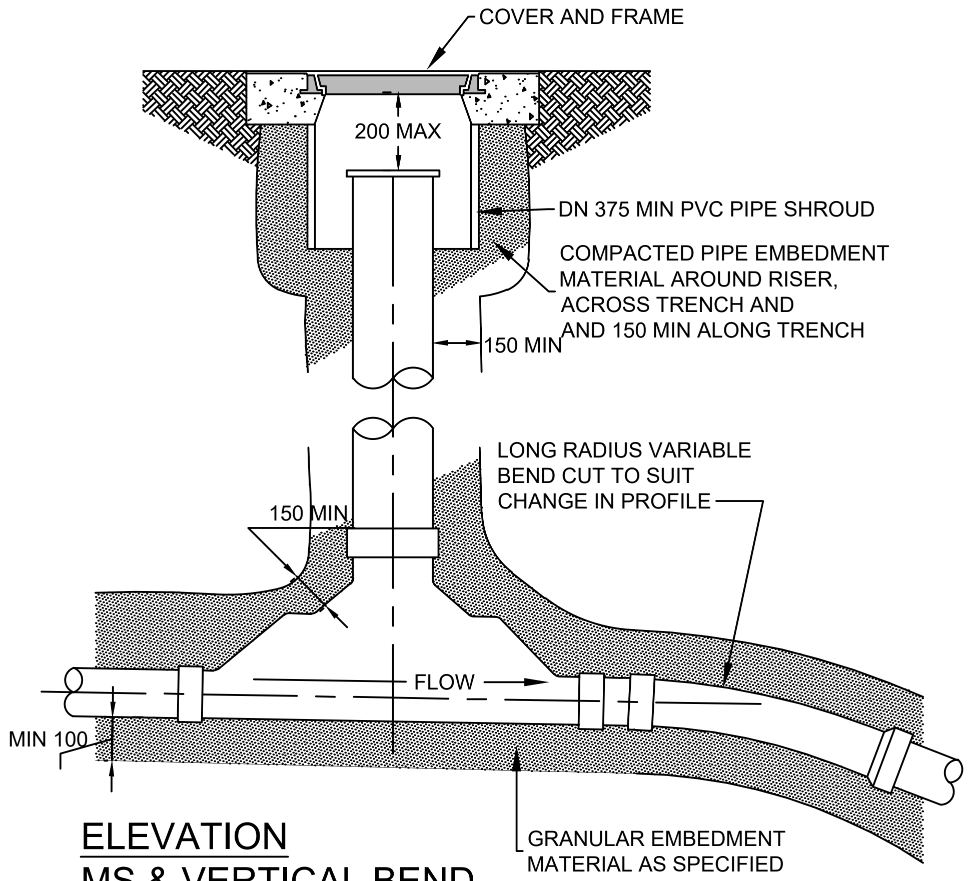


TYPICAL VARIABLE BENDS

ALL COMBINATIONS OF ENDS ACCEPTED



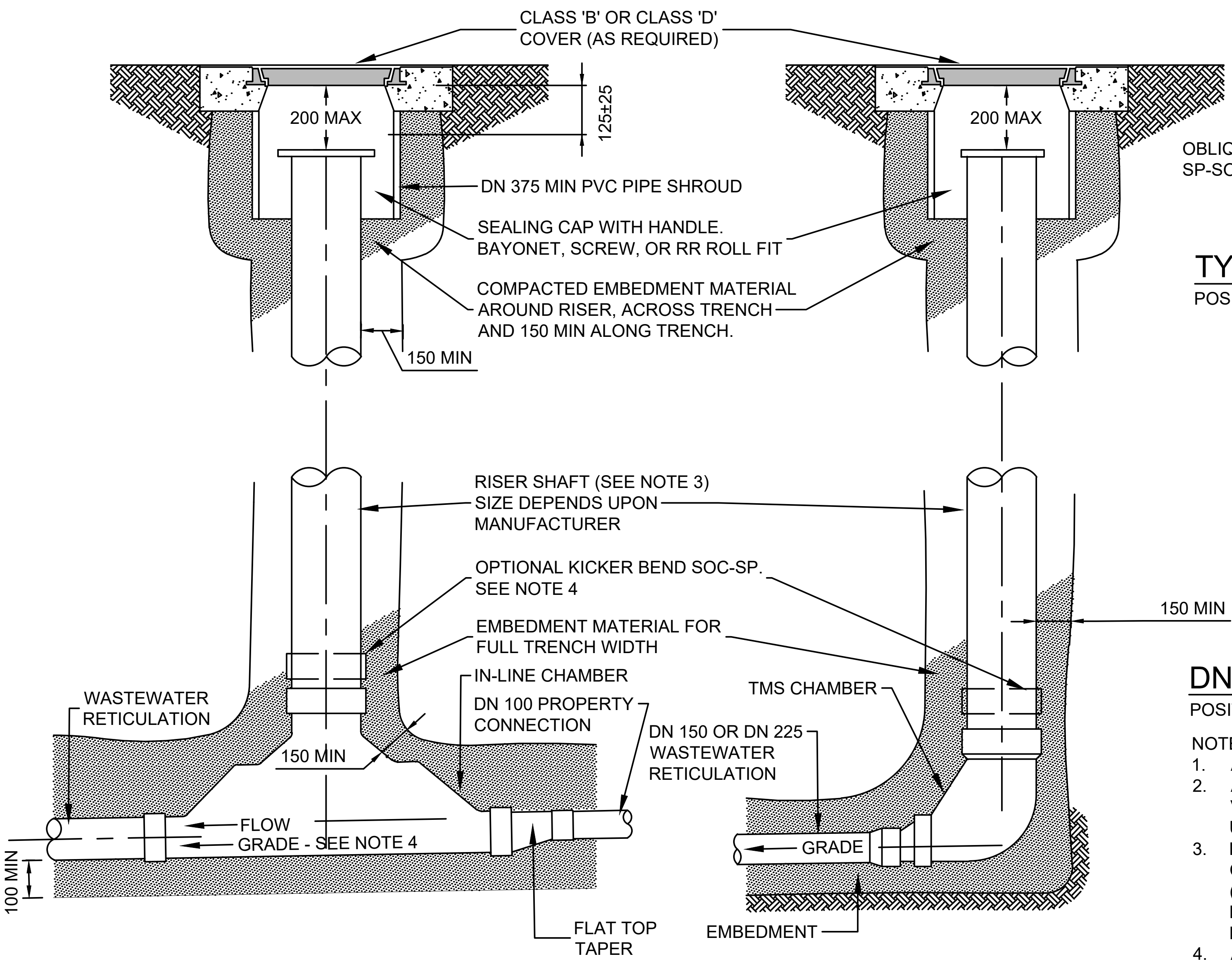
PLAN
MS & HORIZONTAL BEND



ELEVATION
MS & VERTICAL BEND

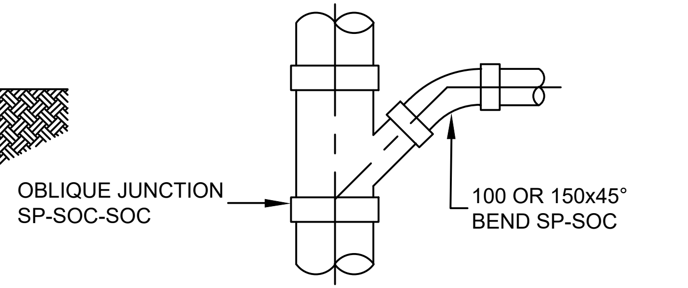
NOTE:
1. ALL DIMENSIONS IN MILLIMETRES.
2. VARIABLE BEND CUT TO LENGTH TO ACHIEVE REQUIRED DEFLECTION.
3. RECORD DETAILS OF BEND LOCATIONS AND ANGLES ON WORK AS CONSTRUCTED DRAWINGS.

STANDARDS NEW ZEALAND PAEREWA AOTEAROA ORIGINAL SOURCE DRAWINGS: WATER SERVICES ASSOCIATION OF AUSTRALIA	NZS 4404:2010 LAND DEVELOPMENT AND SUBDIVISION INFRASTRUCTURE	NOT TO SCALE
	MAINTENANCE SHAFTS - MS AND VARIABLE BEND INSTALLATIONS	B7-11



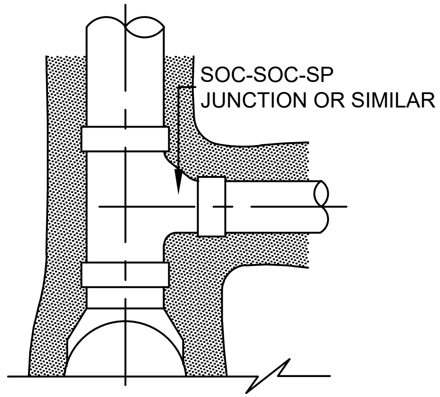
ELEVATION
TERMINAL MAINTENANCE SHAFT WITH PROPERTY CONNECTION AHEAD

ELEVATION
TERMINAL MAINTENANCE SHAFT



TYPICAL PROPERTY CONNECTIONS

POSITIONED IN RISER AS SPECIFIED



DN 150 RETICULATION INLETS

POSITIONED IN RISER AS SPECIFIED

NOTE:

1. ALL DIMENSIONS IN MILLIMETRES.
2. ALL CONNECTION TYPES SHOWN ARE APPLICABLE TO VC, PVC (SOLVENT WELD) AND PVC (RUBBER RING) PIPES UNLESS OTHERWISE SHOWN.
3. INSTALL BRANCH CONNECTIONS AND PROPERTY CONNECTIONS (AS SHOWN ABOVE) IN RISER SHAFT (DROP JUNCTIONS) WHERE SHOWN IN DESIGN DRAWINGS. MAXIMUM OF 1 RETICULATION INLET OR 2 PROPERTY CONNECTIONS.
4. ADJUST MS TO PIPE GRADE BY TILTING CHAMBER. MAX DEVIATION FROM VERTICAL OF THE RISER TO BE 1:10 OR A MAXIMUM OF 300 AT SURFACE. USE KICKER BEND IF REQUIRED TO ADJUST RISER TO VERTICAL.

STANDARDS NEW ZEALAND PAEREWA AOTEAROA ORIGINAL SOURCE DRAWINGS: WATER SERVICES ASSOCIATION OF AUSTRALIA	NZS 4404:2010 LAND DEVELOPMENT AND SUBDIVISION INFRASTRUCTURE	NOT TO SCALE
	MAINTENANCE SHAFTS - TMS AND CONNECTION INSTALLATION	B7-12

QUEENSTOWN LAKES DISTRICT COUNCIL

CONTENTS

1 PURPOSE

The purpose of this procedure is to:

> To verify the quality of worksmanship and materials used in the construction of Council infrastructure, demonstrating compliance with the Queenstown Lakes District Council (QLDC) Land Development and Subdivision Code of Practise, relevant AS/NZS standards, and industry best practice;

> For pressure pipes, provide confirmation that the pipeline is able to sustain a pressure greater than the design pressure without leakage;

> For non-pressure pipes and manholes, provide confirmation that the installation does not exceed allowable rates of infiltration/exfiltration;

> Provide confidence in the pipeline's structural integrity.

2 SCOPE

The scope of this procedure is to identify the appropriate test methodologies for different pipe and installation types for the purpose of confirming acceptability.

Disinfection protocols associated with water mains are covered in the QLDC Code of Practice Appendix D.

3 ROLES AND RESPONSIBILITIES

All contractors working on the Council network, or involved in the construction of infrastructure that will be vested to Council, must adhere to the requirements of the QLDC Land Development and Subdivision Code of Practice.

Only QLDC Approved Contractors shall undertake work on the network. Contractors shall ensure that appropriately trained and competent personnel are present to supervise all field testing activities.

Contractors shall be responsible for maintaining test equipment in good condition, and ensuring that any calibrations and safety certifications are current.

QLDC may audit the testing practices at their discretion to validate that the requirements of this document is being followed.

4 PIPELINE TESTING – NON-PRESSURE PIPES

Leakage testing is used to reveal locations of potential infiltration and exfiltration due to the inclusion of damaged pipes, seals, or incorrectly made joints in the pipeline at the completion of installation.

Leakage testing for acceptance of non-pressure pipelines shall be carried out by at least one of the following methods:

a) Low pressure air testing;
b) Hydrostatic testing

For pipeline test sections installed below the water table, and for submarine pipelines, the test pressure used for the hydrostatic test, and for the air test, shall be increased to maintain the required differential between internal and external pressure.

A pipeline failing to meet the requirements of the air tests may be retested using the hydrostatic test method.

4.1 LOW PRESSURE AIR TEST – PLASTIC PIPES

The test length shall be acceptable where the gauged pressure exceeds 18 kPa (or not more than 7 kPa less than the pressure at the start of the test) for the time interval shown in Table 1 after the shut-off of the air supply.

Table 1 is based on an air test pressure of 25 kPa (in excess of any external hydrostatic pressure due to groundwater) and, on this basis, air volume losses shall not exceed the greater of:

a) A rate of 0.0009 m3/(min x m2) of pipe wall area; and
b) A rate of 0.056 m3 /min, which is regarded as the lowest detectable individual air leak.

Column 2 and column 3 of Table 1 give the times and lengths up to which (b) prevails over (a).

In the case of concrete pipelines, it is recommended that pipelines be water soaked for a period of 24 hours prior to the air testing.

For safety reasons air test pressures in excess of 50 kPa should not be applied.

Table 1 Low pressure air and vacuum tests – Minimum time intervals for 7 kPa pressure change in pipline

DN	Minimum time (minutes)	Maximum length for minimum time to apply (metres)	Test length (metres)				
			50	100	150	200	250
			Minimum test duration (minutes)				
80	1.5	231	1.5	1.5	1.5	1.5	1.6
100	2	185	2	2	2	2	3
150	3	123	3	3	3	5	6
225	4	82	4	5	8	10	13
300	6	62	6	9	14	18	23
375	7	49	7	14	22	29	36
450	9	41	10	21	31	41	52
525	10	35	14	28	42	56	70
600	11	31	18	37	55	73	92
675	13	27	23	46	70	93	116
750	14	25	29	57	86	115	143
900	17	21	41	83	124	165	207
1000	19	19	51	102	153	204	255
1050	20	18.8	56	112	169	225	281
1200	23	15	73	147	220	294	367
1500	28	12	115	230	344	459	574

NOTE –

The time interval may be reduced for a proportionate reduction in the allowable pressure drop. Where there is no detectable change in pressure after 1 hour of testing, the section under test shall be deemed acceptable.

This table is based on the following equation:

$T = 1.02 D_i k L q$

where

T = time for a 7 kPa pressure drop, in seconds

D_i = pipeline internal diameter, in metres

q = allowable volume loss in cubic metre/minute/square metre taken as 0.0009 $m^3/min.m^2$

$k = 0.054DL$ but not less than 1

L = length of test section, in metres.

Columns 2 and 3 have been calculated with $k = 1.0$.

The appropriate air or vacuum test/pressure method for pipes larger than DN 750 should be established by reference to the specifier.

4.1.1 Low Pressure Air Test Procedure

The procedure shall be as follows:

(a) Pump in air slowly until a pressure of 25 +5,−0 kPa is reached. Where the pipeline is below the water table this pressure shall be increased to achieve a differential pressure of 25 kPa. In no circumstances should the actual pressure exceed 50 kPa;

NOTE – Rapid pressurisation may cause significant air temperature changes, which will effect the testing accuracy.

(b) Maintain the pressure for at least 3.0 minutes;

(c) Where no leaks are detected, shut off the air supply;

(d) Where the pipeline fails the test, repressurise to 25 +5,−0 kPa and check for leaks by pouring a concentrated solution of soft soap and water over accessible joints and fittings;

(e) Repair any defects, then repeat steps (a) to (c);

(f) With the air supply shut off, monitor the pressure for the time intervals given in table 1. The test length shall be acceptable where the pressure drops by 7 kPa, or less, over the required (tabulated) test period.

NOTE

1. The test length of pipeline should be restricted to pipeline sections between maintenance holes (the most convenient places for inserting test plugs or fixing temporary bulkheads). The method should not be used for test lengths in excess of 250 m and for pipe diameters larger than 1500 mm.
2. The procedure for low pressure air testing of large diameter pipelines is potentially hazardous because of the very large forces to be resisted by temporary plugs or bulkheads and the serious consequences of accidental bulkhead blow-out. A relief valve, with a 50 kPa maximum setting, should be installed on all pressurising equipment.

4.2 LOW PRESSURE AIR TEST – CONCRETE PIPES

Concrete pipelines shall be tested in accordance with the CPAA Performance Testing of Non-Pressure Concrete Stormwater Pipes publication. The low-pressure air test can provide the criteria for acceptance of a pipeline but not for its rejection. The low-pressure air test shall be used for testing each pipe. If a length fails, the Contractor shall use a hydrostatic test. The following excerpts are from the CPAA publication.

The test is deemed acceptable where the gauged pressure drops from 10 kPa to 8 kPa in a time interval not exceeding that given in Table 22 after the shut-off of the air supply.

It is recommended that pipelines be water soaked for a period of 24 hours prior to the air testing.

Table 2 : Low pressure air tests minimum holding times at average 9 kPa pressure in pipeline (mins – secs)

DN	*Length of Test Section (metres)*									
	10	*20*	*30*	*40*	*50*	*60*	*70*	*80*	*90*	*100*
225	*0:11*	*0:22*	*0:33*	*0:44*	*0:55*	*1:06*	*1:17*	*1:28*	*1:38*	*1:41*
300	*0:19*	*0:39*	*0:58*	*1:18*	*1:37*	*1:57*	*2:14*	*2:14*	*2:14*	*2:14*
375	*0:31*	*1:01*	*1:31*	*2:02*	*2:32*	*2:50*	*2:50*	*2:50*	*3:12*	*3:33*
450	*0:44*	*1:28*	*2:11*	*2:55*	*3:22*	*3:22*	*3:22*	*4:06*	*4:36*	*5:07*
525	*1:00*	*1:59*	*2:59*	*3:55*	*3:55*	*4:11*	*4:53*	*5:34*	*6:16*	*6:58*
600	*1:18*	*2:35*	*3:53*	*4:29*	*4:29*	*5:28*	*6:22*	*7:17*	*8:11*	*9:06*

4.2.1 Low Pressure Air Test Procedure

The procedure shall be as follows:

(a) Pump in air slowly until a pressure just over 10 kPa is reached. Regulate the air supply to maintain pressure between 10 and 11 kPa, whilst check all plugs and fitting with soap solution to ensure there is no leakage. Where the pipeline is below the water table this pressure shall be increased to achieve a differential pressure of 10 kPa. In no circumstances should the actual pressure exceed 20 kPa;

NOTE – Rapid pressurisation may cause significant air temperature changes, which will affect the testing accuracy.

(b) Maintain the pressure for at least 15 minutes to allow air temperature to stabilise with the pipe walls;

(c) After stabilisation period, ensure pressure is at least 10 kPa before shutting off the air supply;

(d) Commence timing as pressure falls to 10kPa and measure time taken for pressure to drop by 2 kPa to 8 kPa;

(e) For the pipeline to pass, the time measured must be less than that given in Table 8 for the length and diameter of the pipe;

(f) Where the pipeline fails the test, either repeat after resoaking the pipe for 24 hours, or undertake a hydrostatic test instead.

NOTE

1. The method should not be used for test lengths exceeding 100 m and for pipe diameters larger than 600 mm.
2. The procedure for low pressure air testing of large diameter pipelines is potentially hazardous because of the very large forces to be resisted by temporary plugs or bulkheads and the serious consequences of accidental bulkhead blow-out. A hydrostatic test should be used instead.

4.3 HYDROSTATIC TEST

The test length shall be acceptable where the specified allowable make up water is not exceeded. Where not specified, the allowable make up water shall be 0.5 L/hour per metre length per metre diameter.

4.3.1 Hydrostatic Test Procedure

The procedure shall be as follows:

(a) The test pressure shall be not less than 20 kPa, or 20 kPa above the groundwater pressure at the pipe soffit at its highest point, whichever is the greater, and not exceed 60 kPa at the lowest point of the section;

(b) Steeply graded pipelines shall be tested in stages where the maximum pressure, as stated above, will be exceeded if the whole section is tested in one length;

(c) The pressure shall be maintained for at least 2 hours by adding measured volumes of water where necessary;

(d) Any visible leaks detected shall be repaired and the pipeline shall be retested.

5 PIPELINE TESTING – PRESSURE PIPES

Hydrostatic pressure testing requires selecting an appropriate configuration of method, pressure, and length of test section. Test parameters and details shall be determined with due consideration to the following:

(a) Pipe material;

(b) Pipe diameter;

(c) Length of test section;

(d) Duration of the test;

(e) Magnitude of test pressure and rate of pressurisation;

(f) Presence of air in the pipeline;

(g) Time required for saturation of porous liners;

(h) Potential movement of pipeline thrust restraints;

(i) Design pressure for thrust and anchor supports;

(j) Accuracy of test equipment;

(k) Ambient temperature changes during testing;

(l) Presence of leaks in equipment used for testing or equipment attachment points (such as sealing plugs);

(m) Potential for leaks in the pipeline.

NOTE – It is advisable to begin testing early in the pipeline installation to confirm adequacy of laying procedures and, where appropriate, to increase the length tested progressively as experience is gained.

5.1 GENERAL TEST REQUIREMENTS

5.1.1 Selection of Test Pressure

The hydrostatic test pressure at any point in the pipeline shall be:

(a) Not less than the design pressure; and

(b) Not more than 25% above the rated pressure of any pipeline component.

NOTE – The design pressure is the maximum system pressure at a point in the pipeline, considering future developments, static pressure, dynamic pressure, and an allowance for short-term surge pressure (water hammer), as determined by analysis.

Compressed air testing shall not be permitted for pressure pipe.

In general, QLDC require that pipes are tested to their rated capacity i.e. a PN16 pipe would be tested at 16 bar.

5.1.2 Selection of Test Length

The pipeline length tested shall be either the whole, or a section (capable of being isolated), of the pipeline depending on the length and diameter, the availability of water, and the spacing between sectioning valves or blank ends.

The pipeline shall be divided into test sections such that:

(a) The hydrostatic test pressure at any point in the pipeline is:

(i) Shall be 1.25 times the rated pressure and no more, but not less than the design pressure at the highest point where pipe is tested on a sloped installation; and

(ii) (ii) Not more than 25% above the rated pressure of any pipeline component;

(b) Test sections shall not exceed 1000m and shall be limited to pipe of the same material. Consideration shall be given to the pressure loading time at the maximum filling rate (see C2.2.3) in determining the test length; and

(c) Water is available for the test together with facilities for its disposal, in accordance with regulatory requirements, after the test.

NOTE –

1. Where long lengths are to be tested, radio or other electronic means of communication between test operatives, to coordinate test procedures and thus minimise the test duration, is desirable.
2. Long test sections may incorporate a large number of mechanical (that is, flanged) joints, which should be checked for leakage. The longer the test section the harder it is to locate a leak, or discriminate between a leak and the other effects, such as the absorption of air into solution under pressure.
3. QLDC recommends that test sections are as short as possible to reduce the efforts during fault finding should a test length fail to pass the test. Test lengths of 250m to 500m are typically considered as practical.

5.1.3 Pre-Test Procedures

The pre-test procedures are as follows:

(a) All required temporary and permanent thrust blocks, or other pipeline thrust resisting methods, including integral joint-restraint systems, shall be in place, and all concrete shall be adequately cured (normally a minimum of 7 days);

(b) Blank flanges or caps shall be installed at the beginning and end of the test section. Testing shall not take place against closed valves. Mechanical ends that are not end load resistant shall be temporarily strutted or anchored, to withstand the test pressures without movement;

NOTE – Temporary supports should not be removed until the pipeline has been depressurised. All test personnel should be informed of the loading limits on temporary fittings and supports.

(c) Where practicable, all bolted joints shall be left exposed to allow for retensioning during or after testing;

(d) Compacted embedment and fill material shall be placed to leave all joints, service connections and ball valves exposed wherever possible;

(e) For PE pipelines, the pressurising time shall not exceed 45 minutes;

NOTE – The pressurising time affects the duration of the PE pipeline test.

(f) The test equipment shall be placed in position and checked for satisfactory operation;

(g) The pump shall be of adequate size to raise and maintain the test pressure;

NOTE – A pump that is too small may increase the test duration or where too large it may be difficult to control the pressure.

(h) Two calibrated test gauges shall be used to cross check gauge accuracy;

(i) Slowly fill the test length of pipeline with water, preferably from the lowest point, ensuring air is vented at the high point valves. Allow a period, in the range of minimum 3 hours to 24 hours (preferred), for the temperature of the test length and the test water to stabilise and for dissolved air to exit the system. The recommended rate of filling shall be based on a flow velocity of 0.05 m/s, calculated from the following equation:

$$Qf \leq 12.5\pi D2$$

where

Qf = filling rate, in litres per second

D = pipe diameter, in metres

NOTE – The slow rate of 0.05 m/s avoids air entrainment when the filling water is cascading through downward gradients along the pipeline.

The period of stabilisation will depend on pipe dimensions, length, material, longitudinal profile, and air exit points. For cement-mortar lined pipe, the pipeline shall be filled at least 24 hours before the commencement of the test, to allow the lining to become saturated.

NOTE – A firm foam swab may be used ahead of the fill water to assist air removal especially where the pipeline undulates. Extract the swab at a high-point wash-out.

Typical pressure test equipment and location are shown in figures 1 and 2.

5.1.4 Post Test Procedures

After testing, pipelines shall be depressurised slowly. All air venting facilities shall be open when emptying pipelines. The test water shall be drained to an approved waterway and all connection points shall be reinstated.

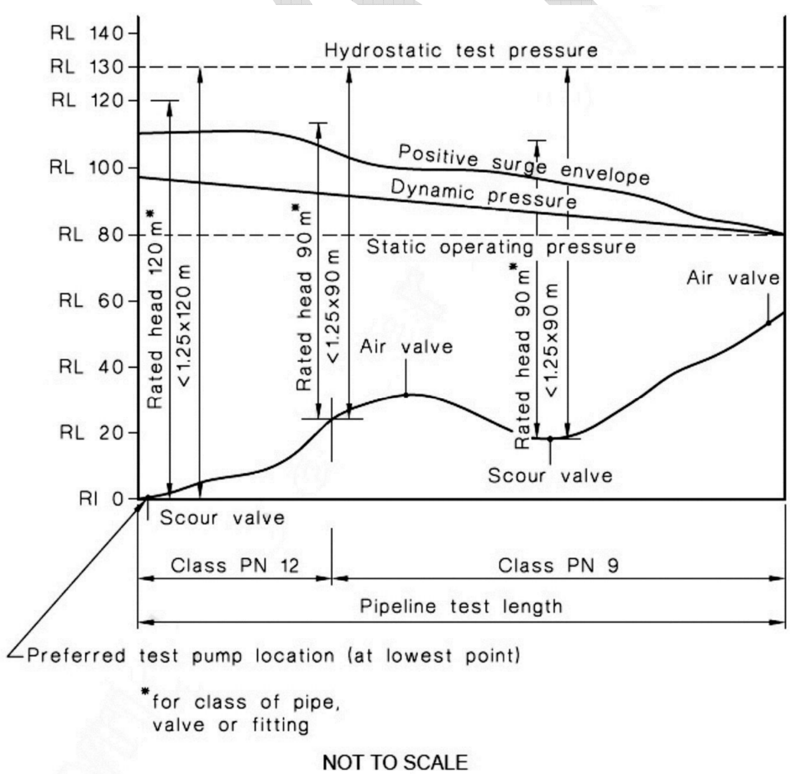


Figure 1 Typical pressure pipeline under typical field test

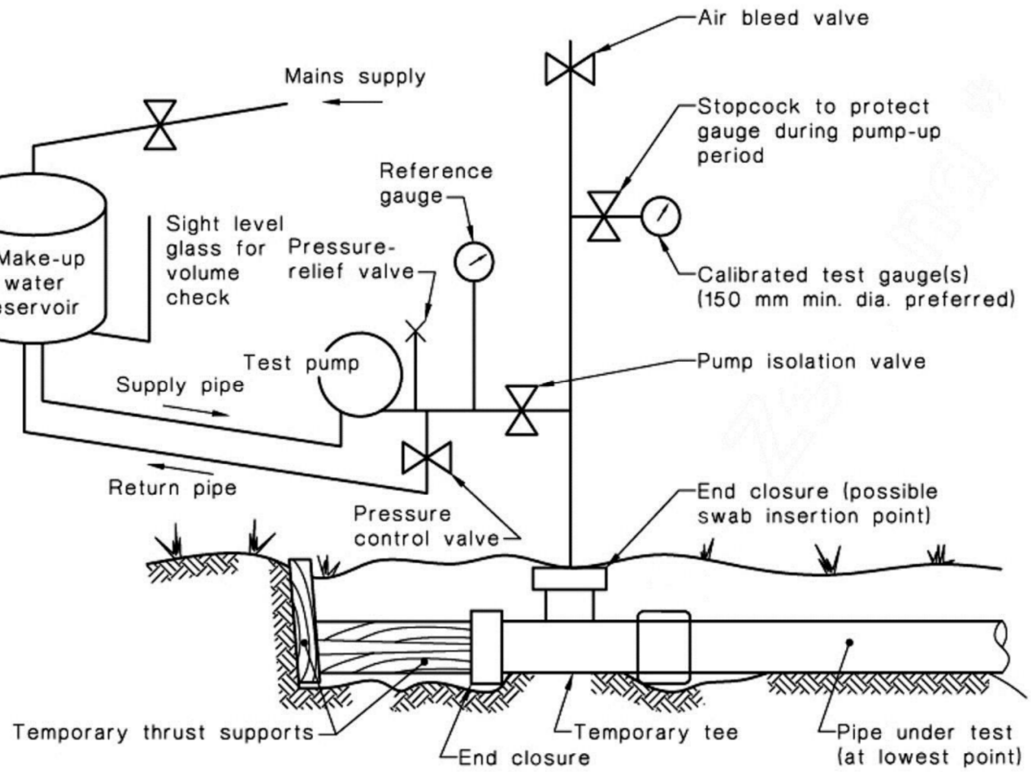


Figure 2 Typical field pressure test equipment layout

A pressure log of the test, recorded at 5 second intervals (or less), must be submitted in .xls or .csv format with the test report.

5.2 CONSTANT PRESSURE TEST (WATER LOSS METHOD) – NON-VISCOELASTIC PIPELINES

This test is applicable for PVC, DI, GRP, and steel pipelines.

5.2.1 Procedure

The procedure shall be as follows:

(a) Close all valves apart from the test pump input and pressurise the test length to the specified test pressure (STP) – (see 5.1.1);

(b) Apply and then maintain the test pressure by the addition of measured and recorded quantities of make-up water at regular intervals over a period, in the range of 1 hour to 12 hours. Note, that after the test section has been filled with water, it is often necessary to use a hand pump to complete the test as a motorised test pump can prove to be difficult to control when testing short lengths of relatively small diameter pipeline ;

(c) Where pressure measurements are not made at the lowest part of the test length, make an allowance for the static head, between the lowest point of the pipeline and the point of measurement,

The quantity of make-up water necessary to maintain the test pressure shall comply with the following equation:

$Q \leq 0.14LDH$

where

Q = allowable make-up water, in litres per hour

L = length of the test length, in kilometres

D = nominal diameter of the test length, in metres

H = average test head over length of pipeline under test, in metres

NOTE – The make-up water is not a leakage allowance, but is an allowance to cover the effects of the test head forcing small quantities of entrapped air into solution. Normally the test should last for a minimum of 2 hours and be concluded within 5 to 8 hours. The make-up water requirement should reduce with time as air goes into solution. Where, after 12 hours the make-up water still exceeds the allowable limit, testing should cease and the cause of loss investigated.

5.2.2 Acceptance

The test length shall be acceptable where:

(a) There is no failure of any thrust block, pipe, fitting, joint, or any other pipeline component;

(b) There is no physical leakage;

(c) The quantity of make-up water necessary to maintain the test pressure complies with 5.2.1.

5.3 CONSTANT PRESSURE TEST (WATER LOSS METHOD) – VISCOELASTIC PIPELINES

This test is applicable to PE, PP, and ABS pressure pipelines. The test lengths may be several kilometres in length.

NOTE - This method is based on VAV P78, as outlined in AS/NZS 2566.2, Appendix A.

5.3.1 Procedure

The procedure shall be as follows:

(a) Purge the air from pipeline;

(b) Apply the specified test pressure (STP) (see C3.1) to the test length;

(c) Shut off main and allow pressure to settle for 12 hours (pressure will drop significantly);

(d) Re-apply and maintain test pressure for 5 hours by successively pumping a sufficient amount of water;

(e) Measure and record water volume (V1 in litres) required to maintain this pressure between Hour 2 and Hour 3;

(f) Measure and record water volume (V2 in litres) required to maintain this pressure between Hour 4 and Hour 5;

(g) Calculate:

$$0.55V1 + Q$$

where

Q is the allowable make-up volume obtained from 5.2.1.

5.3.2 Acceptance

The test length shall be acceptable where:

(a) The test length shall be acceptable where there is no failure of any thrust block, pipe, fitting, joint, or any other pipeline component;

(b) There is no physical leakage; and

(c) $V2 \leq 0.55\ V1 + Q$

5.4 PRESSURE REBOUND TEST (PE PIPES UP TO DN315)

This test is applicable to PE, PP, and ABS pressure pipelines up to and including DN315, where a short test time is required.

NOTE – This test is based on BS EN 805:2000, Appendix A (refer to AS/NZS 2566.2).

5.4.1 Pressure Measurement Rig

The test rig shall be a recently calibrated pressure transducer, data logger, and check pressure gauge that has a dial of at least 100 mm diameter and a pressure range that places the specified test pressure (STP) (see 5.1.1) in the range 35% to 70% of the gauge's full scale. The transducer and the check gauge shall read within ±5% of each other. If they do not agree within this tolerance, the equipment shall be recalibrated or replaced.

5.4.2 Procedure

The test procedure has the following three phases:

(a) A preliminary phase in which the pipeline is —

  (i) Depressurised and allowed to relax after the C3.3 pre-test procedure

  (ii) Pressurised quickly to the test pressure and maintained at this pressure for a period of time without further water being added

  (iii) The pressure is allowed to decay by viscoelastic creep, and

  (iv) Provided the pressure drop does not exceed a specified maximum, the pressure test can proceed to the second phase;

(b) A phase in which the volume of air remaining in the pipeline is assessed against an allowable maximum;

(c) The main test phase in which the pipeline is maintained at the test pressure for a period of time and decay due to viscoelastic creep commenced. The creep is interrupted by a rapid reduction of the pressure in the pipeline to a specified level. This rapid reduction in pressure results in contraction of the pipeline with an increase (rebound) in pressure. If, during the rebound period, the pressure versus time record shows a fall in pressure, the pipeline fails the test.

5.4.3 Preliminary Phase

The procedure shall be as follows:

(a) Reduce pressure to just above atmospheric at the highest point of the test length, and let stand for 60 minutes. Ensure no air enters the line;

(b) Raise the pressure smoothly to STP in less than 10 minutes. Hold the pressure at STP for 30 minutes by pumping continuously, or at short intervals as needed. Do not exceed STP;

(c) Inspect for leaks during the 30 minute period, then shut off pressure;

(d) Allow the pressure to decay for 60 minutes;

(e) Measure the pressure remaining at 60 minutes (P60);

(f) If P60 ≤ 70% of STP the test is failed. The cause shall be located and rectified. Steps (a) to (e) shall be repeated. If P60 > 70% of STP, proceed to the air volume assessment.

5.4.4 Air Volume Assessment

The procedure shall be as follows:

(a) Quickly (<5 mins) reduce pressure by ΔP (10% - 15% of STP)

(b) Measure water volume bled out (ΔV)

(c) Calculate $\Delta V_{max\ allowable}$ as follows:

$$\Delta V_{max\ allowable} = 1.2 \times V \times \Delta P(1/E_W + D/eE_R)$$

where

1.2	=	air allowance
V	=	pipe volume, in litres
ΔP	=	measured pressure drop, in kilopascals
D	=	pipe internal diameter, in metres
E_R	=	pipe material modulus, in kilopascals (see table 2)
E_W	=	bulk modulus of water, in kilopascals (se table 3)
e	=	pipe wall thickness, in metres

(d) If $\Delta V > \Delta V_{max}$ allowable the test has failed. The cause shall be located and rectified. The preliminary phase shall be repeated. If $\Delta V \leq \Delta V_{max}$ allowable, proceed to the main test phase.

NOTE – ΔV and ΔP should be measured as accurately as possible, especially where the test length volume is small.

5.4.5 Main Test Phase

Observe and record the pressure rise for 30 minutes.

In the event of failure, locate and repair leaks. If failure is marginal or doubtful, or if it is necessary to determine leakage rate, use a reference test (see 5.3).

NOTE – Figure 3 gives an example of a full pressure test with the main test phase extended to 90 minutes

Table 3 Pipe E material modulus for PE 80B and PE 100

Temp (°C)	**PE 80B – *E* Modulus** (kPa×10³)			**PE 100 – *E* Modulus** (kPa×10³)		
	1 h	**2 h**	**3 h**	**1 h**	**2 h**	**3 h**
5	740	700	680	990	930	900
10	670	630	610	900	850	820
15	600	570	550	820	780	750
20	550	520	510	750	710	680
25	510	490	470	690	650	630
30	470	450	430	640	610	600

Table 4 Bulk modulus E_w – Water

Temperature (°C)	**Bulk Modulus** (kPa×10^3)
5	2080
10	2110
15	2140
20	2170
25	2210
30	2230

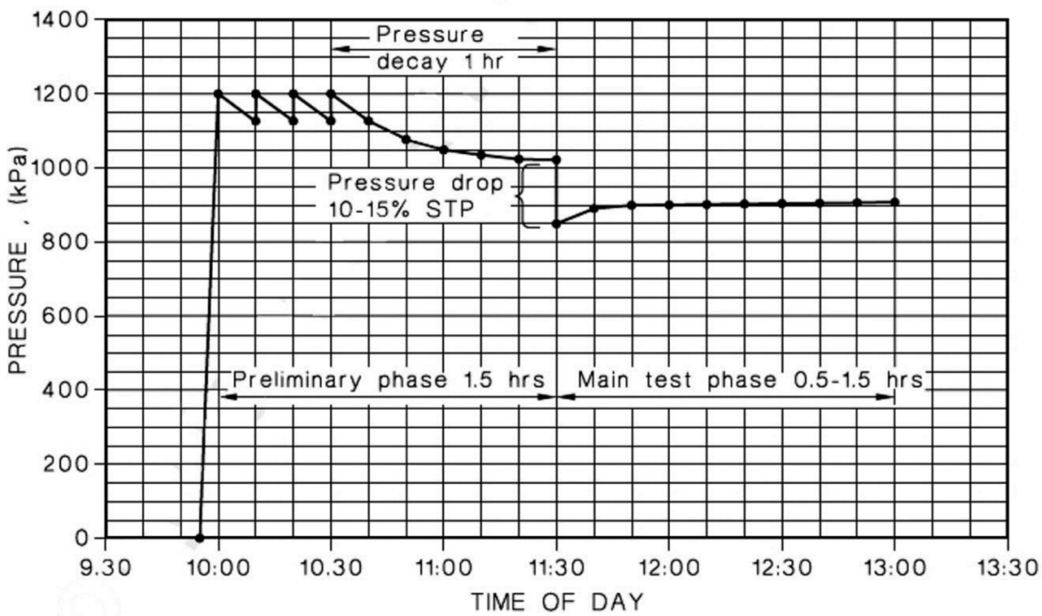


Figure 3 Typical successful modified rebound test for a PE pipeline

5.4.6 Acceptance

The test length shall be acceptable if:

(a) There is no failure of any thrust block, pipe, fitting, joint, or any other pipeline component;

(b) There is no physical leakage;

(c) The pressure rises or remains static in the 30-minute period. If doubt exists about the pressure recovery, the monitoring period may be increased to 90 minutes, and any pressure drop that does occur shall not exceed 20 kPa over the 90-minute period.

If the pressure drops by more than 20 kPa during the 90-minute extended period, the test fails.

Repetition of the main test phase shall only be done by carrying out the whole test procedure, including the relaxation period of 60 minutes described in 5.4.3.

5.5 VISUAL TEST FOR SMALL DIAMETER PRESSURE PIPELINES

This test is applicable for small pipelines of all materials (less than 200 m in length), and pipelines where pipeline joints have been left exposed for the test operation (such as coiled pipe).

5.5.1 Procedure

The procedure shall be as follows:

(a) The test pressure (see 5.1.1) shall be applied and the test section isolated by closing the high point air release valves and the pump feed valve;

(b) The test section shall be visually inspected for leakage at all joints, especially bolted joints, all fittings, service connections, and ball valves;

(c) Pressure gauges shall be checked to ensure that pressure has not fallen significantly indicating an undetected leak;

(d) Any detected leak shall be repaired and the section shall be retested;

(e) Where no leak is detected, high point air release valves shall be opened, the pipeline shall be depressurised to slowly drain the line into an approved waterway and all connection points shall be reinstated.

5.5.2 Acceptance

The test length shall be acceptable where:

(a) There is no failure of any thrust block, pipe, fitting, joint, or any other pipeline component;

(b) There is no physical leakage; and

(c) There is no pressure loss indicative of a leak.

6 MANHOLE TESTING

The type of test shall be selected according to the performance requirement of the system, the type of installation methodology, ground conditions and Health and Safety risk factors associated with the installation. All manhole tests shall include 300mm of the connecting pipework with the lid fitted into place.

6.1 HYDROSTATIC TEST (CONCRETE MANHOLES)

This test may be used for manholes up to 3.5m depth and relies on obtaining a proper seal from the pipeline plugs to withstand the hydrostatic pressure. The limitation on this test is the non-uniform pressure distribution and the low pressure at the top of the manhole will not sufficiently test the top seal of the lid. To test the top seal this test shall be supplemented with the visual check (smoke test) in section 6.4 or the low pressure air test as per section 6.2. The manhole shall be completely backfilled and interconnected pipework and manholes be vacated before starting the test.

6.1.1 Procedure

Ensure that there is no entry into the connecting trench or any connected manhole associated with the manhole being tested. The manhole shall not be pressurised beyond the static pressure alone and the lid shall remain open.

The procedure shall be as follows:

(a) Seal openings using properly sized or inflatable plugs;

(b) Completely fill the manhole to the top of the lid frame with water;

(c) Allow the filled manhole to soak for minimum 4 hours;

(d) Top up any water loss to the top of the lid frame during the soak period;

(e) Measure the water loss over every 1 hour for 8 hours;

(f) Empty the manhole and allow to stand for 1 hour before completing a visual inspection for groundwater infiltration.

6.1.2 Acceptance

The test shall be acceptable where:

(a) The average quantity of make-up shall not be more than 0.3 litres per 1m diameter per 1m depth per hour, and;

(b) The post-test visual inspection shall show no evidence of groundwater ingress through any joint.

6.2 VACUUM TEST

The vacuum test creates differential pressure between the inside and outside of the manhole. This test shall be completed with the manhole completely backfilled and the lid in place.

6.2.1 Procedure

The procedure shall be as follows:

(a) Clean manhole thoroughly;

(b) Seal openings using properly sized or inflatable plugs;

(c) Connect seal plate to manhole opening;

(d) Draw vacuum of -254mmHg (or -338.6mbar) and isolate valves;

(e) Hold test time according to the manhole sizes as listed in the table below:

Table 5 Manhole Test Duration Requirements

Depth (m)	Diameter (mm)								
	675	900	1050	1200	1300	1500	1800	2400	3000
	Time (s)								
<2	11	14	17	20	23	26	33	39	45
3	14	18	21	25	29	33	41	49	57
3.5	17	21	25	30	35	39	49	59	69
4.3	20	25	30	35	41	46	57	69	81
5	22	29	34	40	46	52	67	81	95
5.5	25	32	38	45	52	59	73	87	101
6	28	35	42	50	53	65	81	97	113
6.7	31	39	46	55	64	72	89	107	125
7.3	33	42	51	59	68	78	97	115	133
8	36	46	55	64	75	85	105	125	145
8.5	39	49	59	69	81	91	113	135	157
9	42	53	63	74	87	98	121	145	169
9.5	46	58	69	81	94	105	129	153	177
10	49	63	74	87	98	113	139	165	191

(f) Release the vacuum and remove the test gear and plugs

6.2.2 Acceptance

The test shall be acceptable where:

(a) For the duration of the test the vacuum did not drop below -228mmHg (or - 304mbar).

(b) There are no visible wet patches or “sweating” at any of the pipe penetrations, seals, or riser joints.

6.3 INFILTRATION TEST (CONCRETE MANHOLES)

This test is completed by creating an external water column around the manhole to that will force groundwater through any leaking joints. This method is recommended where manholes are over 3.5m deep or can only be part tested using the hydrostatic testing method up to 3.5m depth. However, the limitation on part testing to 3.5m is that the hydrostatic pressure shall be demonstrated to be higher than the groundwater pressure at the location of the joints being tested. The vacuum test procedure is preferred over this option.

This test does not confirm the lid seal and shall be supplemented with the visual check (smoke test) in section 6.4 or the low pressure air test as per section 6.2.

6.3.1 Procedure

The procedure shall be as follows:

(a) Excavate or provide a moat of approximately 500mm around the circumference of the manhole and fill with water;

(b) A 32mm PVC sleeve is provided adjacent to the manhole wall to 1 m below the hydrostatic test depth. The bottom 1m of the sleeve shall be perforated to allow groundwater to enter the sleeve;

(c) The water in the moat is filled until the groundwater in the sleeve reaches the level of the water in the moat;

(d) The groundwater level is maintained for eight (8) hours.

6.3.2 Acceptance

The test shall be acceptable where:

(a) There are no visible leaks, wet patches or “sweating” at any of the pipe penetrations, seals or riser joints.

6.4 VISUAL CHECK/SMOKE TEST (CONCRETE MANHOLES)

This test shall only be conducted on manholes where the joints and pipe penetrations being tested have not been backfilled over and are visible for inspection of forced smoke leaking through defective seals. The limitation of this test is to manholes that are not located within a 100 year flood plain level and is ideally suited for low risk shallow manholes.

6.4.1 Procedure

The procedure shall be as follows:

(a) Seal openings using properly sized or inflatable plugs;

(b) Connect seal plate to opening of manhole lid with appropriate connection to introduce the smoke;

(c) Introduce smoke into manhole being tested according to the manufacturer’s recommendation;

(d) The smoke shall be introduced for a minimum of 5 minutes;

(e) Inspect joints for smoke leaks.

6.4.2 Acceptance

The test shall be acceptable where:

(a) There is no smoke leaking from any of the joints

6.5 PLASTIC/GRP MANHOLE TESTING

Manholes shall be tested twice:

1. Off-site as a single unit at the manufacturer's facilities according to industry best practice for the material being used; and
2. On installation on site, fully backfilled and connected, and tested per the vacuum test described in section 6.2.

Records associated with the off-site test shall be provided to the QLDC.

7 PROCESS OUTPUTS

Completed test records sheet, in accordance with the attached templates, shall be provided to QLDC for each field test completed.

APPENDIX 1 – LOW PRESSURE AIR TEST (NON PRESSURE PIPE)

GENERAL INFORMATION			
Contract No. or Resource Consent No.			
Contractor			
Site Supervisor			
Site Location			
Date & Time			
Pipe ID		Pipe Diameter	
Pipe Material & Class		Pipe Length	

TEST RESULTS	
Parameter	**Result**
Minimum Duration (from Table 1)	
Test Duration (mins)	
Pressure at Start of Test (kPa)	
Pressure at End of Test (kPa)	
Calculate Pressure Drop ΔP (kPa)	
Acceptance Criteria	**Pass (Y/N)**
Pass Criteria - ΔP < 7kPa	
Visual Inspection	

Signed on behalf of Contractor:

Signed on behalf of QLDC:

Print Name: ___________________________

Print Name: ___________________________

APPENDIX 2 – HYDROSTATIC TEST (NON PRESSURE PIPE)

GENERAL INFORMATION			
Contract No. or Resource Consent No.			
Contractor			
Site Supervisor			
Site Location			
Date & Time			
Pipe ID		Pipe Diameter	
Pipe Material & Class		Pipe Length	

TEST RESULTS	
Parameter	**Result**
Test Duration (mins)	
Test Pressure (kPa)	
Volume of Make Up Water (l)	
Make Up Water Rate (l/hr)	
Specify Allowable Make Up Rate	
Acceptance Criteria	**Pass (Y/N)**
Allowable Make Up Rate > Measure Make Up Rate	
Visual Inspection	

Signed on behalf of Contractor:

Signed on behalf of QLDC:

Print Name: ___________________________

Print Name: ___________________________

APPENDIX 3 – CONSTANT PRESSURE TEST (NON VISCOELASTIC PRESSURE PIPE)

GENERAL INFORMATION			
Contract No. or Resource Consent No.			
Contractor			
Site Supervisor			
Site Location			
Date & Time			
Pipe ID		**Pipe Diameter**	
Pipe Material & Class		**Pipe Length**	

TEST RESULTS	
Parameter	**Result**
Test Duration (mins)	
Test Pressure (kPa)	
Volume of Make Up Water (l)	
Make Up Water Rate (l/hr)	
Calculate Allowable Make Up Rate Q ≤0.4LDH	
Acceptance Criteria	**Pass (Y/N)**
Allowable Make Up Rate > Measured Make Up Rate	
Visual Inspection	

Signed on behalf of Contractor:

Signed on behalf of QLDC:

Print Name: ___________________________

Print Name: ___________________________

APPENDIX 4 – CONSTANT PRESSURE TEST (VISCOELASTIC PRESSURE PIPE)

GENERAL INFORMATION			
Contract No. or Resource Consent No.			
Contractor			
Site Supervisor			
Site Location			
Date & Time			
Pipe ID		**Pipe Diameter**	
Pipe Material & Class		**Pipe Length**	

TEST RESULTS	
Parameter	**Result**
Test Pressure (kPa)	
Pressure after 12 hrs (kPa)	
Volume of Make Up Water (l) **V1 (between hours 2 & 3)**	
V2 (between hours 4 & 5)	
Allowable Make Up Rate (Q = 0.4LDH)	
Calculate 0.55 V1 + Q	
Acceptance Criteria	**Pass (Y/N)**
Pass Criteria V2 ≤ 0.55 V1 + Q	
Visual Inspection	

Signed on behalf of Contractor:

Signed on behalf of QLDC:

Print Name: ___________________________

Print Name: ___________________________

QUEENSTOWN LAKES DISTRICT COUNCIL

APPENDIX 5 – PRESSURE REBOUND TEST (PE PIPES UP TO DN315)

GENERAL INFORMATION			
Contract No. or Resource Consent No.			
Contractor			
Site Supervisor			
Site Location			
Date & Time			
Pipe ID		Pipe Diameter	
Pipe Material & Class		Pipe Length	

TEST RESULTS – PRELIMINARY PHASE	
Parameter	**Result**
Test Pressure (kPa)	
Pressure after 60 mins decay (kPa)	
Acceptance Criteria	**Pass (Y/N)**
Pass Criteria - P60 > 70% of STP	
Visual Inspection	

TEST RESULTS – AIR VOLUME ASSESSMENT	
Parameter	**Result**
Record volume of water bled out (ΔV)	
Calculate: $\Delta V_{max\ allowable} = 1.2 \times V \times \Delta P\ (1/E_W + D/E_R)$	
Acceptance Criteria	**Pass (Y/N)**
Pass Criteria - $\Delta V \leq \Delta V_{max}$	

TEST RESULTS – MAIN TEST PHASE	
Parameter	**Result**
Record pressure at start of test phase (kPa)	
Pressure after 60 mins decay (kPa)	
Acceptance Criteria	**Pass (Y/N)**
Pass Criteria – Pressure rises or remains static*	

* If doubt exists about the pressure recovery, the monitoring period may be increased to 90 minutes, and any pressure drop that does occur shall not exceed 20 kPa over the 90-minute period.

•

Signed on behalf of Contractor:

Signed on behalf of QLDC:

Print Name: __________________________

Print Name: __________________________

APPENDIX 6 – MANHOLE HYDROSTATIC TEST

GENERAL INFORMATION			
Contract No. or Resource Consent No.			
Contractor			
Site Supervisor			
Site Location			
Date & Time		**MH Diameter**	
Manhole ID		**MH Material**	

TEST RESULTS								
Parameter	**Hour 1**	**Hour 2**	**Hour 3**	**Hour 3**	**Hour 4**	**Hour 5**	**Hour 6**	**Hour 7**
Volume of water added (l) to maintain level								
Acceptance Criteria	**Pass (Y/N)**							
Pass Criteria - 0.3 litres per 1m diameter per 1m depth per hour								
Visual Inspection								

Signed on behalf of Contractor:

Signed on behalf of QLDC:

Print Name: ______________________

Print Name: ______________________

QUEENSTOWN LAKES DISTRICT COUNCIL

APPENDIX 7 – MANHOLE VACUUM TEST

GENERAL INFORMATION			
Contract No. or Resource Consent No.			
Contractor			
Site Supervisor			
Site Location			
Date & Time		MH Diameter	
Manhole ID		MH Material	
TEST RESULTS			
Parameter	**Result**		
Pressure at start of test (mbar)			
Test duration (refer Table 4)			
Pressure at end of test period (mbar)			
Acceptance Criteria	**Pass (Y/N)**		
Pass Criteria – Pressure at end of test < -304mbar			
Visual Inspection			

Signed on behalf of Contractor:

Signed on behalf of QLDC:

Print Name: __________________________

Print Name: __________________________

APPENDIX 8 – MANHOLE INFILTRATION AND VISUAL TEST

GENERAL INFORMATION			
Contract No. or Resource Consent No.			
Contractor			
Site Supervisor			
Site Location			
Date & Time		MH Diameter	
Manhole ID		MH Material	
TEST RESULTS			
Acceptance Criteria	**Pass (Y/N)**		
Visual Inspection			

Signed on behalf of Contractor:

Print Name: ___________________________

Signed on behalf of QLDC:

Print Name: ___________________________

CONTENTS

1 PURPOSE

Water supply authorities are required by law to ensure that the water supply system is free from conditions that may be hazardous to public health. The Water Services Act 2021 requires drinking water suppliers to ensure that the drinking water supplied by the supplier is safe.

The purpose of this procedure is to:

- Prevent contamination of the water supply system by defining the minimum requirements for the disinfection of both new watermains and existing watermains following planned or reactive maintenance
- Prevent contamination of the water supply system by defining required best practices for workers and materials that come in contact with water. For pressure pipes, provide confirmation that the pipeline is able to sustain a pressure greater than the design pressure without leakage;
- Ensure compliance with legislative requirements

2 SCOPE

The scope of this procedure is to define the minimum requirements for disinfection across all of the Council water supply system, including but not limited to the following:

- New watermain installations and connections
- Reticulation repairs and maintenance
- Water reservoirs and storage tanks

3 ROLES AND RESPONSIBILITIES

All contractors working on the Council network, or involved in the construction of infrastructure that will be vested to Council, must adhere to the requirements of the QLDC Land Development and Subdivision Code of Practice.

Only QLDC Approved Contractors shall undertake work on the network. Contractors shall ensure that appropriately trained and competent personnel are present to supervise all disinfection activities.

Contractors shall be responsible for annual medical clearance of their water reticulation workers. Contractors shall ensure that their water reticulation workers are medically fit for work on a daily basis.

QLDC may audit the disinfection practices at their discretion to validate that the requirements of this document is being followed.

Any confirmed or suspected contamination to the water supply network must be escalated to QLDC immediately.

4 DISINFECTION OF TOOLS, MATERIALS AND OTHER EQUIPMENT

4.1 VEHICLES

A high standard of cleanliness shall be maintained in the interiors of all vehicles used for water reticulation works.

Vehicles must be equipped with sanitary wipes or antibacterial liquid for hand sanitation when working on site.

All fittings carried in vehicles must be boxed, capped or sealed with plastic wrapping. All pipes must be capped.

4.2 STORES

A high standard of cleanliness shall be maintained in the interior of all stores.

Water supply and wastewater equipment shall be stored separately. All materials shall be stored and handled to minimise contact with foreign materials. Fittings shall be boxed, capped or sealed with plastic wrapping. All pipes shall be capped.

4.3 TOOLS AND EQUIPMENT

All tools used in the construction or maintenance of the main and fittings that come into contact with the treated water must have been thoroughly disinfected and sprayed or rinsed in a minimum 0.1% chlorine solution (1,000 mg/l) prior to use.

Larger items of plant and equipment including excavators shall be steam cleaned before use on potable water works. Disinfected tools must not be placed directly on the ground prior to use.

4.4 MATERIALS

All materials used in the construction or maintenance of the main and fittings that come into contact with the treated water must be:

1. provided sealed by the manufacturer under hygienic conditions and are not uncovered until immediately before use,

   Or

2. thoroughly disinfected and sprayed or rinsed in a minimum 0.1% chlorine solution (1,000 mg/l) prior to use. Disinfected items must not be placed directly on the ground prior to installation.

A bactericidal lubricant complying with AS/NZS4020 shall be used on all rings and gaskets coming into contact with the reticulated water.

4.5 DISINFECTION AND NEUTRALISING CHEMICALS

A minimum 0.1% solution for disinfection of tools, equipment, fittings and materials is made up of 1 part chlorine solution (i.e. commercially available Sodium hypochlorite solution of 12-15% available chlorine) to 9 parts water and shall have a pH value of between 7 and 8. A newly prepared solution shall be made available at least weekly and the old solution disposed of after dechlorination with Sodium Thiosulphate (or suitable alternative).

4.6 DEVIATION FROM STANDARD PROCEDURES

Where there are deviations from the procedure, for example during emergency works, these works shall be fully documented with supporting information showing the alternative disinfection procedures utilised and the reasons for deviations from the standard procedures. Any changes from the standard procedure needs to be approved by the appropriate service delivery area manager prior to the disinfection being undertaken.

5 NEW WATERMAINS DISINFECTION PROCEDURE

5.1 FLUSHING

The main shall be thoroughly flushed in sections through hydrants, producing sufficient flow velocity to remove all foreign matter. The volume of water used must be equivalent to at least three pipe volumes. The flow of water shall be from one direction at a time and depending on the position of the flushing point(s), flushing may be required to alternate between opposite directions to ensure all of the water is completely flushed out of the pipe.

5.2 CHLORINATION

Each section of new watermain, including all fittings and service connection pipes, shall be disinfected within 10 days before being placed into service.

The pipe shall be drained completely and then slowly filled with potable water that has been pre-mixed with chlorine in a tanker. The water shall be tested for chlorine concentration before use and contain sufficient free available chlorine (FAC) to produce a uniform concentration of between 15 and 25 mg/l in the pipe.

If pre-mixed chlorinated water is not used the chlorine solution must be injected at a continuous rate to ensure a concentration of 15 to 25 mg/l is in contact with every part of the main (Refer to Section 5.3 for chlorine dosage). This can be achieved by pumping in the chlorine solution or by using a chlorine injector while the main is being filled with water.

The chlorinated water shall be introduced at the lowest point of the section of pipe to be disinfected to ensure that no air is trapped. All service pipes and hydrants shall be left open and allowed to run for a couple of minutes. The services and hydrants shall then be closed to allow the highest end of the main to fill completely. Chlorine levels shall be tested and recorded along the length of the main at a minimum of 150m intervals to ensure effective distribution of the chlorine.

The use of hypochlorite powder, granules or tablets dumped into the pipe or through hydrants is not acceptable under any circumstance.

After 12 hours contact time the pH of the water shall be recorded. The effectiveness of hypochlorite as a disinfectant is greatly reduced above pH 8.0. A pH level greater than 9.0 will not be accepted as compliance with the disinfectant requirements and must be repeated using a solution with a pH less than 9.0.

After 24 hours the residual chlorine concentration must be at least 10 mg/l. If this requirement is not achieved, the chlorination procedure shall be repeated. Once this requirement is achieved, the main and service connection pipes shall be flushed with chlorinated water until the chlorine concentration of the water is between 0.5 to 1.0 mg/l. Watermains shall again be flushed with water equivalent to three pipe volumes. Refer to Section 7 for disposal of super-chlorinated water.

Testing takes approximately 24 hours to complete and the main must be connected within 10 days of an acceptable result. Refer to Section 8 for test sample results. The watermain must remain charged during this time to prevent contamination.

The test results must be provided to QLDC.

5.3 CHLORINE DOSAGES

The required amounts of Sodium hypochlorite must be calculated based on the length and diameter of the main to be disinfected. The steps to calculate the required dose are described below:

I. Use sodium hypochlorite solution. This solution usually has 10% or 15% FAC

II. Obtain a clean water tanker, as used for potable drinking water. The tanker should have a known water capacity

III. Measure the required amount of sodium hypochlorite solution into a beaker and pour it into the empty tanker

IV. Fill the tanker to the appropriate volume and ensure the solution is well mixed;

Example:

A. Calculate the volume of the mains to be chlorinated, that is, 85 m of 100 mm dia. main

$$\text{Vol.} = \frac{85 \text{ x } \pi \text{ x } 0.12}{4} = 0.67 \text{ m3}$$

$$= 667.6 \text{ litres}$$

Plus 110 m of 150 mm dia. Main

$$\text{Vol.} = \frac{110 \text{ x } \pi \text{ x } 0.152}{4} = 1.944 \text{ m3}$$

$$= 1.944 \text{ litres}$$

Total volume = 1,944 + 667.6 = 2,611.6 litres

B. The total volume of 2,611.6 litres is less than the volume of the water tanker (say 5,000 litres) so calculate how many millilitres of sodium hypochlorite is required for the 5,000 litre tanker to give a final solution of 25 g/m^3

$$v = \frac{V \text{ x } c}{s \text{ x } 10}$$

v = volume of sodium hypochlorite in ml
V = volume of water tanker
c = concentration of final solution in g/m3
s = strength of concentrated hypochlorite in % FAC

$$v = \frac{5000 \text{ x } 25}{15 \text{ x } 10} = 833 \text{ ml}$$

5.4 NEW MAIN CONNECTION

The connection of a new main to existing reticulation may be treated as a medium risk (refer to Section 11.1 for risk classification) situation provided sanitary construction procedures are followed ensuring no contamination of either the new or existing main by foreign material or groundwater.

If the newly chlorinated main has not been connected to the existing reticulation within 10 days of chlorination, the main shall be retested for E.coli as per the initial testing. If any of the new samples fail the E.coli test the disinfection procedure must be repeated.

New local network main connection procedure:

1. Excavate trench and dig sump under the section of the existing pipe to be removed to allow for the connection. The sump shall be of a depth at least 400mm.

2. Confirm that the new pipe is clear of all foreign matter and clean

3. Shutdown and drain the connecting watermain in accordance with good practice.

4. Thoroughly clean and disinfect existing connecting pipework/fittings.
5. Any new fittings to be installed shall be kept clear of the surrounding trench material and when unwrapped placed on a clean surface (e.g. impervious plastic sheet) until installed.
6. Spray all surfaces of fittings, and wipe the interior of open ends of the new and existing watermains with a minimum 0.1% chlorine solution (Refer to Section 4.5).
7. After completion of the work, the watermain must be flushed out through hydrants downstream of the new connection. The volume of water used must be equivalent to at least three pipe volumes.

6 DISINFECTION PROCEDURE FOR RESERVOIRS

Additional guidance for reservoir disinfection is provided in AWWA Standard ANSI/AWWA C652-02 for "Disinfection of Water-storage Facilities".

Network reservoirs shall only be filled and disinfected by a QLDC authorised contractor in accordance with an approved work methodology that includes isolation and disinfection procedures.

6.1 INTENTION

The intention of this procedure is to establish a sustainable reservoir disinfection process that is efficient in the areas of water usage, time and cost. Upon successful completion of this process, the water used for disinfection should be able to be distributed into the network as potable water.

6.2 CLEANING

The reservoir shall be thoroughly cleaned, using a jet-wash and hypochlorite solution, and then inspected by an authorised QLDC representative. Disinfection shall not commence until QLDC has provide approval to proceed.

All equipment used in the disinfection of a reservoir must be oil-free, in good working order, have up-to-date and complete maintenance records and must not pose a contamination risk during the procedure. Use of divers and robotic equipment is subject to specific approval from the QLDC Operations team before the commencement of the procedure.

6.3 RESERVOIR FILLING AND DISINFECTION BY CHLORINATION

The reservoir shall be partially filled with potable water to a volume of 20% of the reservoir’s capacity. All inlet and outlet valves on the reservoir shall then be isolated and, if practical, locked prior to disinfection starting.

Chlorine shall be added to the fill volume to result in a FAC of 2.0 mg/L. The water shall then be left to stand for a minimum of 24 hours. Field testing to confirm the chlorine concentration is required using a portable handheld meter; the testing results shall be provided to the QLDC Operations team. Should testing indicate a significant drop in the chlorine concentration, QLDC shall advise how to proceed.

6.4 TESTING

The chlorine concentration shall be measured at the end of the initial 24-hour standing period and, if required, additional chlorine shall be added as the reservoir is filled to the Top Water Level (High) The final chlorine concentration at Top Water Level (High) shall be within the range of 0.6 to 1.0 mg/L. The reservoir shall be filled in such a way that the water is well mixed.

Field testing of the chlorine concentration shall be carried out using a handheld meter with samples taken from representative sample points to confirm the actual FAC concentration. If the reservoir has top and bottom sample points, both points must be sampled. If the concentration is less than the specified minimum, further chlorination and mixing shall be undertaken until this concentration is achieved.

Having achieved the required chlorine concentration from both sample points, the reservoir shall be left to stand for a further 24 hours. Following this period, the reservoir shall be sampled as early as practicable by an IANZ certified laboratory. Sampling must be completed by authorised laboratory personnel only. The required tests are listed in Section 8 of this document.

Acceptable sample results are given in Section 8 of this document and must be achieved before the reservoir is placed into service. If the results are not satisfactory, the reservoir shall be re-chlorinated and re-tested until acceptable results are achieved.

The reservoir can be placed into service following QLDC receipt of acceptable sampling results.

7 DISPOSAL OF CHLORINATED WATER – IF REQUIRED

Should the reservoir disinfection process be unsuccessful for any reason, the chlorinated water must be disposed in an appropriate manner, preferably via discharge to the wastewater network. Discharge of water with residual chlorine concentration into the wastewater network requires prior approval from QLDC. The rate of discharge to the sanitary sewer shall be limited to a maximum of 10 litres per second (further restrictions may apply due to location of discharge).

If the disposal of super-chlorinated water into the sanitary sewer system is not achievable then the water must be de-chlorinated to a maximum residual of 0.02 mg/l before discharge to ground or a stormwater system. Alternatively, the super chlorinated water could be retained in a temporary surface storage pond until the maximum residual is less than 0.02 mg/l before being allowed to discharge to the stormwater drainage system, ground, or into a natural watercourse.

8 LABORATORY TEST RESULTS

Laboratories shall be IANZ certified.

The sample results shall be in accordance with Table 1 before the reservoir or pipeline will be considered satisfactory to put into service. Test results shall be provided to QLDC.

Table 1 Acceptable Laboratory Test Results

Parameter	Acceptable Value
Residual Chlorine	Between 0.6 and 1.0 mg/l
Turbidity	<1 NTU
E. coli	<1/100ml

Note 1: For the disinfection of an existing watermain it is likely that the watermain will have been returned to service before the results are obtained. Field tests may be accepted for medium risk whilst waiting for laboratory results.

Note 2: Should E.coli be identified in any sample either prior to, or following the return to service of the reservoir or watermain, then the response should be as per the Drinking Water Standards for New Zealand 2005 (as amended in 2008), section 3.4.1.2.

APPENDIX 1 – WATERMAIN DISNIFECTION CHECKSHEET

GENERAL INFORMATION			
Contract No. or Resource Consent No.			
Contractor			
Site Supervisor			
Site Location			
Date & Time			
Pipe ID		Pipe Diameter	
Chlorine Type Added		Pipe Length	

TEST RESULTS		
Test Point	Initial (mg/l)	24 Hours (mg/l)
pH Reading at 12 hours		
Laboratory Results Acceptable (Attach)	☐ Yes ☐ No	

Signed on behalf of Contractor:

Signed on behalf of QLDC:

Print Name: ___________________________

Print Name: ___________________________

APPENDIX 2 – RESERVOIR DISINFECTION CHECKSHEET

GENERAL INFORMATION	
Facility	
Asset ID	
RESERVOIR DISINFECTION	
PRE-DISINFECTION INSPECTION	
Date Inspected	
Inspected by	
Cleaned Satisfactorily	☐ **Yes** ☐ **No**
INITIAL DISINFECTION	
Date Filled (to 2m depth)	
Chlorine Type, Concentration and Amount Added	
Residual at 24 hours	
Tested By	
Note details of any additional chlorine required	
TESTING AT TOP WATER LEVEL (HIGH)	
Residual Chlorine (Top)	
Residual Chlorine (Bottom)	
Tested By	
Laboratory Results Acceptable (Attach)	☐ **Yes** ☐ **No**

Signed on behalf of Contractor: Signed on behalf of QLDC:

Print Name: _________________________ Print Name: _________________________

Appendix E - Typical Plan and Cross Section Figures from Table 3-3 (Informative)

QUEENSTOWN LAKES DISTRICT COUNCIL

The following figures are provided by Standards New Zealand. The copyright of these figures is waived.

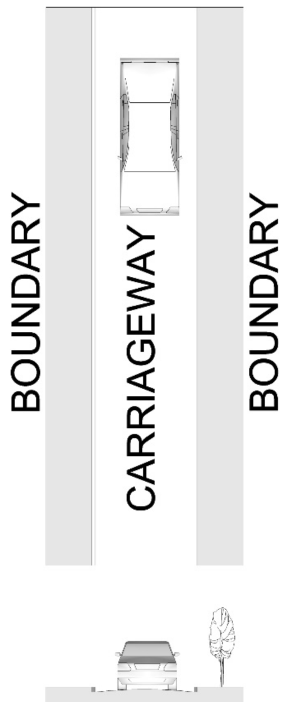


Figure E1 – Rural, live and play, access to lifestyle or clustered housing (1 to 6 du)

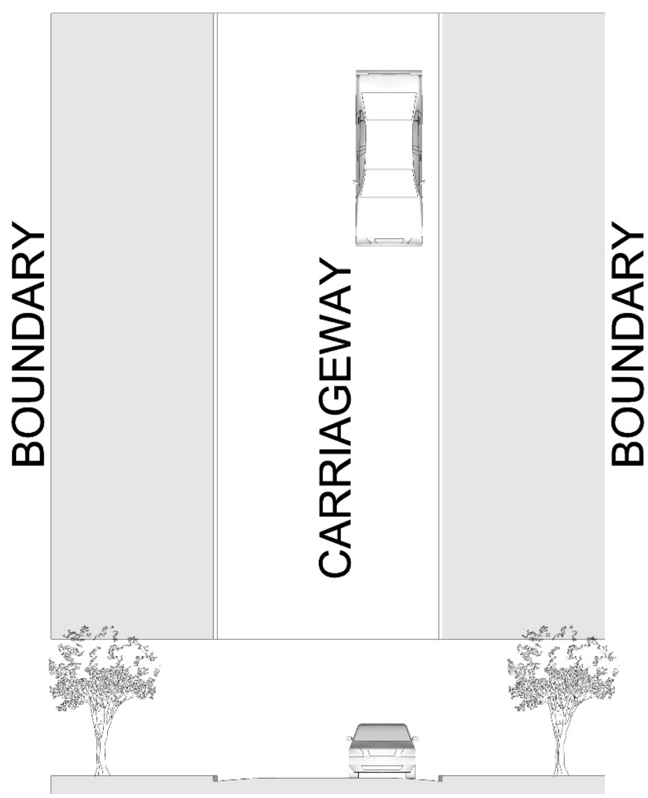


Figure E2 – Rural, live and play, access to lifestyle or clustered housing (1 to 20 du)

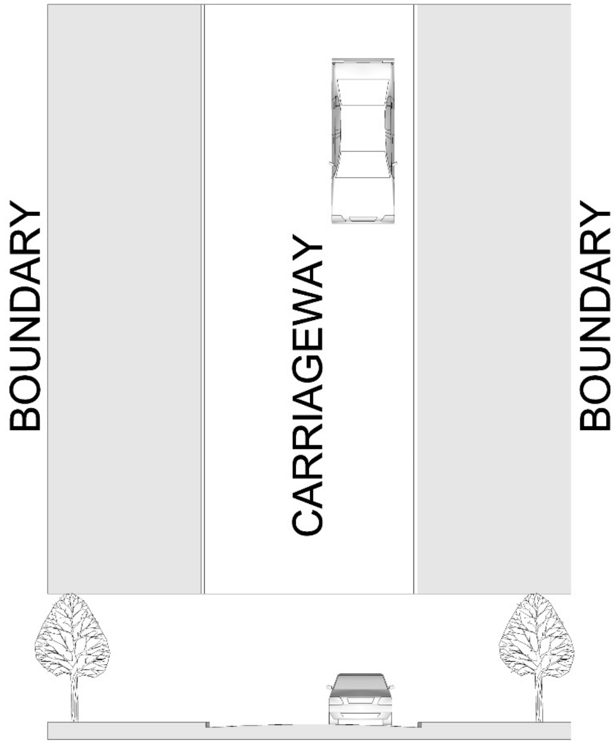


Figure E3 – Rural, live and play, access to housing

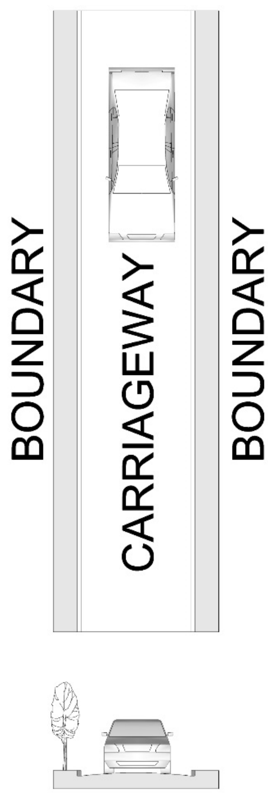


Figure E4 – Rural, shop and trade, side or rear service access

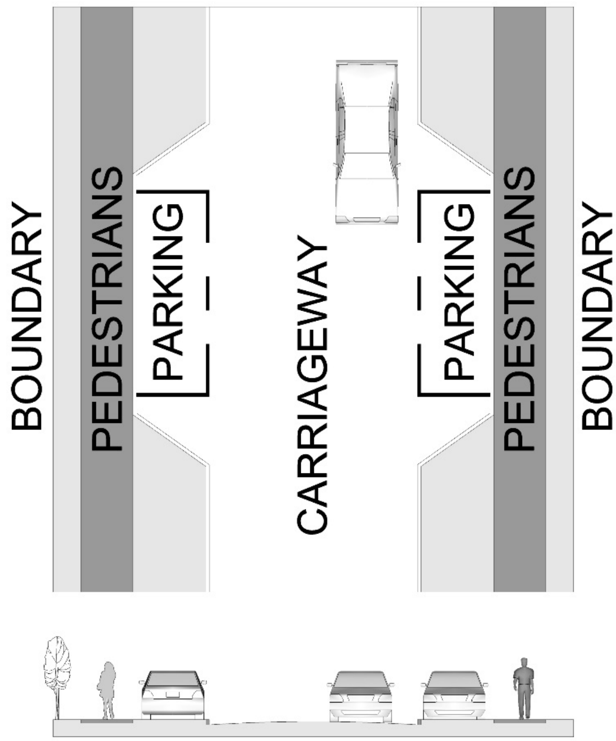


Figure E5 – Rural, shop and trade, access to trade

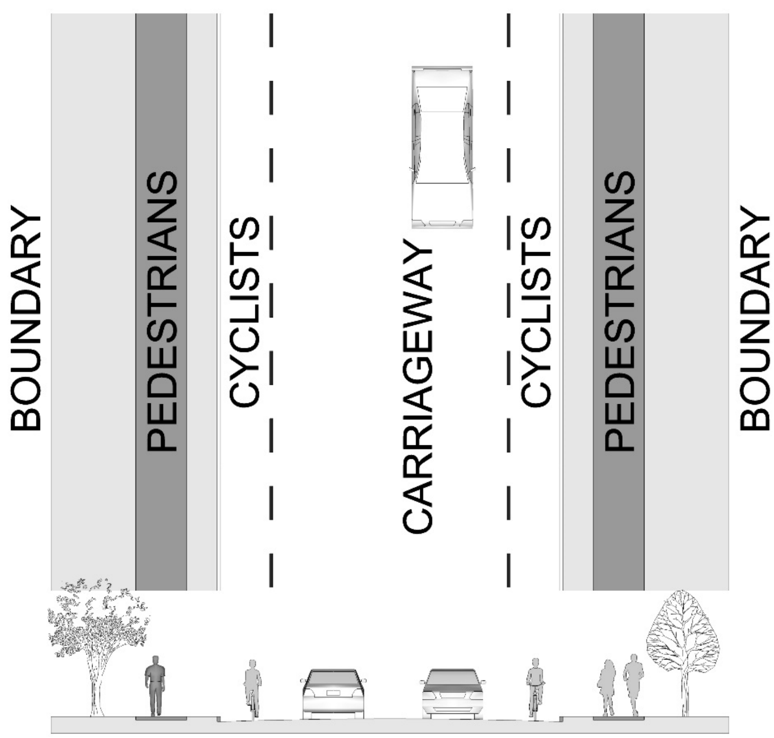


Figure E6 – Rural, make and move, primary freight access

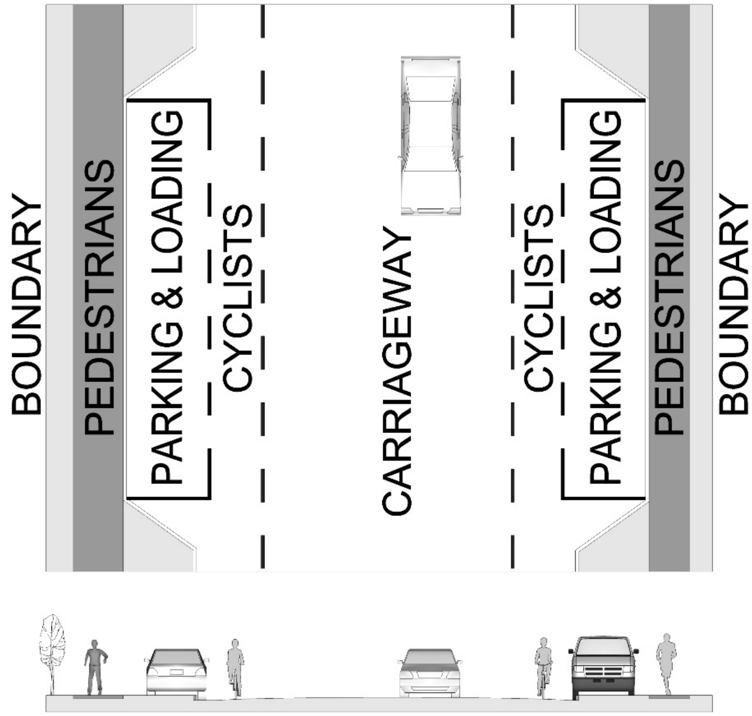


Figure E7 – Rural, make and move, access to office and education

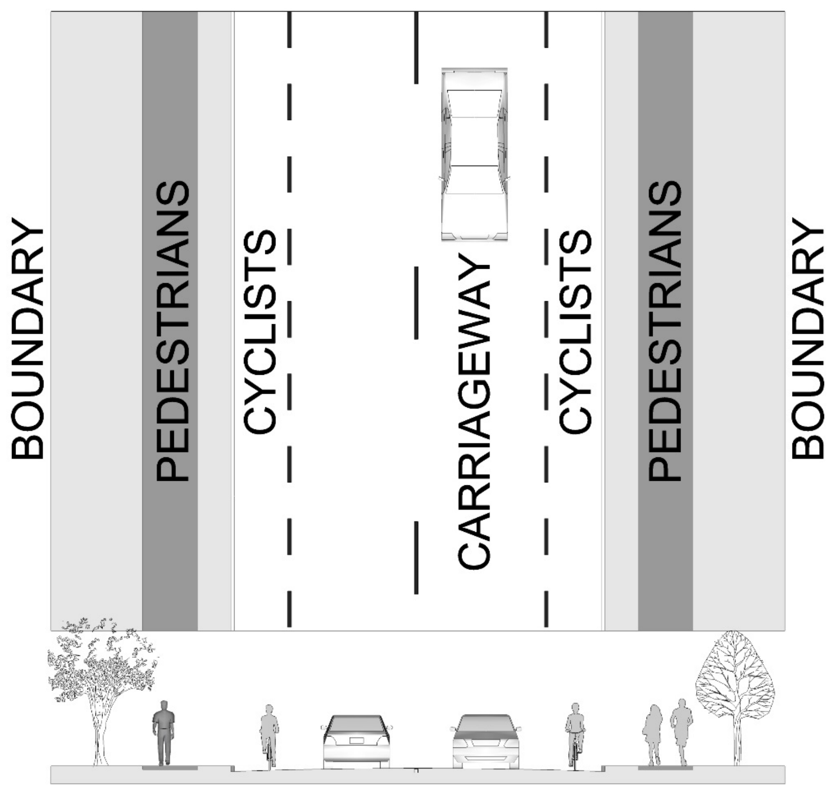


Figure E8 – Rural, all other situations (where not specified elsewhere in table 3.3)

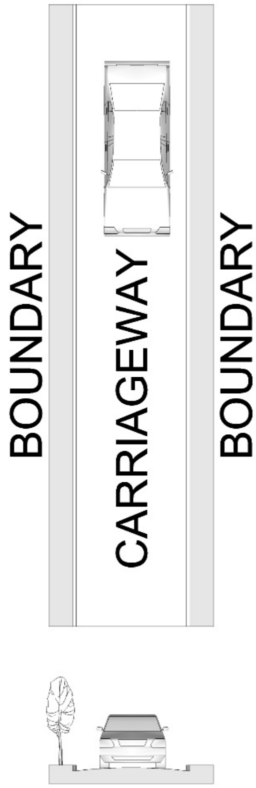


Figure E9 – Suburban, live and play, access to houses/townhouses (1 to 3 du, or 1 to 6 du)

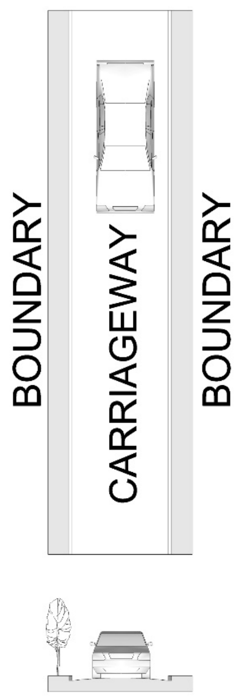


Figure E10 – Suburban, live and play, side or rear service access

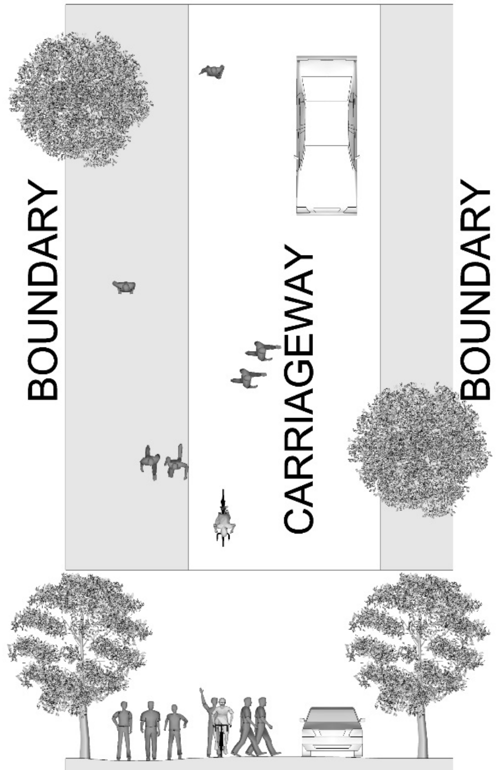


Figure E11 – Suburban, live and play, access to houses/townhouses (1 to 20 du)

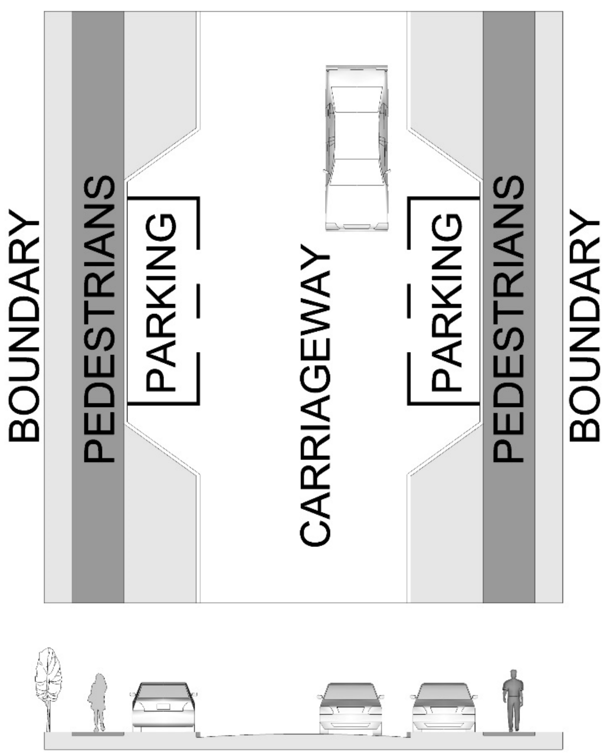


Figure E12 – Suburban, live and play, primary access to housing (1 to 200 du)

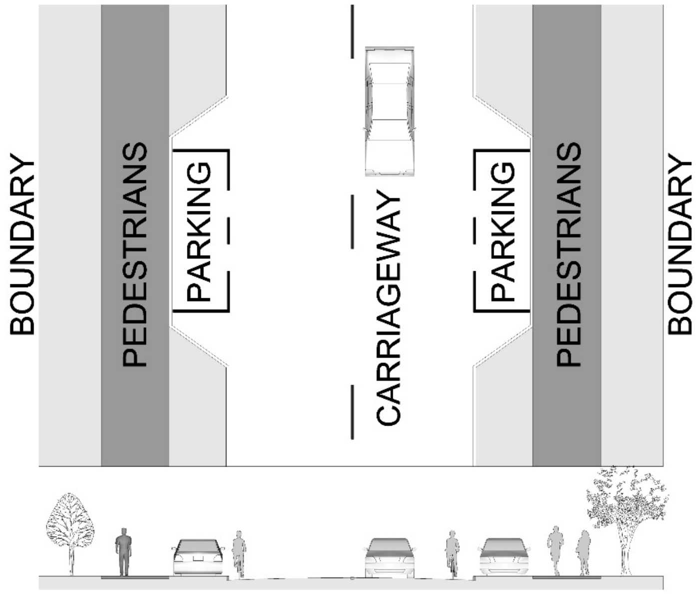


Figure E13 – Suburban, live and play, primary access to housing (up to 800 du)

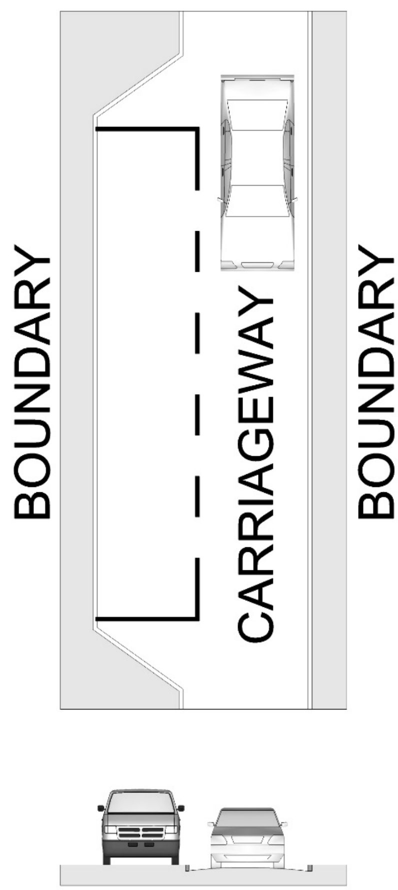


Figure E14 – Suburban, shop and trade, work and learn, side or rear service access

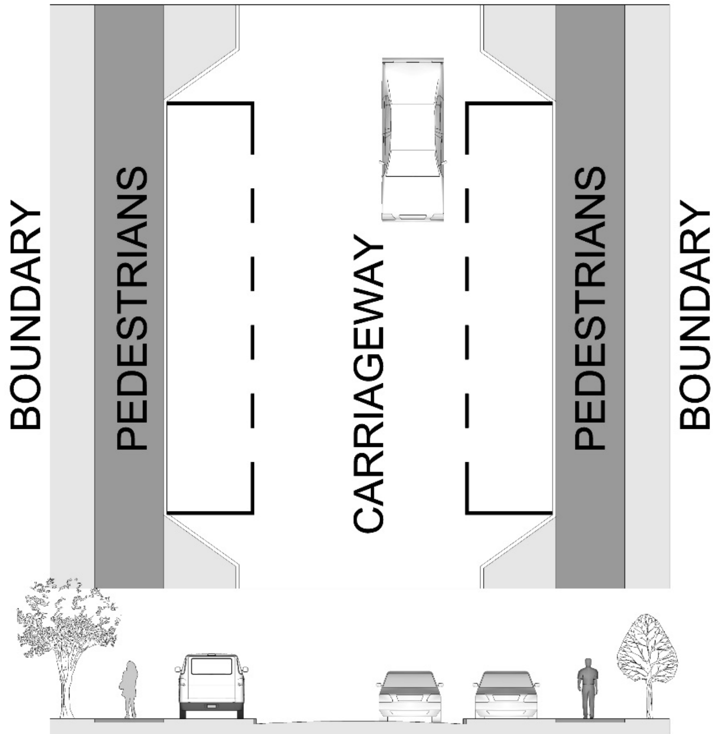


Figure E15 – Suburban, shop and trade, work and learn, access to trade, office, and education

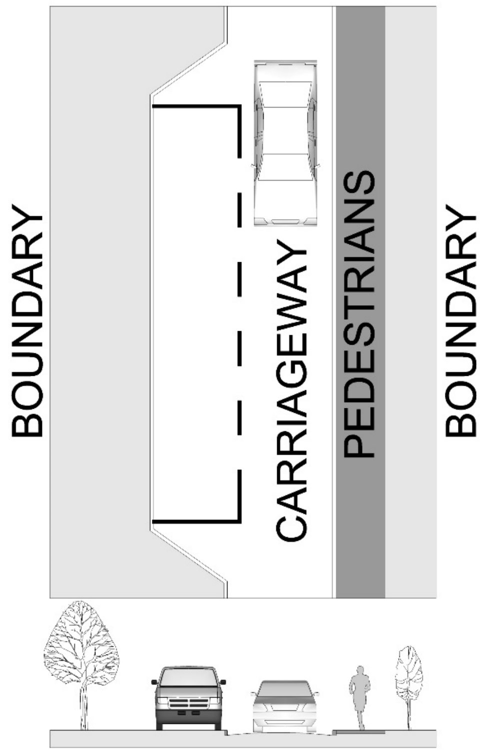


Figure E16 – Suburban, make and move, side or rear freight access

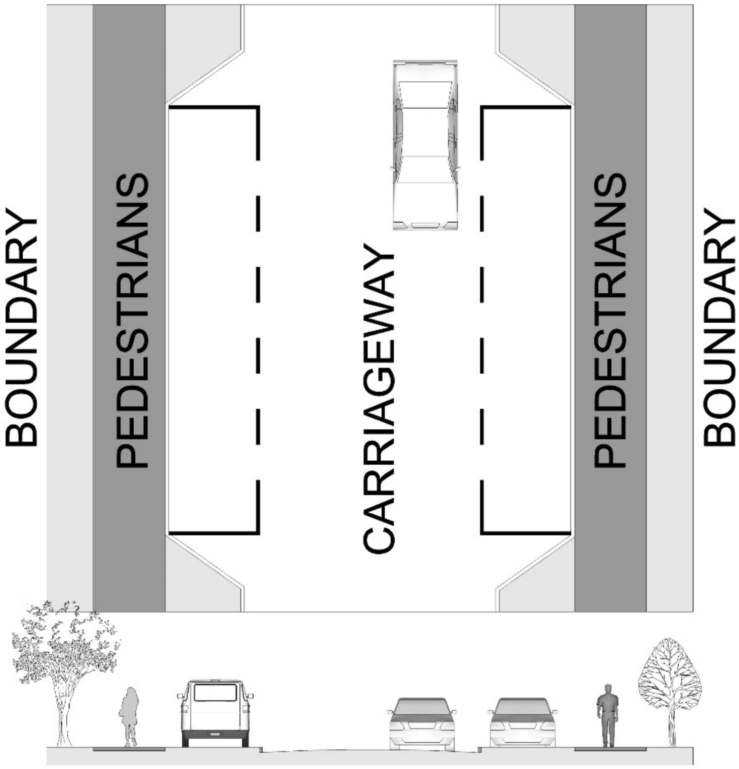


Figure E17 – Suburban, make and move, primary freight access

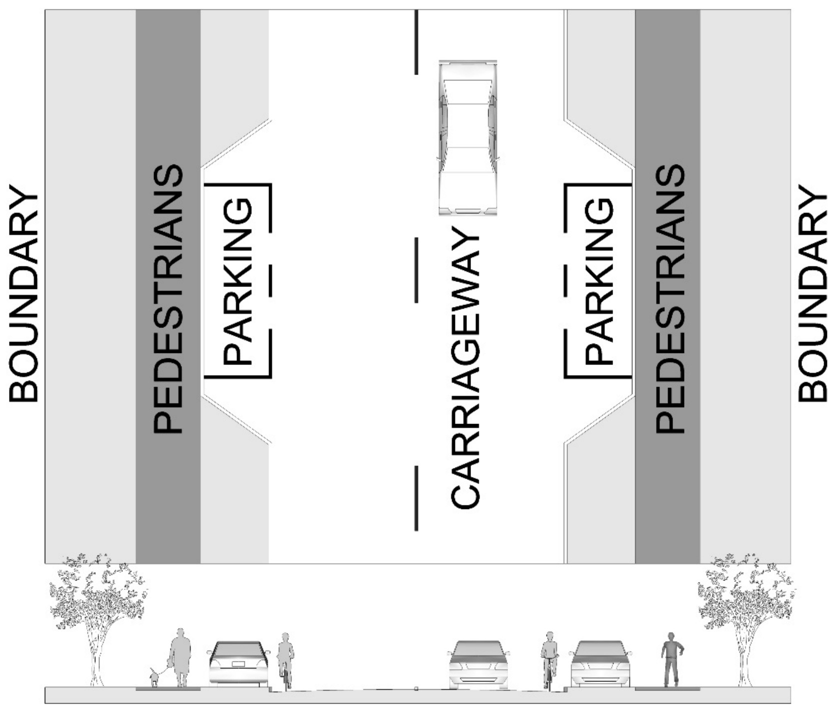


Figure E18 – Suburban, shop and trade, work and learn, make and move, all roads serving multi-purpose areas involving most or all of the indicated land uses, not specified elsewhere in table 3.3

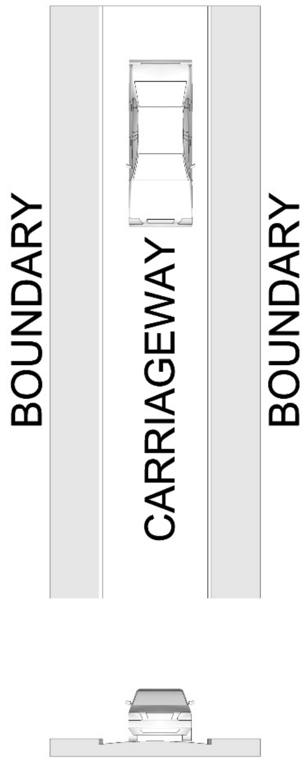


Figure E19 – Urban, live and play, access to lifestyle or clustered housing

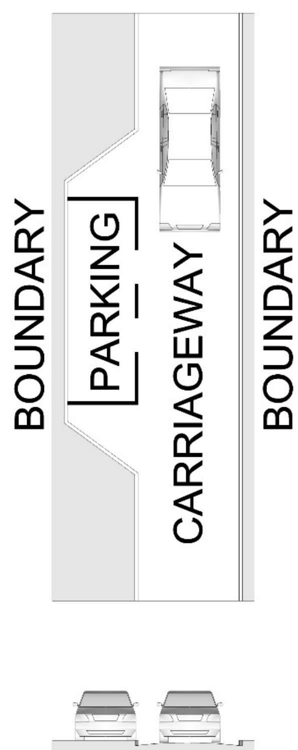


Figure E20 – Urban, live and play, side or rear service access

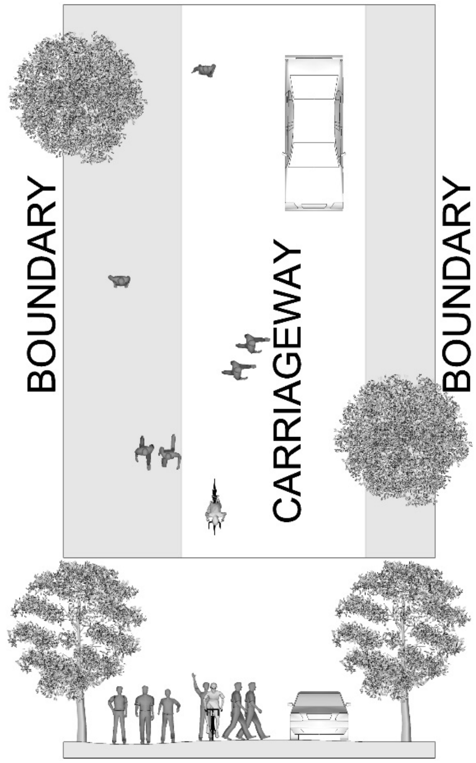


Figure E21 – Urban, live and play, access to houses/townhouses

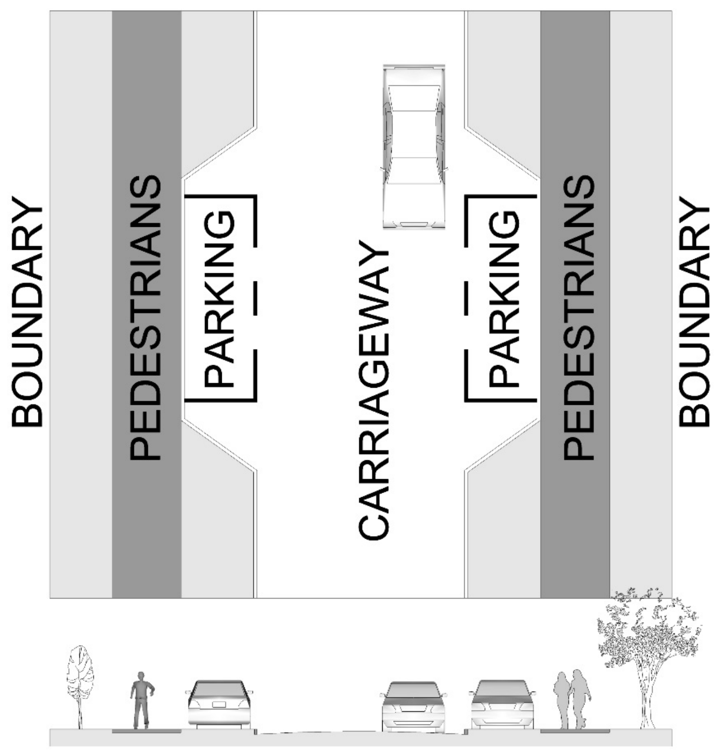


Figure E22 – Urban, live and play, primary access to housing

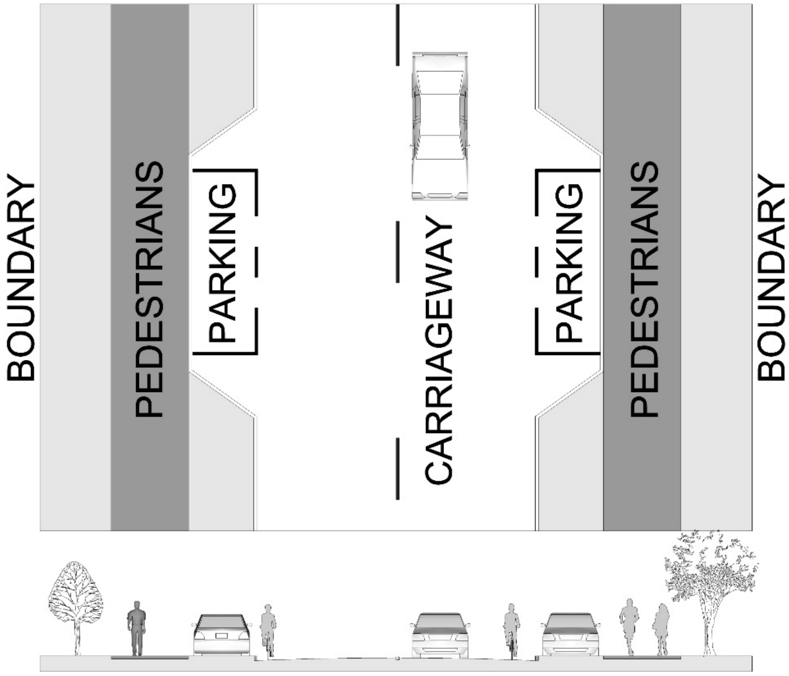


Figure E23 – Urban, live and play, all other land use activity types within this area type not specified elsewhere in table 3.3

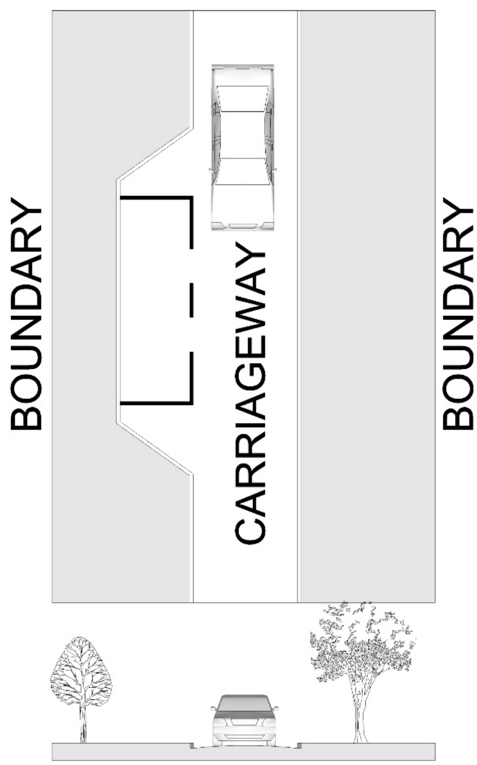


Figure E24 – Urban, shop and trade, side or rear service access

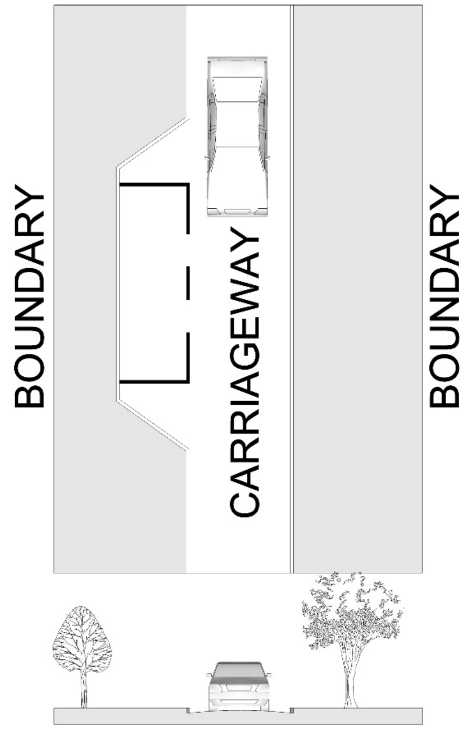


Figure E25 – Urban, shop and trade, access to lots, or shop or trade units

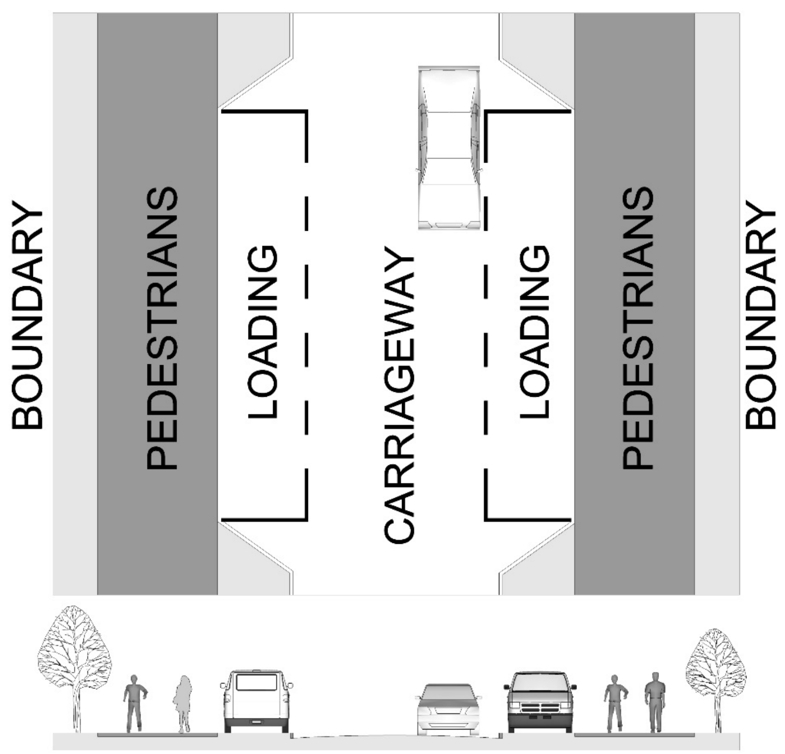


Figure E26 – Urban, shop and trade, primary access to trade

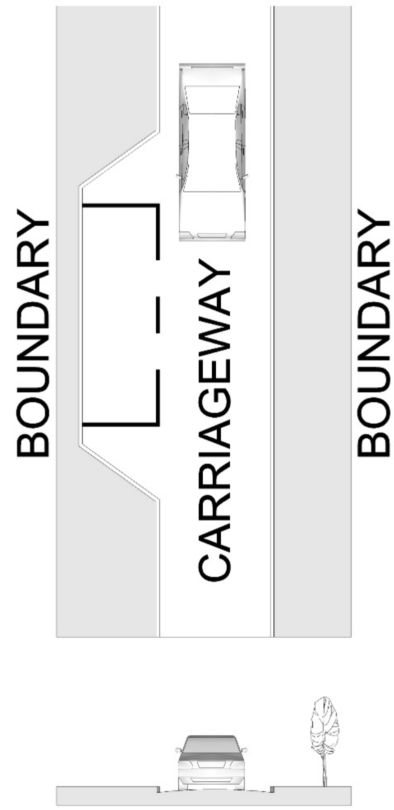


Figure E27 – Urban, work and learn, side or rear service access

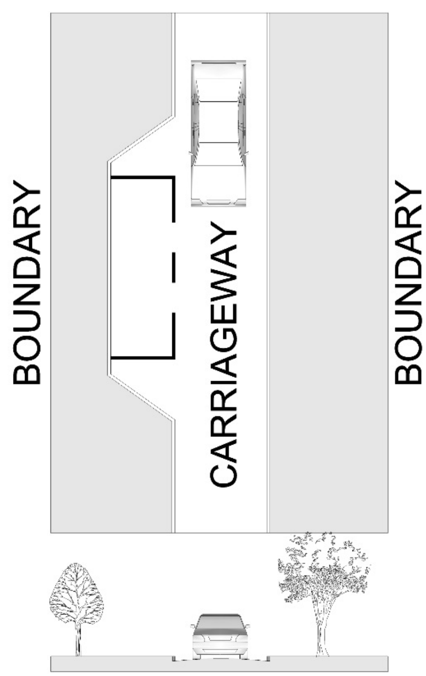


Figure E28 – Urban, work and learn, access to lots, or work or learn activities

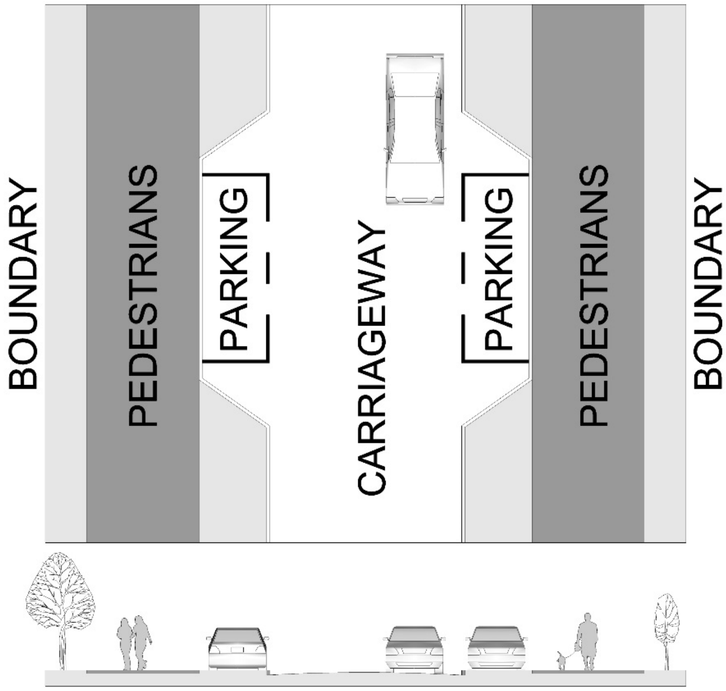


Figure E29 – Urban, work and learn, primary access to office and education

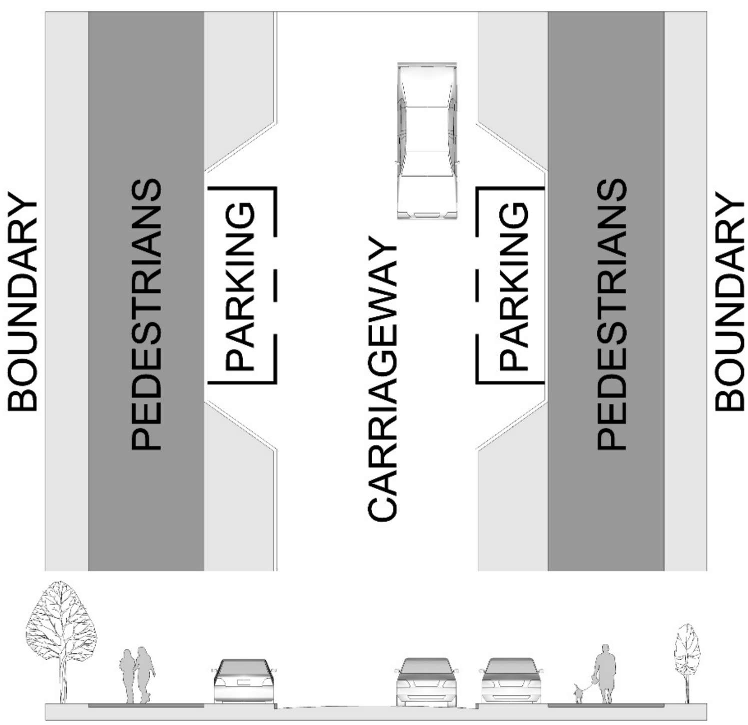


Figure E30 – Urban, mixed use, multiple user access

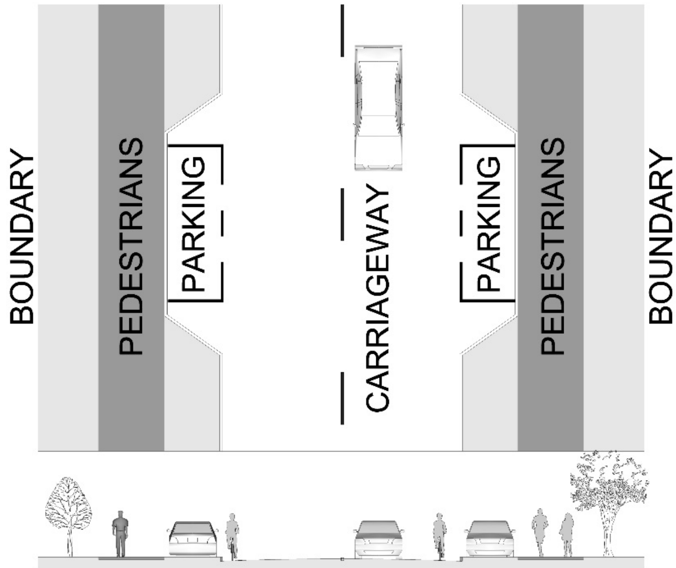


Figure E31 – Urban, mixed use, neighbourhood centres (and all other areas serving multiple land uses not listed elsewhere in table 3.3)

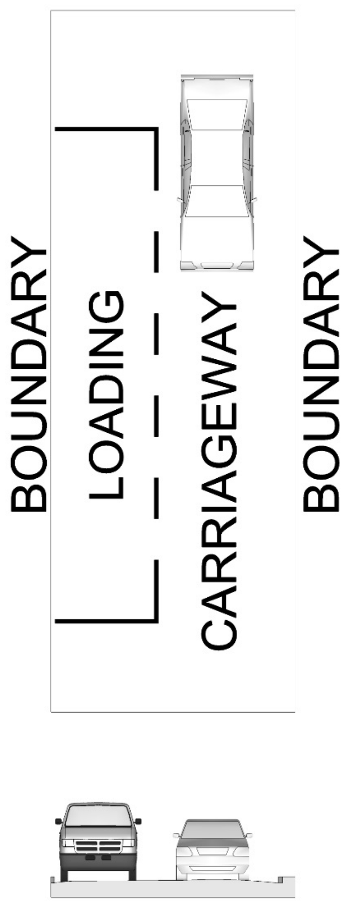


Figure E32 – Centre, mixed use, side or rear service access

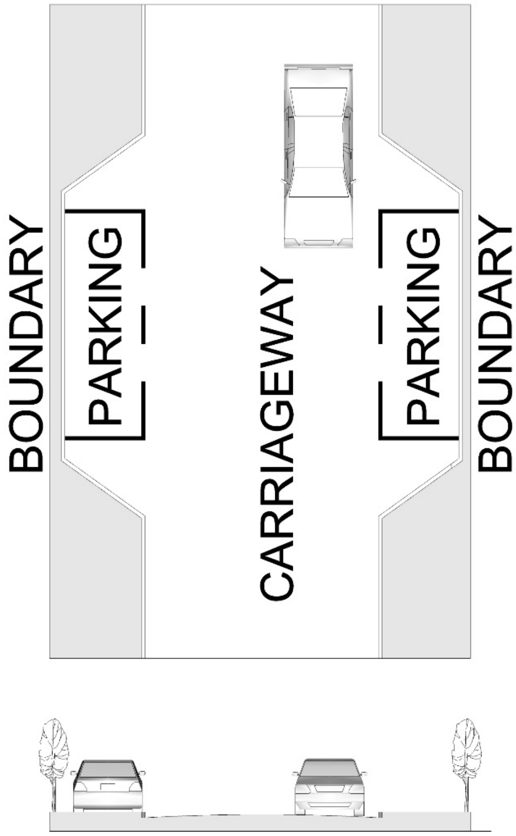


Figure E33 – Centre, mixed use, access to lots or mixed use activities

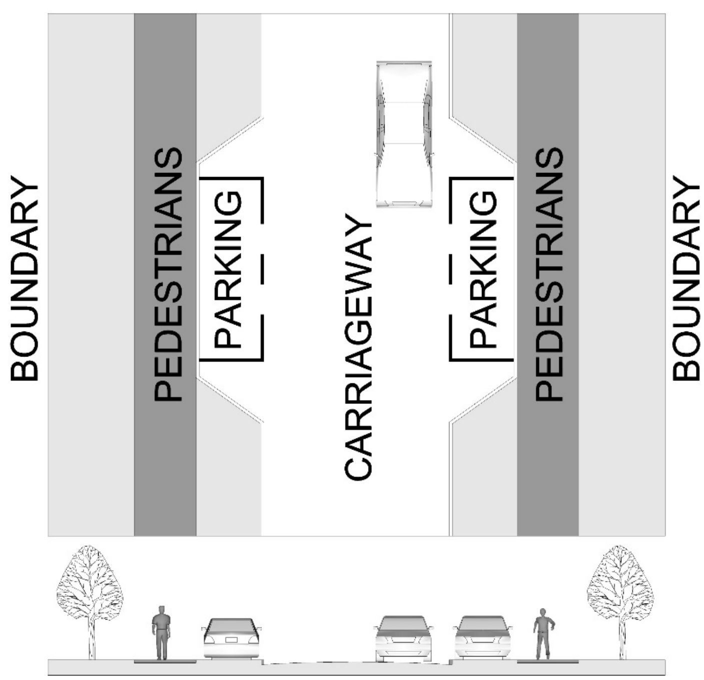


Figure E34 – Centre, mixed use, primary access and local movement

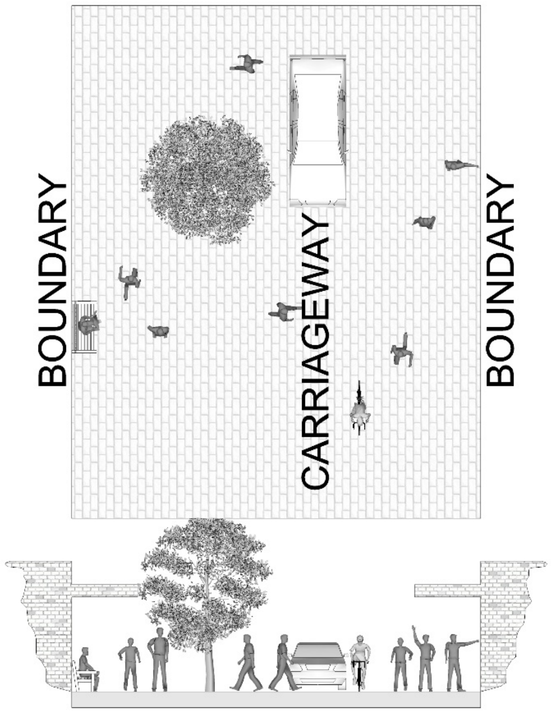


Figure E35 – Centre, mixed use, shared spaces, access way, mall, and community reserve

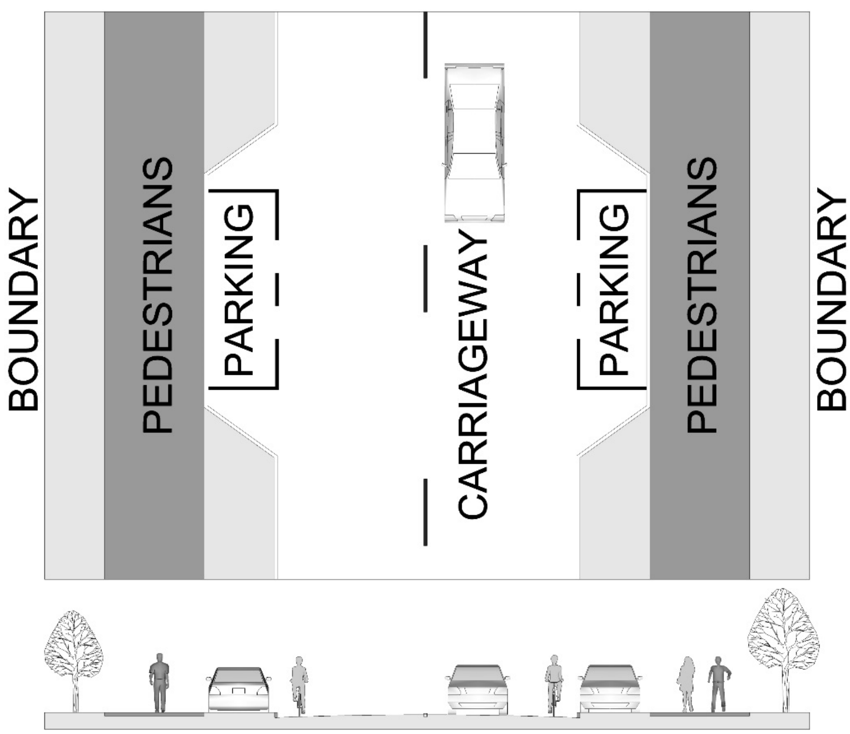


Figure E36 – Centre, mixed use, urban street

CONTENTS

1 MATERIAL AND INSTALLATION SPECIFICATION

1.1 GENERAL

1.1.1 Scope

This standard relates to the supply and installation of a permanent automatically controlled watering system.

It includes Drip Irrigation, Fixed Location Systems, fixed spray, pop-up spray, mist spray and trickle irrigation.

The irrigation system shall be designed and installed in accordance with all governing ordinances, laws and regulations that meet all local conditions.

1.1.2 Qualifications

Installers to be experienced, competent trades people familiar with the materials and techniques specified.

Designers to hold an NZQA National Certificate in Irrigation Design or equivalent.

1.1.3 Design

The irrigation system will comply with the following standards:

1.1.3.1 INZ Design Standards for Piped Irrigation Systems in New Zealand 2013

1.1.3.2 AS/NZS 3500. Plumbing and drainage Part 1: Water services

1.1.3.3 INZ Code of Practice for the Design of Piped Irrigation Systems In New Zealand 2013

1.1.3.4 AS/NZS 2845.1 Water supply - Backflow prevention devices - Materials, design and performance requirements

1.1.3.5 AS 2845.3 Water supply - Backflow prevention devices - Field testing and maintenance

1.1.3.6 INZ Irrigation Installation Code of Practice 2013

1.1.4 Design Evaluation

The design report as detailed in 1.91 will be submitted with the irrigation design plan so that the irrigation design and performance can be evaluated before QLDC approval.

1.1.5 Adherence to Design Plan

Contractor must carry out the installation of the system in strict accordance with the Council approved design plan. Any variations must be approved by the Irrigation Designer or Engineers representative. The correct components as specified must be installed.

1.1.6 Performance

Install an irrigation system in accordance with INZ Irrigation Installation Code of Practice 2013.

Meet statutory requirements for backflow prevention.

The uniformity performance indicator units for the individual spray heads and nozzles at the spacing's on the irrigation layout plans shall be greater than:

> Coefficient of uniformity (CU) 85%
> Distribution uniformity (DU) 0.80
> Scheduling coefficient (SC) 1.3

Minimum Sprinkler Operating Pressures:

> Spray Heads 200 kPa
> Rotating Sprinkler up to 7.0m Radius 300 kPa
> Rotating Sprinkler over 10.0m Radius 350 kPa
> Rotating Sprinkler over 14.0m Radius 400 kPa
> Drip Irrigation 200 kPa

Maximum Pressure differential within a sprinkler zone 7%.

Maximum zone water velocity 2.0 m/sec.

Maximum mainline velocity 1.50 m/sec.

The irrigation window for replacing 5mm ET is a maximum cycle time of 5 hours per night to avoid vandalism.

1.1.7 System Pressure Test

It shall be Contractor's responsibility to demonstrate two successful pressure tests: The first at 224c certification the second 12 months after 224c certification sign off.

This will involve first isolating all points of connection to previously existing pipe where they are present.

Pressure testing shall be done in conjunction with the Engineer. The line will be retested until satisfactory. It shall be the Contractor's responsibility to provide all equipment required for the pressure test and provide suitable connection ports. At the point where the system can be pressurised, a 25mm ball valve shall be installed to enable the connection to be made without depressurising the system.

1.1.8 MDPE Pressure Test Procedure

1.1.8.1 As per QLDC Code of Practice Appendix C

Where the initial pressure test fails, the cost to the Council of supervising subsequent tests shall be deducted from the payments.

Where an irrigation system fails the pressure test and yet the leak is unable to be detected by the Contractor, the Contractor shall be required to pay for a professional leak detection service.

1.1.9 Commissioning

Prior to planting or seeding an area, the irrigation contractor shall be required to demonstrate that the system is correctly adjusted and ready to be used on the areas that are being planted.

1.1.9.1 Flush system thoroughly, check heads, sprays and drippers and clean if blocked. Clean strainers. Adjust system for even distribution with no dry areas.

1.1.9.2 The acceptable deviation from the design specification will be:

> flows ±5%
> pressures ±5%
> uniformity - not more than 2% (or 0.02) under the supplied
> performance as submitted for clause 1.3

The system shall be test-run and the correct operation of all components checked. Sprinkler zones should be verified to conform to the approved plan. Sprinkler radius and arc’s will be adjusted to avoid overthrow outside of the required irrigation areas.

Once commissioning is complete, arrangement shall be made to demonstrate the system to representatives of the Council and/or the Engineer.

1.1.10 Handover Manual

Two operations manuals for the control system, sprinklers, valves and fittings shall be provided to the Engineer and a laminated copy of the irrigation as-built plans is to be placed inside the control box. The plans should identify each station for ease of operation. The manuals shall include the following.

1.1.10.1 Summary Irrigation Report

The summary report as detailed below.

1.1.10.1.1 Description of Systems

Description of the normal operating characteristics of the irrigation system and operating level.

1.1.10.1.2 Design Brief

General description of irrigation system and what and how it irrigates the different areas.

1.1.10.1.3 Sprinkler Pressure

The sprinkler pressures in each zone detailing the nominal, minimum and maximum for each sprinkler type.

1.1.10.1.4 Valve Operating Pressures and Flows

The require set pressure and flow used on the downstream side of each valve in the irrigation system.

1.1.10.1.5 Water Supply

1.1.10.1.5.1 Number of Supply Take Off points

Number of water supplies in system.

1.1.10.1.5.2 Size off Take Point

The take off connection size for and number of connections.

1.1.10.1.5.3 Maximum Flow of Water Supplies

The maximum flow from each water supply.

1.1.10.1.5.4 Flow and Pressures at Water Supply Take off Points

The flow and pressure requirement for of each irrigation zone at the water supply.

1.1.10.1.5.5 Filtration

Filtration required.

1.1.10.1.6 Sprinkler Run Times

1.1.10.1.6.1 Application rates

Application rates or the sprinklers used.

1.1.10.1.6.2 Zone run Times

The expected zone run times based on an evaportranspiration (ET) rate of 5mm per day.

1.1.10.1.6.3 Maximum System Run Time

The maximum expected system time base on 5mm application per day.

1.1.10.1.7 Water Usage Total

Total water used per day per irrigation cycle replacing 5mm ET.

1.1.10.1.8 Details of the process to follow in the event of a warranty claim.

1.1.10.1.9 The expiration date of the warranty for every item.

1.1.10.1.10 Make, model, size, specification, and date codes of all products.

1.1.10.1.11 Operation manuals or brochures on the valves and sprinklers.

1.1.10.1.12 Spare parts data.

1.1.10.1.13 Trouble shooting information.

1.1.10.1.14 Testing information.

1.1.10.1.15 Successful pressure test certification.

1.1.10.1.16 IQP certification of backflow preventor (if applicable).

All of the above information is to be provided in a addable electronic format and a PVC 3-ring or 4-ring binder. All loose sheets are to be laminated. The name and address of the installing Contractor and that of the company supplying the product (if different) is to be included on the front page of the binder.

The 'as-built' plan, operations manual and commissioning are required for practical completion. The Contractor is to complete and submit to the Engineer the Council's 'asset data information sheet'.

1.1.11 Practical Completion

The Contractor is to liaise with the Engineer and nominated surveyors, to ensure the location of all system components are captured accurately. The following information shall be required:

> The location and depths of all pipe, sprinklers, valves (solenoid, ball and quick coupler) valve boxes, cabling, cable joints, controller, rain switch and soil moisture sensor (if applicable).
> The make and model information of all products, including those in the head works which may already be present (e.g. backflow preventer and water meter).
> Any cable/tubing joint not within a solenoid valve box.
> The size, type and pressure rating of all pipe work.
> Any service locations found outside of the originally documented locations.
> Changes in mainline pipe direction and dimensions and offset measurements for all pipes and pipe junctions.

1.1.12 As Bult Plan

As the system progresses on a daily basis an accurate record of the location, type and size of all sprinklers, fittings, pipes and cables shall be maintained, preferably as a CAD file.

The as-built plan shall clearly illustrate with respect to permanent landmarks, based on dimensioned triangulation from at least two fixed above ground permanent points.

All information and data shall be submitted to the QLDC as per section 1.8.10 (QLDC Code of Practice).

1.1.13 Warranty

The entire system shall be warranted against defective materials and workmanship for the period of 12 months from the ate of practical completion. However certain component products shall have extended warranties:

> Irrigation Sprinklers - Minimum of 3 years
> 25mm Solenoid Drip Control Valves - Minimum of 3 years
> 25mm & 40mm Solenoid landscape Control Valves - Minimum of 5 years

1.1.14 System Maintenance

During the maintenance period the contractor shall be responsible for making good any defects or faults that may occur, including leaks, sprinkler malfunction, control valve malfunction and trench subsidence.

The contractor shall respond to any defects bought to his attention by the client within 2 days.

2 MATERIAL SPECIFICATION

2.1 SPRINKLERS

2.1.1 General

Generally, sprinklers shall be laid out as shown on the plans, but in all cases, adjusted to provide correct and effective coverage of areas as constructed.

2.1.2 Popup Spray Heads

The sprinkler shall feature combination full circle and part circle matched precipitations spay nozzles with a 100mm pop up height. The sprinklers shall have a 15mm (1/2”) BSP female threaded connection and the riser shall be ratcheting to allow easy arc adjustment. Sprinklers shall be operated in groups by solenoid valves as shown on the irrigation plan. Refer Standard Drawing Layout D- 7.

2.1.3 Popup Rotating Sprinklers 20mm

The sprinklers shall feature combination full circle and adjustable part circle drive assemblies. The sprinklers shall have a 20mm (3/4”) BSP female threaded connection and a check-O-matic anti-drain value capable of holding back at least 3 metres of elevation. The riser shall have a pop up height of at least 127mm (5”). Sprinklers shall be operated in groups by solenoid valves as shown on the irrigation plan. Refer Standard Drawing Layout D- 8.

2.2 DRIP ZONES

2.2.1 General

Trees shall be irrigated with two drippers. Pipe work to the trees shall be generally as shown on the plan. Landscape inline drip pipe will be typically spaced at 600mm between laterals and 300mm from the beginning of each planted area.

2.2.2 Drippers

Each tree shall be irrigated with two pressure compensated 4.0 litre per hour drippers attached to a 13mm lateral pipe. The two drippers shall be connected via the 15mm LDPE to the 13mm lateral pipe (500KPa rated) which is to be installed in a ring around the two trees.

The dripper shall connect directly into the lateral pipe and be capable of being taken apart for cleaning. In the event that LDPE dripper lateral pipe is under paving or concrete then the LDPE Lateral will be installed 300mm into the tree pit. Drippers shall be capable of being taken apart for cleaning.

Refer Standard Drawing Layout D- 6.

2.3 VALVES

2.3.1 Solenoid Control Valve Assemblies

The landscape turf and dripper stations shall be controlled with solenoid operated control valves. These will be sized as per the manufactures recommendations. Valves shall be fitted with adjustable pressure regulators specifically designed to fit the solenoid valve. Alternatively, preset or adjustable “in-line” type pressure regulators may be used for small flow drip stations; these shall be set that the downstream pressure is a maximum of 3 Bar. All valves shall feature BSP female threaded inlets, have flow control and internal bleed for manual operation.

In addition, those valves controlling drip zones shall incorporate a 120 mesh filter in the assembly to provide the drippers protection from any debris in the lines.

All solenoid valves will be housed in valve boxes and have manual isolating fitted upstream of the valve. Refer Standard Drawing Layout D- 3.

2.3.2 Lateral Isolation Valves

All lateral isolation valves shall be fig. 125 bronze gate valves, DR rated for in ground use. Valves shall be pressure rated at not less than 14 Bar.

2.3.3 Drip Lateral Isolation Valves

The isolation valve to each section when required shall be a 15mm or 20mm ball valve.

2.3.4 Quick Coupling Valves (QCV)

All quick coupling valves shall be 25mm (1”) BSP female threaded brass valves with single lug key. All quick couplers shall be housed in valve boxes. All QCVs shall be connected to the mainline with swing joint risers to allow correct levelling. All QCVs shall be securely anchored in the ground with a stabilising bar and stainless steel U bolt clamp.

2.3.5 Valve Boxes

All valve boxes shall be constructed from high impact plastic or galvanised steel. They must be able to support the weight of a vehicle without damage. Valve box lids shall be of the bolt-down type and be supplied with bolts fitted.

The following valve box sizes shall be used:

> Lateral Isolation Valves 6” Round
> Landscape & Drip Solenoid Valves 12” Rectangular
> Dripper Lateral Manual Valves 6” Round
> Cable Joints 6” Round
> Water meter, Backflow preventer 22.5” Rectangular

Also refer Standard Drawing Layout D- 1, D-2, D-3, D-4 and D-5.

All valve boxes shall feature T section lids so that the lid is fully supported by the body of the box.

2.3.6 Backflow Preventors

Each connection to the potable water supply must be protected by a double check valve backflow preventer assembly housed in a protective valve box, as detailed in the Standard Drawing Layout D- 1 and D-2.

2.3.7 Wate Meter

Each cnnection to the potable water supply must have a water meter installed immediately upstream of the back flow preventer. The water meter shall be housed in a protective valve box, as detailed in the Standard Drawing Layout D- 1 and D-2. Meter type as per QLDC water metering policy.

2.4 PIPEWORK

2.4.1 General

The use of solvent weld fittings is not permitted.

2.4.2 Mainline

All pipes under constant pressure shall be uPVC to AS/NZS 1477, rated to 12.5 Bar, or PE100 PN12.5 to AS/NZS 4130, rated to 12.5 Bar. Pipes sized 100mm and above shall be PE while those below 100mm shall be MDPE.

2.4.3 Lateral

All lateral pipes downstream of a solenoid valve shall be PE 80B to AS/NZS 4130, rated to PN 9 (9 Bar).

2.4.4 Dripper Laterals

All lateral pipe downstream of the drip zone control valves shall be LDPE, sized as shown on the plans. The LDPE shall be manufactured to (NZS 7601), the following pressures shall apply 15mm – PN9.7, 20mm – PN 9, 25mm PN8.

The end of each lateral shall be terminated in a valve box with a threaded cap/plug to allow flushing.

2.4.5 Dripper Take Offs

From the LDPE lateral a 13mm lateral pipe will be installed in a ring around the tree. Refer Standard Drawing Layout D- 6.

2.5 FITTINGS

2.5.1 PVC Mainline Fittings

All mainline PVC pipe fittings shall be ductile iron with rubber ring or flanged connections. Cast iron or gun metal tapping bands shall be used for valve take offs. All mainline tees and bends shall be ductile iron. All flange connections shall be made using galvanized nuts, bolts and washers.

2.5.2 PE Fittings

All fittings for PE pipe shall be compression type. Take-offs for sprinklers shall be PE tapping saddles, manufactured to NZS/AS 4129, rated to PN 16.5 (16 Bar).

All tapping saddles shall have stainless nuts and bolts and a stainless retaining ring around the threaded section of the saddle.

2.5.3 LDPE Fittings (PN9)

LDPE pipe in the drip irrigation zones shall be joined with Hansen or Anka fittings designed for the purpose and manufactured to NZS 7601.

2.5.4 Inline Drip Fittings

All inline drip pipe shall be joined with Anka 15mm fittings.

2.5.5 Sprinkler Risers

All gear drive sprinklers shall be mounted on swing joint risers.

All sprinklers with an inlet 20mm and greater shall be mounted on articulated risers comprising 3 threaded MF elbows and a 300mm long threaded nipple. All swing joint risers shall have a nominal lay length of 300mm.

All Spray sprinklers shall be connected to the reticulation system comprising two BSP thread barbed elbow (with 4 barbs) and a 300mm length of 15mm LD polythene pipe. Refer standard drawing D7 and D8.

2.6 ROAD, BRIDGE & STREAM CROSSINGS

2.6.1 General

Where pipe crosses a bridge or stream, fusion or butt welded polyethylene pipe shall be used. The PVC pipe shall be terminated with a flange fitting to which the polyethylene flanges will be connected. The transition point and any elbows required shall be secured with thrust blocks to prevent movement. Refer to plan for PE pipe sizes.

The pipework shall be securely strapped to the bridge structure at no more than 1m intervals.

A drain down point shall be fitted to discharge the mainline at each stream crossing. This shall consist of a fusion tapping saddle and 50mm lever ball valve.

Wiring where applicable shall be installed in electrical ducting and securely strapped to the bridge structure at no more than 1m intervals.

2.6.2 Road & Path Crossings

With sizes equal too and less than 63mm a 100mm duct will be installed and when required a 50mm electrical duct complete with draw wire will be installed beside the 100mm duct. Pipes under roads will be installed to a minimum depth of 1m cover. Refer Standard Drawing Layout D- 9.

2.7 CONTROL SYSTEM

2.7.1 General

The control system can be battery powered controllers for irrigation which is used for establishment only. Irrigation which is required to be permanent controlled shall be the conventional AC powered controller suitable for outside installation. Decoder systems can be used on systems which have a greater station count than 24 valves. Decoder system are more acceptable to surge damage and general require a high level of technical expertise when trouble shooting.

Automatic controllers shall be provided for irrigation systems. These should be of 240 volt power supply.

The Controllers are solid state with the state of the art controller technology, which will provide the versatility required for operating the proposed irrigation system. They shall be housed in a protective plastic cabinet and some of their features are:

- Three independent programs, two that can run concurrently.
- Simple program review.
- Water budgeting.
- Programmable valve test.
- Self-diagnostic circuit breaker.
- Non-volatile memory.
- Time battery backup.
- Two year warranty

Battery controllers shall be submersible up to 2m in water as per IP-68 standards with a 2 year warranty. Batteries shall last for a minimum of 1 year's operation.

2.7.2 Control Cables

Cable from the field to the valves or sprinklers shall be multi core polyethylene sheathed cable.

Minimm wire size shall be 1.5mm2. In all cases, one of the cables in multi core shall be black to denote the common wire. No joints shall be made between the irrigation control unit and the valve.

2.7.3 System Grounding

The control system shall have equipment as recommended by the manufacturer to provide surge protection to the irrigation field units. In most circumstances this will be a copper clad earth rod installed in a 150mm valve box connected via 16mm2 copper cable to the irrigation field unit.

2.7.4 Wire Connectors

All wire joints shall be made using grease filled type connectors suitable for below grade burial. King type or 3M DBY or 3M DBR connectors shall be used.

2.7.5 Metallic Detector Tape

150mm above the pipe a metallic detector tape printed with the works "Water Pipe Below" shall be laid over the position of the pipe line. Refer standard drawing layout.

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3 INSTALLATION

3.1 SPRINKLERS

All pipe work shall be thoroughly flushed prior to any sprinklers being installed. The sprinklers shall be screwed on to the swing joint and set level with the surrounding ground by using a 500mm straight edge. A 400mm square of biodegradable coir matting shall be placed around each sprinkler to stabilise the soil around the sprinkler and provide a suitable environment for the seed to strike.

Soil around the sprinkler shall be compacted to prevent the sprinkler sinking. The sprinkler shall then be tested for correct operation and arc of coverage. Refer Standard Drawing Layout D- 7 and D-8.

3.2 DRIPPERS

Drippers shall be installed underneath the bark mulch Refer Standard Drawing Layout D- 6.

3.3 VALVES

3.3.1 Solenoid Control Valves

All solenoid valves shall be installed in rectangular valve boxes. Threaded rigid PVC risers shall be used to ensure the valve sits a maximum of 100mm beneath the lid of the valve box for ease of maintenance. The valve assembly shall be centrally located within the box, and no part of the box shall be in contact with any part of the valve or connecting pipe work.

The valve assembly shall be fitted such that it is clear of any soil or backfill material. A 75mm layer of gravel shall be packed under each valve.

Drip zone valves shall incorporate a pressure regulator and 120 mesh filter.

Pressure regulators shall be adjusted to ensure the downstream pressure on the drip zones does not exceed 3 Bar. Refer Standard Drawing Layout D- 3 and D-5.

3.3.2 Mainline Isolation Valves

All mainline sluice valves shall be installed such that the operating nut is vertical, not on an incline. A 250mm (10”) culvert pipe or similar shall be cut to fit around the valve and extend up into the valve box to allow easy access and prevent soil burying the valve.

All mainline sluice valves shall be correctly thrusted to prevent their movement as detailed in QLDC plan W05.

3.3.3 Lateral Isolation Valves

Lateral valves shall be installed at mainline depth. A 150mm duct tube shall be cut to fit over each valve operating handle and extend up into the valve box for operation with an extension key. Refer as detailed in QLDC plan W05.

3.3.4 Backflow Preventer

A line strainer shall be installed immediately upstream of the back flow preventer and its valves. An isolating valve must be installed upstream of the line strainer. The backflow preventer, line strainer and all associated valves shall be installed in an approved valve box that provides adequate access for testing and servicing, with the lid accessible at finished grade level. The assembly shall comply with the Water supplies Protection act 1961/87, in accordance with the practical solutions of the Building act 1991 for a medium hazard connection. The backflow Preventer must be tested by an independently qualified person (IQP) Refer Standard Drawing Layout D- 1 and D-2.

3.3.5 Water Meter

A water meter shall be installed immediately upstream of the back flow preventer and its valves. The water meter shall be installed in an approved valve box that provides adequate access for testing and servicing (425mm x 575mm), with the lid accessible at finished grade level. Install with minimum of 10 pipe diameters upstream and 5 diameters downstream. Refer Standard Drawing Layout D- 1 and D-2.

3.3.6 Quick Coupling Valves

All quick couplers shall be housed in valve boxes. All QCVs shall be connected to the mainline with swing joint risers to allow correct levelling. All QCVs shall be securely anchored in the ground with a stabilising bar and stainless steel U bolt clamp.

Where drip isolation valves are used they shall be isolated with a lever ball valve.

These shall be housed in 150mm (6”) boxes, located as close as possible to the LDPE feeder pipe.

3.3.7 Valve Boxes

All valve boxes shall be installed on treated timber or brick supports to prevent them settling. All valve box lids shall be set flush with surrounding ground. Where possible valve boxes shall be installed off pedestrian areas.

3.4 PIPEWORK

3.4.1 General

Pipe work installation involves the trenching, bedding, laying backfilling and commissioning of the pipe work system as shown on the plans.

3.4.2 Trench and Backfill

As per section 6.5 ‘Construction’ from the QLDC Land Development and Subdivision Code of Practice:

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 drawings CM – 001 and CM – 002.

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 B drawing CM – 002.

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 CM – 002.

3.4.3 Pipework

All mainline pipes shall be installed to provide 1m of cover over the pipe in roads, with all other areas being a minimum of 400mm. All pipework shall be joined in accordance with manufacturer’s instructions. Refer Standard Drawing Layout D- 9.

3.4.4 Thrust Blocks

Concrete thrust blocks cast in situ shall be installed on the PVC mainline at each bend, tee, sluice valve or end of line to prevent movement. Pre cast blocks shall not be used. Prior to pouring concrete, the pipe and fittings shall be wrapped in polythene sheet. The thrust block shall be constructed in such a way that the load is evenly spread over a vertical trench wall in undisturbed ground.

3.4.5 Dripper Laterals

The LDPE laterals may be installed by mole plough as long as the minimum depth of 400mm is obtained, dripper, refer standard drawing layout. The lateral pipe must be flushed before the installation of drippers shall be installed on a 13mm lateral ring around the tree. Refer standard drawing layout.

The end of each 15mm lateral shall be fitted with a threaded end cap or in the case of a ring main shall be fitted via a tee to facilitate flushing prior to installing the dripper and for future maintenance.

3.4.6 Inline Drip Pipe

Inline drip pipe for landscape plantings shall be installed on top of the ground and securely anchored by ground staples at 1 metre intervals. Lateral lines supplying water to the in line drippers shall be thoroughly flushed so as to prevent any blockages in the inline drippers. The in line drip pipe will be covered by a bark mulch.

3.4.7 Fittings

All fittings shall be installed in accordance with manufacturer's instructions and in accordance with their intended design use.

3.5 CONTROL SYSTEM

3.5.1 General

All electrical work shall be carried out in accordance with relevant.

New Zealand standards and codes of practice by experienced personnel.

3.5.2 Field Control Cabling

All wire from the irrigation control unit to the valves shall be run in continuous lengths, no joins are permitted in these cables. The cable shall be laid beside the pipe. At joints and valves, 500mm of slack cable shall be left to allow the valve wiring to be completed with ease above ground.

At the control location each pair of wires shall be clearly labelled with the station number that they operate for ease of installation. All wire shall be laid in the trench adjacent to the pipe, the cable shall be 'snaked' and an expansion loop shall be left at bends and tee junctions to avoid stretching the cable when backfilling. The cable shall be laid on one side of the pipe, it shall not be laid crossing over the pipe.

At points where thrust blocks are to be poured the cable must not be buried in the concrete.

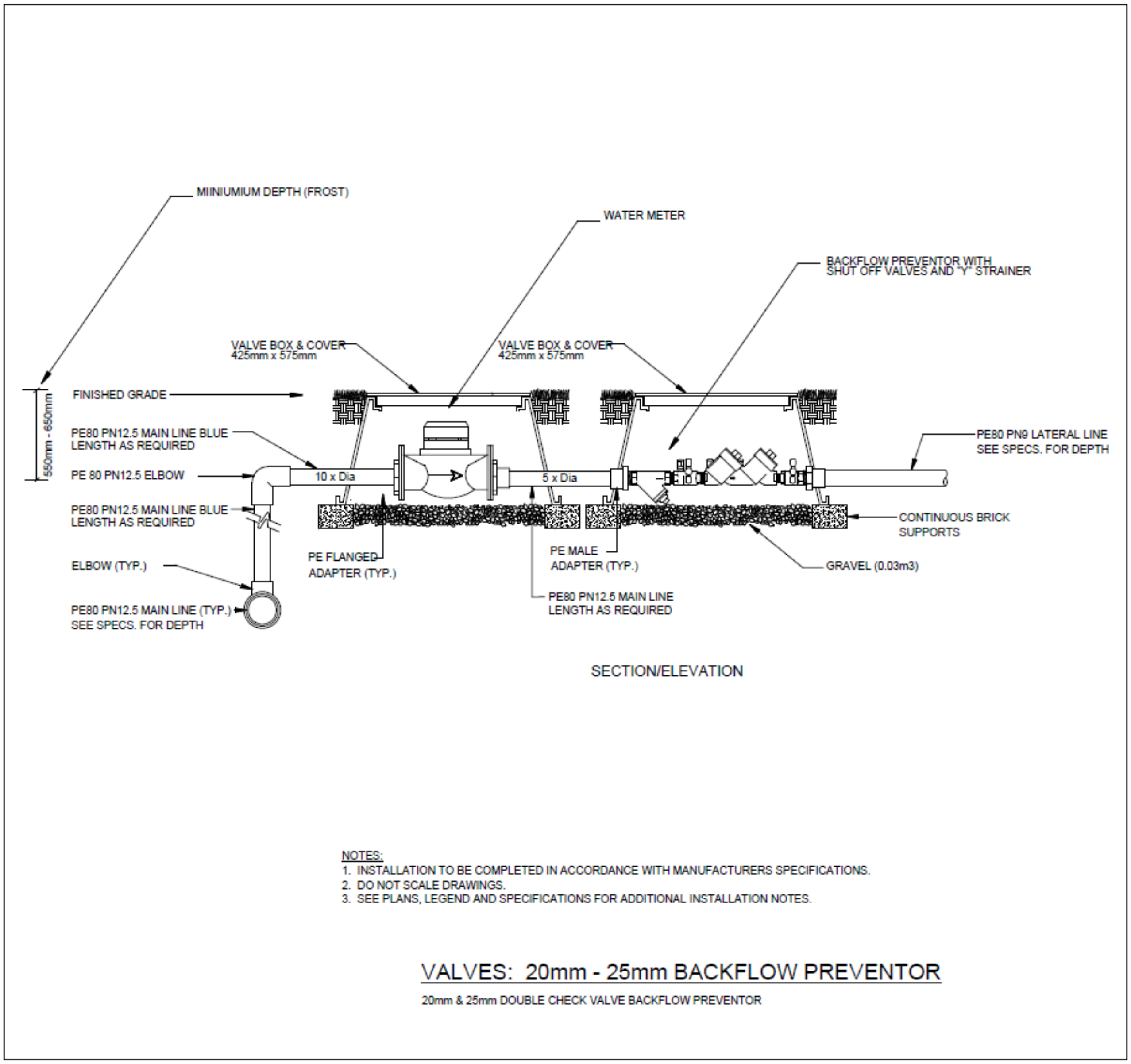
Wherever a cable junction is to be made there shall be at least 500mm of spare cable that can be brought above ground for ease of maintenance.

An accurate record of each control unit number and the stations they operate shall be maintained as the installation progresses. This shall be transferred to the controller as soon as possible and on a frequent basis.

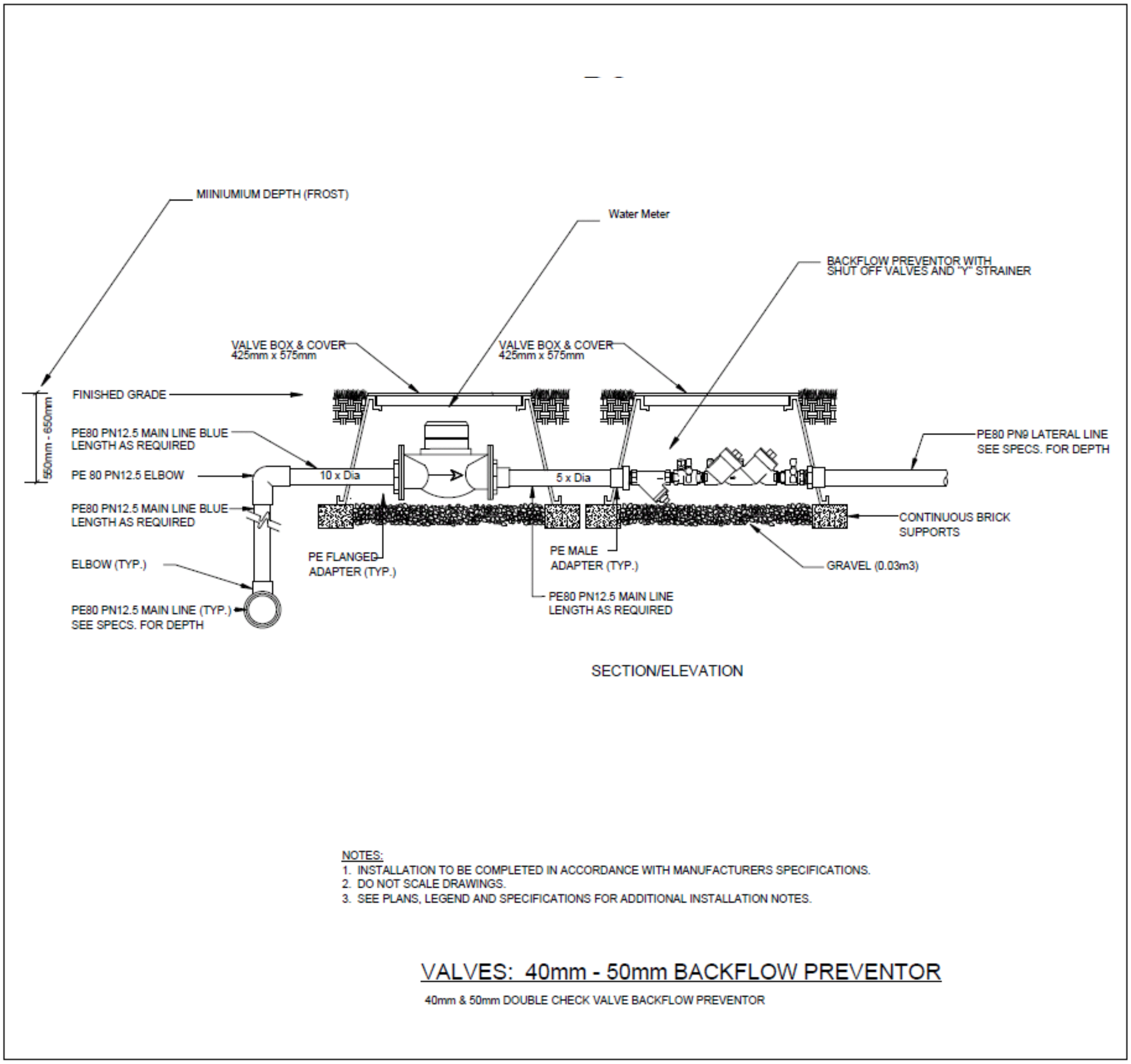
3.5.3 Irrigation Control Units

Controllers shall be installed as per the local authority codes and manufactures recommendations. Controllers shall also be earthed independently of the building earth. This earth shall have a maximum resistance as tested of 10 Ohms.

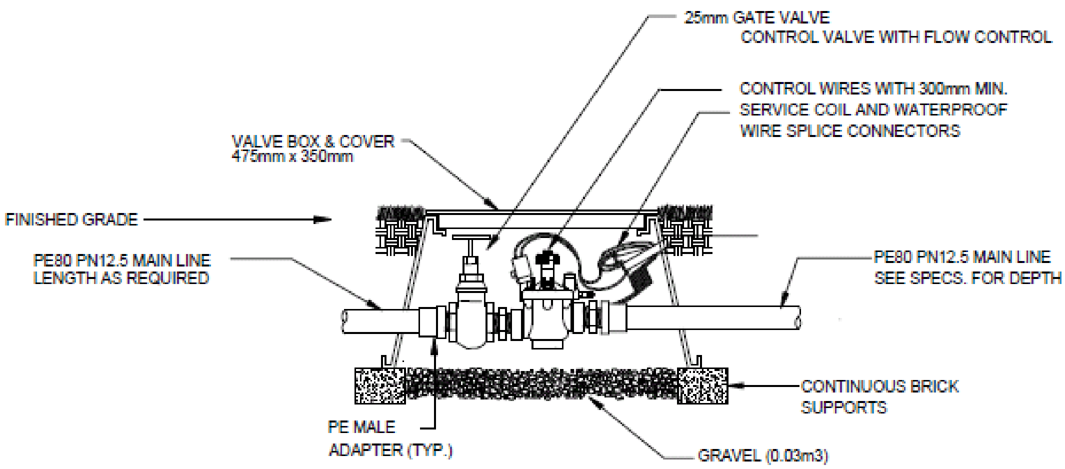
4 IRRIGATION STANDARD DRAWINGS



Standard Drawing Layout D- 1: Connection 20mm – 25mm



Standard Drawing Layout D- 2: Connection 40mm – 50mm



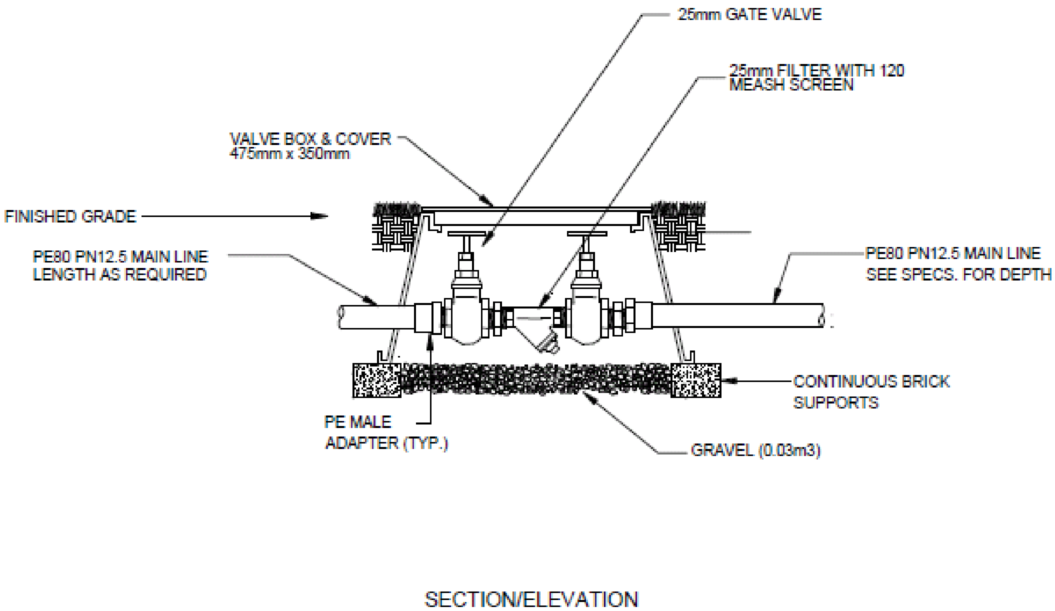
SECTION/ELEVATION

NOTES:
1. INSTALLATION TO BE COMPLETED IN ACCORDANCE WITH MANUFACTURERS SPECIFICATIONS.
2. DO NOT SCALE DRAWINGS.
3. SEE PLANS, LEGEND AND SPECIFICATIONS FOR ADDITIONAL INSTALLATION NOTES.

ISOLATING VALVE: 25mm SOLENOID VALVE

25mm Isolating Valve with Solenoid Valve

Standard Drawing Layout D- 3: Control Valving 25mm



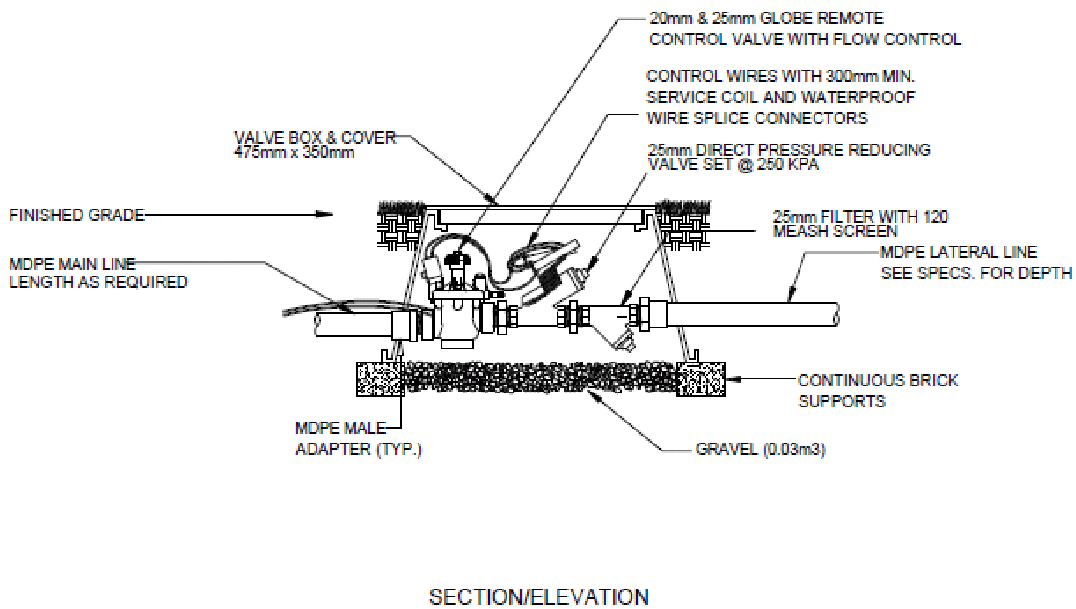
NOTES:

1. INSTALLATION TO BE COMPLETED IN ACCORDANCE WITH MANUFACTURERS SPECIFICATIONS.
2. DO NOT SCALE DRAWINGS.
3. SEE PLANS, LEGEND AND SPECIFICATIONS FOR ADDITIONAL INSTALLATION NOTES.

25mm FILTER WITH ISOLATING VAVLES

25mm Fliiter with Isolating Valves

Standard Drawing Layout D- 4: Filter – 25mm

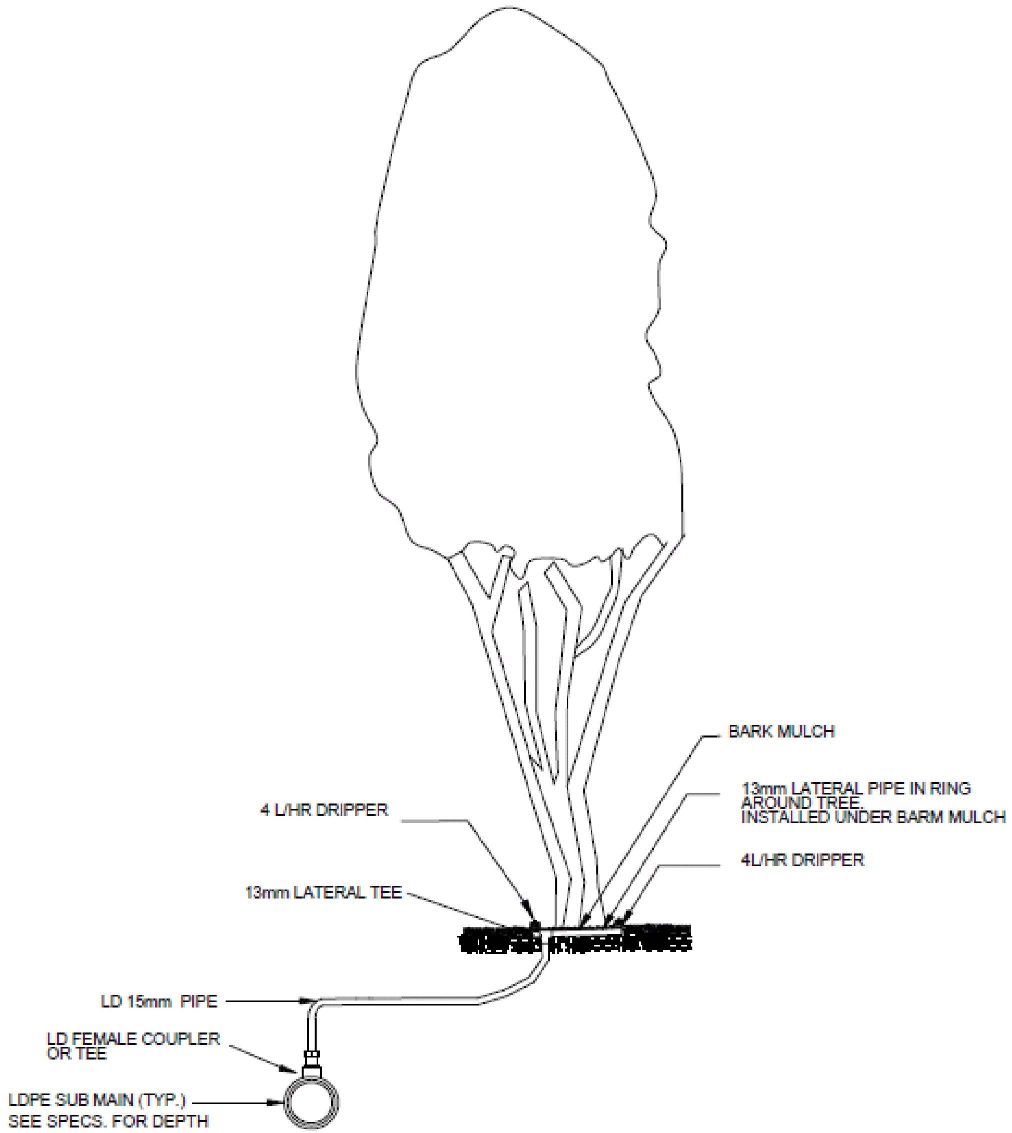


NOTES:
1. INSTALLATION TO BE COMPLETED IN ACCORDANCE WITH MANUFACTURERS SPECIFICATIONS.
2. DO NOT SCALE DRAWINGS.
3. SEE PLANS, LEGEND AND SPECIFICATIONS FOR ADDITIONAL INSTALLATION NOTES.

TRICKLE CONTROL VALVES: 25mm SOLENOID VALVE

25mm Solenoid Valve with 25mm Press/Reg Valve & 25mm Filter

Standard Drawing Layout D- 5: Trickle Control 25mm

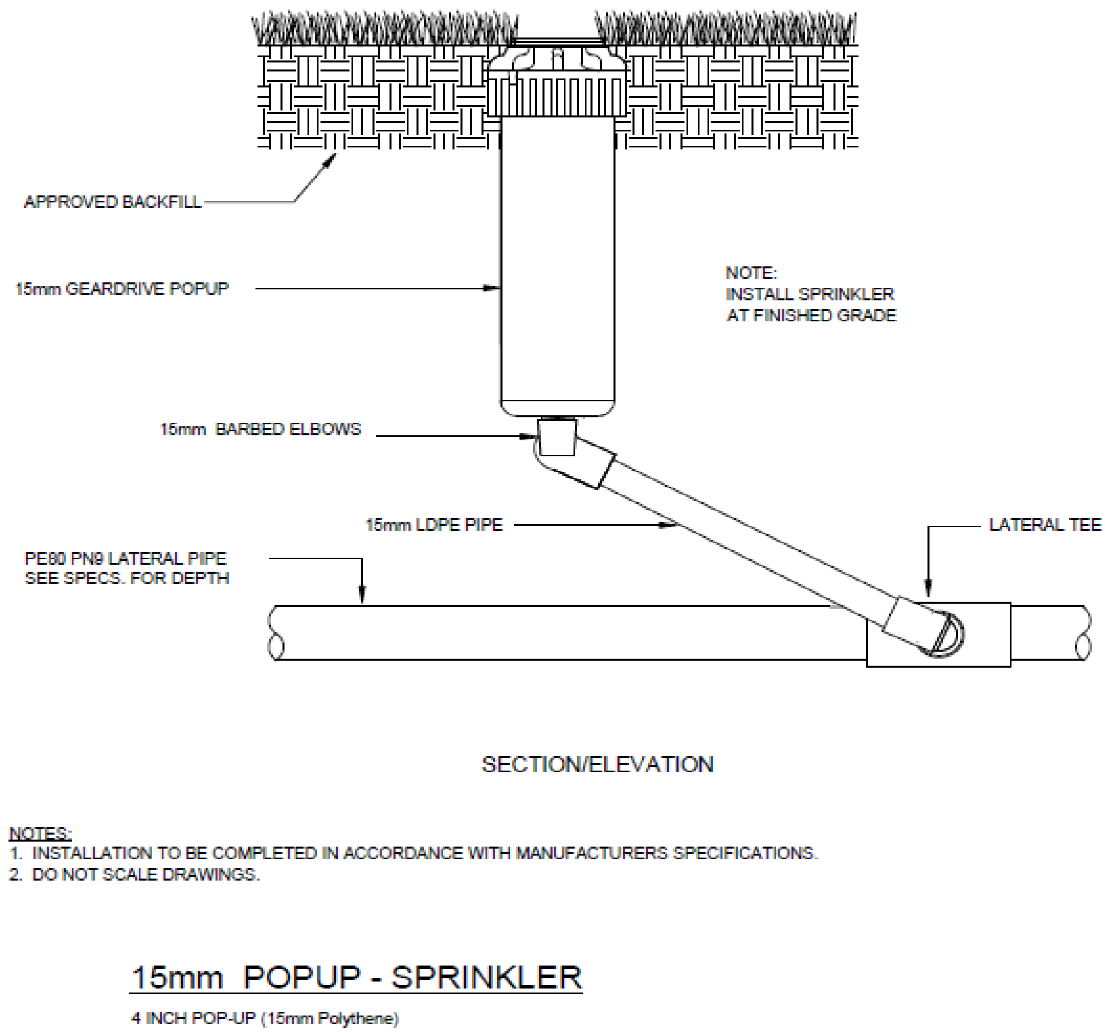


NOTES:
1. INSTALLATION TO BE COMPLETED IN ACCORDANCE WITH MANUFACTURERS SPECIFICATIONS.
2. DO NOT SCALE DRAWINGS.
3. SEE PLANS, LEGEND AND SPECIFICATIONS FOR ADDITIONAL INSTALLATION NOTES.

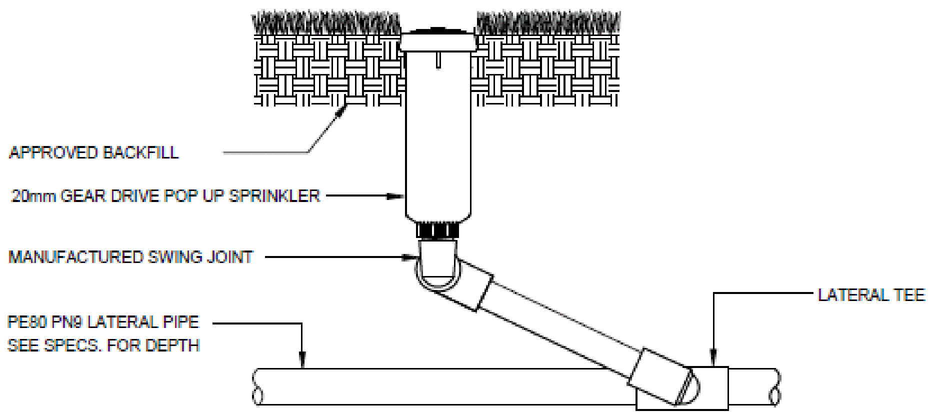
TRICKLE: DRIPPER

4 L/H Compensating Cleanable Dripper

Standard Drawing Layout D- 6: Trickle Dripper



Standard Drawing Layout D- 7: Popup Sprinkler 15mm



SECTION/ELEVATION

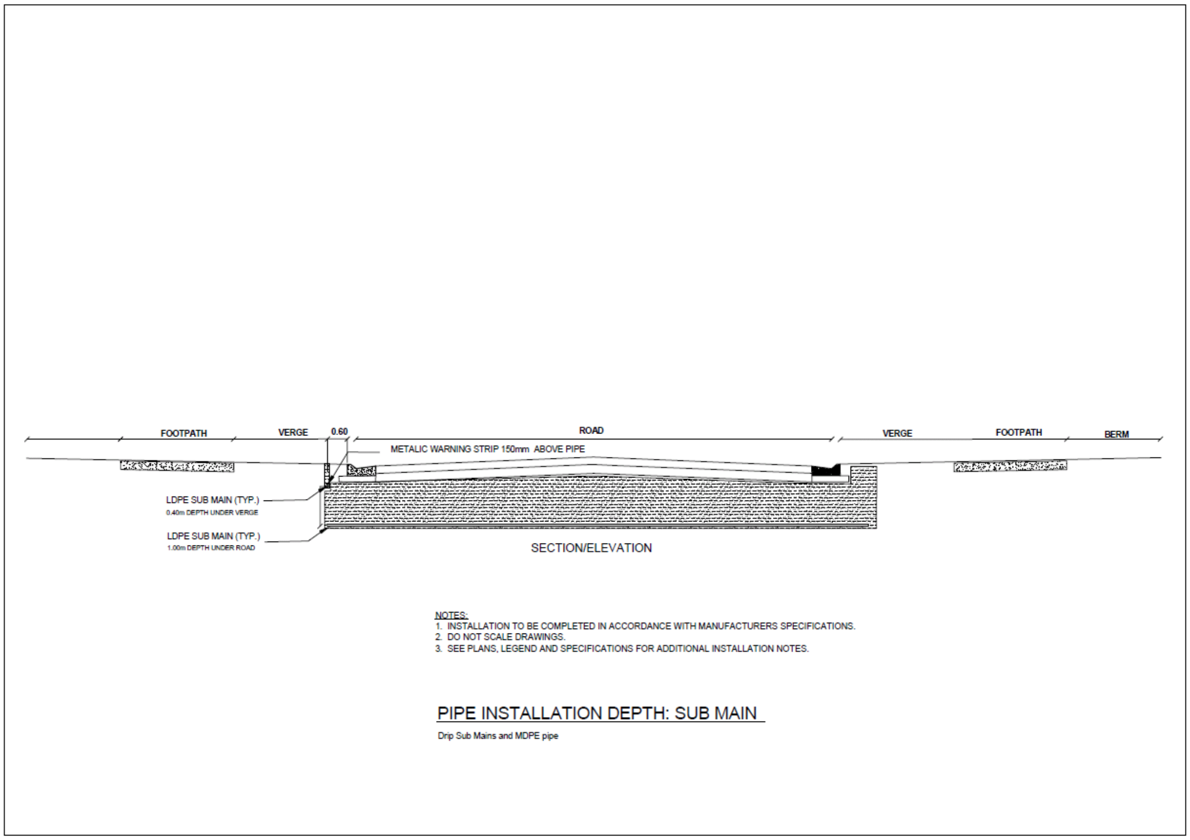
NOTES:

1. INSTALLATION TO BE COMPLETED IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS.
2. DO NOT SCALE DRAWINGS.
3. INSTALL SPRINKLER AT FINISHED GRADE

20 mm GEAR DRIVE 100mm POP-UP

SINGLE-STREAM SPRINKLER, SWING JOINT

Standard Drawing Layout D- 8: Gear Drive Popup 20mm



Standard Drawing Layout D- 9: Pipe Installation - Submain

1 GENERAL REQUIREMENTS

#	Function	Details
1	Landscaping	

	i.	All-weather vehicle access to the wet-well, valves, electrical and any other major equipment installed on site. Where indivisible components requiring servicing are between 20 and 200kg, design the access for a (crane mounted on a) light truck of:
		• length = 5 metres,
		• width = 2.5 metres and
		• maximum axle loading on 7.00 x 15 single tyred axle = 2500 kg ensuring that:
		  • the rear axle of the truck mounted crane can be brought to within 2m of the vertical centreline of the component to be lifted, and
		  • Insure there is sufficient head room to operate the crane.

	ii.	Hard surfacing (concrete or asphalt) to all areas where sludge, raw sewage or chemicals are likely to spill, draining to the wastewater system or wet-well
	iii.	Washdown area for pump cleaning – with drain back to wet well
	iv.	Ability to locate a mobile standby generator
2	Pumps	
	i.	Duty and standby required
	ii.	Flygt submersible where (where possible Flygt N-Technology pumps)
3	Motor control	
	i.	Soft starters compatible with Flygt pumps.
4	Pipework and valves	
	i.	Knife gate valves used for isolate of each pump and non-return ball valves (both should be housed in individual valve chamber beside wet well).
	ii.	Cast ball check valve
5	Wet well and emergency storage	
	i.	Minimum of nine hours storage (ADWF). A smaller wet well with off line storage is preferred. Where the pump station is considered “large” and has a standby generator and spare pump supplied (additional to duty / standby pumps) – with the agreement with Council, emergency storage may be reduced.
	ii.	May be constructed from pre cast concrete or fibre glass.
	iii.	Venting – Where applicable use of McBerns GM375 Mixed Media Odour filters
	iv.	Automatic well washing (on hinged bracket)
	v.	Manhole adjacent to pump station with cutoff valve. Note - SS knife valve with deflector plate on inlet pipe with valve spindle to top of well. *Allows wet-well and associated pipework to be safely isolated from the sewer system*
	vi.	All pipe work, riser joint & attachments within wet well shall be stainless steel 316
	vii.	Cover lids - McBerns 4-sided safety cover lid type
	viii.	Valve chambers and pits with a 50mm minimum diameter drain hole falling into the wet-well
	ix.	Locate the covers to enhance equipment maintenance and to permit the setting up of davits or tripods for entry to confined spaces.
	x.	Drop structure on the inlet at an angle of at least 45 degrees to prevent the forming of vortices on pumping
	xi.	Any ducts (electrical / control) shall be a minimum of 100mm diameter

#	Function	Details
6	Switchboard	
	i.	Beige in colour to reduce internal heat build-up.
	ii.	Weatherproof protection hoods for any instruments exposed to sunlight. *To prevent degradation of liquid crystal displays by ultraviolet light or moisture ingress from heating and cooling effects*.
	iii.	RTU aerial: Locate the external line-of-site aerial on the furthest side of the building from the road boundary whilst maintaining line of sight. Detail securing of aerials against wind and snow loading. Mount the aerial on a 50mm diameter aluminium scaffolding tube extending two metres above the top of the electrical control cabinet or building. Ensure this pipe is easily lowered to the ground for aerial maintenance
	iv.	Remote pump starting and stopping shall also be provided from the SCADA system
	v.	All ducting from the sewer well and valve chambers to electrical cabinet shall be filled with builders foam
	vi.	UPS required for SCADA control system – to operate for a minimum of 4 hours.
7	Remote Terminal Unit (RTU)	
	i.	Developer to provide proposed method of RTU communication to Veolia for approval. The developer is responsible for all costs associated with the provision of the SCADA communication.
	ii.	Developer is required to use the maintenance contractor for all changes required for the software configuration to Council's SCADA system and includes graphical interface, pump station reports and pump station generated alarms.
8	Magflow meter	
	i.	Isolating valve in the same or a separate concrete chamber downstream of the meter. *This valve allows isolation of the pressure main if the meter has to be removed, eliminating the requirement to drain the whole pressure main*
12	Water supply	
	i.	RPZ - Wilkins Double Check Valve assembly (Model 350) with DekoRRa 301-BG-C2 insulated backflow enclosure
	ii.	Inlet supply – 32mm Outlet – 25mm with female camlock connection and isolating valve
13	Public Toilets	
	i.	All new public toilet facilities with a pump station or septic tank must be connected to SCADA and comply with this Electrical and SCADA Standard.
	ii.	The following parameters should be monitored for new public toilets connected to SCADA: • Well levels • Pump status • High/low warnings • Any faults • Loss of communications
	iii.	Spare capacity in the RTU should be provided for a flow meter to be installed in the future.

ELECTRICAL & SCADA STANDARD

FOR WASTEWATER PUMP STATION SWITCHBOARD DESIGN & INSTALLATION IN THE QUEENSTOWN LAKES DISTRICT

2025

VEOLIA

ELECTRICAL & SCADA STANDARD

WASTEWATER PUMP STATION SWITCHBOARD DESIGN

for:

Queenstown Lakes District Council

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OVERVIEW

This Electrical & SCADA Standard for Submersible WWPS has been prepared for Queenstown Lakes District Council (QLDC) to provide for a consistent approach to QLDC submersible WWPS infrastructure through the enforcement by QLDC of a uniform standard.

The specification is prepared specific for Submersible WWPS [2 pump WWPS, external (non building housed) switchboard of <30 kW].

It is intended that:

- This Electrical & SCADA Standard: Submersible WWPS apply for all submersible WWPS of <30 kW within the Queenstown-Lakes District.
- This Electrical & SCADA Standard: Submersible WWPS form the basis for the preparation of tailored individual specifications for pump stations of ≥ 30kW within the Queenstown-Lakes District.

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APPENDIX A – Equipment Data Sheet
APPENDIX B – RTU Standard I/O Configuration and Tag Naming
APPENDIX C – Operations and Maintenance Manual Example
APPENDIX D – WWPS commissioning test and check sheets
APPENDIX E – Standard Electrical Drawings

DRAWINGS

QLDC_WWPS_01 QLDC Pump Station Standardisation <30kw Soft Starter
QLDC_WWPS_01 REG Electrical Drawings Register
QLDC_WWPS_01 STD Standard Project Information
QLDC_WWPS_01 BOM Equipment Schedule
QLDC_WWPS_01 GA - General Arrangements
QLDC_WWPS_01 LDL1 - Label Schedule
QLDC_WWPS_01 01- Wiring Schematics

The enclosed Specification for the Design and Construction of Submersible Wastewater Pumping Station Switchboards up to 30 kW contains references to the following Australian and New Zealand Standards:

AS/NZS 60947.8: Low voltage switchgear and control gear - Protection of electric motors - Built-in thermal detectors and associated control units

AS/NZS 1100: Technical drawing

AS 1101: Graphic symbols for general engineering

AS/NZS 1102: Graphical symbols for electrotechnical documentation

AS 1307.2: Surge arresters - Metal-oxide surge arresters without gaps for a.c. systems

AS 1319: Safety signs for the occupational environment

AS/NZS 1554.6: Structural steel welding - Welding stainless steels for structural purposes

AS 1627.1: Metal finishing - Preparation and pre-treatment of surfaces - Removal of oil, grease and related contamination

AS/NZS 2053.2: Conduits and fittings for electrical installations - Rigid plain conduits and fittings of insulating material

AS/NZS CISPR 11: Industrial, scientific and medical (ISM) radio frequency equipment - Electromagnetic disturbance characteristics - Limits and methods of measurement

AS 2184: Low voltage switchgear and controlgear - Moulded-case circuit-breakers for rated voltages up to and including 600 V a.c. and 250 V d.c.

AS/NZS: 61000.3.6 Electromagnetic compatibility (EMC) - Limits - Assessment of emission limits for distorting loads in MV and HV power systems

AS/NZS 3000: Electrical installations (known as the Australian/New Zealand Wiring Rules)

AS/NZS 3008.1.2: Electrical installations - Selection of cables - Cables for alternating voltages up to and including 0.6/1 kV - Typical New Zealand installation conditions

AS 3111: Approval and test specification - Miniature overcurrent circuit-breakers

AS 3112: Approval and test specification - Plugs and socket-outlets

AS/NZS 3133: Approval and test specification - Air-break switches

AS/NZS 3190: Approval and test specification - Residual current devices (current-operated earth-leakage devices)

AS/NZS 3439.1: Low-voltage switchgear and controlgear assemblies - Type-tested and partially type-tested assemblies

AS/NZS 61000.6.1: Electromagnetic compatibility (EMC) - Generic standards - Immunity for residential, commercial and light-industrial environments

AS/NZS 4383: Preparation of documents used in electrotechnology

AS/NZS 4792: Hot-dip galvanised (zinc) coatings on ferrous hollow sections, applied by a continuous or a specialised process

AS/NZS 5000.1: Electric cables - Polymeric insulated - For working voltages up to and including 0.6/1 (1.2) kV

AS 5000.2: Electric cables - Polymeric insulated - For working voltages up to and including 450/750 V

AS/NZS 60044.1: Instrument transformer - Current transformers

AS 60269.1: Low-voltage fuses - General requirements

AS 60269.2: Low-voltage fuses - - Supplementary requirements for fuses for use by authorized persons (fuses mainly for industrial application)

AS 60269.4: Low-voltage fuses - - Supplementary requirements for fuse-links for the protection of semiconductor devices

AS 60417: Graphical symbols for use on equipment

AS/NZS 60529: Degrees of protection provided by enclosures (IP Code)

AS 60947.2: Low-voltage switchgear and controlgear - Circuit-breakers

AS 60947.4.1: Low-voltage switchgear and controlgear - Contactors and motor-starters - Electromechanical contactors and motor-starters

AS 60947.4.2: Low-voltage switchgear and controlgear - Contactors and motor-starters - A.C. semiconductor motor controllers and starters

AS 60947.5.1: Low-voltage switchgear and controlgear - Control circuit devices and switching elements - Electromechanical control circuit devices

AS 61800.3: Adjustable speed electrical power drive systems - EMC requirements and specific test methods

AS/NZS CISPR 11: Industrial scientific and medical (ISM) radio-frequency equipment - Electromagnetic disturbance characteristics - Limits and methods of measurement

AS IEC 61131.1: Programmable controllers - General information

AS IEC 61131.2: Programmable controllers - Equipment requirements and tests

AS IEC 61131.3: Programmable controllers - Programming languages

IEC 60073: Basic and safety principles for man-machine interface, marking and identification - Coding principles for indicators and actuators

AS 60204.1: Safety of machinery—Electrical equipment of machines
AS 4024: Safeguarding of Machinery

AE-5014: Aurora Energy Network Connection Standards

1 SCOPE OF WORKS

Installation of switchboards designed for the purpose of providing submersible pump control need to meet numerous standards for vesting as future QLDC owned and operated facilities.

1.1 Key design parameters

As a minimum, the switchboard shall be designed to achieve the following;

- House all electrical components,
- Allow for space to accommodate larger switchgear should this be required in the future,
- Be safe for network operators to use without requirement of electrical qualification,
- Be positioned away from wells and other civil structures that might detrimentally affect operation and maintenance of the facility,
- Be built to withstand local environmental conditions together with the potential harm that may result from wastewater odours.
- Conform to this Electrical and SCADA standard.
- For QLDC sites be connected to the QLDC SCADA base station for system monitoring. This station is located at the Veolia Site office.
- For the Lake Hayes Scheme be connected to the SCADA base station for system monitoring. This station is located at the Fulton Hogan controlled, Lake Hayes Estate Treatment Station.
- Consideration of Temporary Traffic Management Requirements and compliance with the Code of Practice for Temporary Traffic Management.

1.2 Conformance to standards

Any electrical contractor engaged to design and install electrical switchgear at new or upgraded wastewater pump stations needs to ensure the above, high level design parameters are met whilst conforming to the following relevant standards;

- Pump station design to meet QLDC infrastructure code requirements,
- Electrical installation to meet all relevant industry and safety standards,
- All electrical work shall be performed in accordance with AS/NZS 3000 and the requirements of the supplier of electrical energy.
- Design and functionality to meet this Electrical and SCADA standard,
- Design approval by QLDC or their approved representatives.

1.3 Expected deliverables

Equipment to be supplied and installed by the Electrical Contractor shall include but not be limited to:

(1) Civil works for switchboard footings.

(2) Supervision over installation of conduits and ducting.

(3) Supply of pumping station electrical cabinet, main switchboard and motor control.

(4) Wet well level indications, controls and associated wiring.

(5) Installation of mounting pole and floodlight.

(6) Installation of telemetry hardware and RTU.

(7) Liaise with Veolia to prepare SCADA alarms and pages

1.4 Provision of documents

The provision of documents associated with the deliverable of new pump station switchboards shall be determined by the requirements of the contract. This shall include, but not be limited to, the following;

- Component list / specification / asset description. This list shall be supplied in a format determined by QLDC for the purpose of populating their Asset Management Database.
- Functional control description for the purpose of understanding pump station control logic and functionality.
- User manuals, equipment manuals and operation manuals.
- Electrical drawings.
- Declaration of Conformity Statements
- Electrical Certificates of Compliance.
- Test certificates and commissioning documents.
- Programming software and print outs of control logic files.

1.5 Commissioning

Commissioning is the most important aspect of the contract. Electrical contractors are expected to liaise closely with QLDC 3 Waters Contractors Veolia (QLDC sites) and Fulton Hogan (Lake Hayes Sites) throughout this process.
A commissioning plan shall be developed together with check sheets that aim to test every functionality of the electrical and mechanical components installed.

Commissioning shall be witnessed by the appropriate QLDC staff and Veolia or Fulton Hogan representatives and signed off by them.

Commissioning checks completed on new wastewater facilities shall include functional testing on the following components;

- Pump performance
- Primary pump control
- Secondary pump control

- Well level measurement
- Flowmeter
- RTU communications and SCADA connectivity
- SCADA I/O checks

2 ELECTRICAL SUPPLY

2.1 General

The power supply shall be a 400/230 V ac, 50 Hz, 3 phase, 4 wire, earthed neutral electrical supply. Where possible, the pillar / plinth which houses the connection to the supplier of electrical energy shall be at pillar / pole top or transformer.

2.2 Electricity Metering

The supplier of electrical energy meters, CT's (if required) and other equipment shall be installed in a manner acceptable to the supplier of electrical energy.

The Electrical Contractor shall arrange with the supplier of electrical energy for the reuse of the existing or replacement of electrical meters as required.

The electrical contractor shall liaise with QLDCs energy retailer to request appropriate power metering at site. Depending on the anticipated power consumption of the facility, QLDC may request a pulse output off the power metering connected through to the RTU for remote monitoring of power use.

3 SWITCHBOARD DESIGN

3.1 Structural design

3.2 Concrete Footing

A concrete footing shall be installed except where ground conditions are deemed to be unstable by either the QLDC Chief Engineer or the Electrical Contractor, in which case an engineered design by an appropriately qualified civil engineer will need to be supplied.

The concrete footing dimensions shall be sized so that is larger in area than the footprint of the switchboard enclosure.

3.3 Plinth

Where the switchboard is floor-mounted, the switchboard shall be provided with a bolt-on, hot dip galvanised rolled steel or stainless steel channel plinth. The plinth shall be approximately 200 mm high and secured to the concrete footing using grade 316 stainless steel bolts and masonry anchors.

The plinth shall not be drilled except for enclosure and securing mounting holes.

Gasket

Where a plinth is required, a rubber gasket shall be installed between the plinth and the switchboard enclosure to ensure that moisture cannot be trapped between the surfaces. The gasket shall be 3mm thick, 3-ply insertion rubber reinforced with 2-ply canvas.

Bolts and fastening equipment

- Bolts used to secure switchboards or major items of equipment shall be in accordance with AS 1252 and have a bolting category of 8.8/S.
- All other bolts, nut, washers and fasteners shall be hot dipped galvanised or grade 316 stainless steel.
- All minor fastenings, saddles, screws, washers, nuts, metal threads etc. shall be grade 316 stainless steel.
- All stainless steel shall be insulated from other metals using plastic washers and spacers to ensure that no galvanic action and/or corrosion can take place.

Conduits

- Conduits shall be supplied and installed for cables in accordance with AS/NZS 3000, this clause and the drawings.
- The Electrical Contractor shall size conduits in accordance with AS/NZS 3000 for the number and size of cables to be installed within each conduit, but shall in no case be smaller in nominal size than 20 millimetre diameter.

- Electrical conduits and conduit fittings shall be medium duty rigid UPVC conduits and fittings in accordance with AS/NZS 2053.2.
- The Electrical Contractor shall install all conduits between the pumping station switchboard and the wetwell.
- The main conduits for the pump power and level control devices between the pumping station and the wetwell shall be 1x 100mm per pump and 1x50mm for instrumentation.
- Any underground bends or elbows installed should be swept long radius bends.
-
- Cap and individually gland the ducts from the sewer well to the cabinet to eliminate any fumes entering the cabinet

3.4 Switchboard specification

Design of the switchboard shall reflect the functionality required of the wastewater pump station.

The switchboard shall be designed with separate internal panels comprising the following critical hardware;

Switchgear

- Generator changeover switch or
- auto changeover switch if there is an on-site generator.
- If there is no on-site generator, an externally mounted generator plug is required for the purpose of connecting a mobile generator.
- External generator plug to be mounted in a lockable enclosure on the side of the switchboard.
- Generator plug should be designed to use with a portable generator of suitable size and application that can be used to run the pump station without the need for on site supervision from an operator ie the front doors of the external enclosure must be able to be closed and locked when a portable generator is connected to the switchboard.
- Generator plug to be IP54 rated.
- Sizing and specification of this socket shall be determined by rating of the pump motors and switchboard.
- Single phase likely to be a 3 pin 10 Amp socket with RCD protection
- 3 phase socket C Form 63A or C Form 125A plug.

Motor Control Centre

- Internal Switchboard Form 3A comprising individual compartments for the main incomer, tariff metering, local services, DB, level duty and telemetry controls, field terminations and pump starters (1 per starter)

- Live parts within an enclosure must be arranged to provide basic protection against direct or indirect contact.
- Soft starters or VSDs to run the pumps
- Pump motor isolators
- Power factor capacitors
- Phase rotation relays
- Under current / over current
- Over voltage / under voltage

Telemetry and SCADA hardware

- RTU to communicate to the SCADA base station
- 24V DC UPS for low voltage supply to critical control gear,
- Suitable communication aerial
- Telemetry panel to be located in the upper portion of the switchboard, close to eye level.

Metering

- Network metering to conform to local Power Supply Authority Standards.

Distribution

- Circuit breakers for local distribution
- This may or may not include the pump circuit breakers

Pump control hardware and instrumentation

- Pump controller
- Primary level control

Flowmeter

- Electromagnetic flowmeter transmitter or display unit
- Pressure monitoring (if any)

3.5 Switchboard and component rating

External enclosures should be rated to IP56.

The switchboard shall be designed and manufactured in accordance with the drawings QLDC_WWPS_01 provided with this Specification and the following:

- Components installed such as motor fuses holders, isolating switches, contactors and motor plugs and sockets etc. shall be sized to suit these ratings.
- The motor starters/VSDs, motor fuses and thermal overloads used for the pumps shall be sized to suit the pump ratings.
- All switching and control devices shall be secured in the switchboard using DIN rail mounting wherever possible.

Switchboard Enclosure

Where a switchboard is to be installed externally, or when required by the project specification for internal switchboards, a custom built metal enclosure shall be in accordance with the following:

1) Principal switchboard enclosure requirements indicated in Appendix A, or where no Principal switchboard enclosure requirements are indicated should be 2mm thick 304 stainless steel (316 stainless steel if enclosure is specifically located in, on or immediately around sewerage and is exposed to an aggressive atmosphere) to be resistant against UV and malodours generated from wastewater or other corrosive marine environments (e.g. marine) or where required by the project specification.
2) Front access shall be provided by hinged lockable doors. Opening the doors shall give access to a dead front panel on which controls and indications are mounted. Locks shall be in accordance with Section 3.4.1. Gas struts shall be used to assist door opening and being restrained.
3) Locking of the enclosure is by means of a stainless steel swing handle and roller rod assembly able to accommodate a standard QLDC water/waste water padlock.
4) Exterior sheetmetal shall have a minimum thickness of 2 mm. Large doors, or doors or panels with a large number of cut-outs, shall have additional thickness or shall have stiffeners added to ensure rigidity.
5) The top surface shall slope to prevent accumulation of water. The slope on single sided enclosures shall be such so as to direct water away from the front of the cubicle.
6) With doors and covers in position, provide a degree of protection in accordance with AS 1939 of not less than:
   (a) IP56 if any component within the enclosure has an IP rating of less than IP5X or
   (b) IP26 if all components within the enclosure have an IP rating of IP5X or greater.
7) Equipment which is installed within outdoor cubicles shall be protected against the effects of excessive temperature by either:
   (a) The equipment being de-rated to accommodate the higher ambient temperatures which are to be expected within the cubicles or
   (b) The cubicles being ventilated to ensure that the cubicle internal temperatures do not exceed the temperature ratings of the equipment

(any ventilation shall not decrease the IP rating of the enclosure) and/or the fitting of a metal sun shield of appropriate design allowing for orientation when installed.

8) Ground and floor mounted cubicles shall be provided with a bolt-on, painted hot-dip galvanised (to AS/NZS 4680) rolled steel channel or stainless steel plinth 200mm high.

9) Seismic restraints should be used to secure the switchboard to any adjacent wall.

10) Provided with an interior automatic LED lamp(s) and a switched socket outlet (with RCD protection), accessible when the front door is open.

11) Switchboards and control panels shall be provided with thermostatically controlled anti-condensation heaters in accordance with Section 3.6.9.

12) Internal switchboard to be powder coated of beige colour with exact colour specification required to be ‘RAL 7035 Light Grey Ripple’ colour in order to ensure maximum heat dissipation from radiant and/or solar heat. This does not apply to the external enclosure.

13) 304 SS exteriors shall be powder coated with exact colour specification to match Dulux Coloursteel “Desert Sand” with a TSR of 58% and LRV of 51% (unless 316 SS is used, then do not powder coat), with a minimum of one zinc shield base coat and one architectural polyester top coat to a thickness of 80 + or – 20 microns.

14) Stainless exteriors shall be roughed surface with a minimum of one 2 pack polyester etch primer and one architectural polyester top coat.

Displays and local lamp indication

All switches, controls, instrument displays and pump and level indicators used for the operation of the pump station shall be positioned on the switchboard such that there must be no direct or indirect contact with live conductive parts.

Stainless Steel Fabrication

Metalwork required to be manufactured from stainless steel shall be constructed in accordance with the following:

(1) Manufactured from grade 304 stainless steel, unless where the enclosure is specifically located in, on or immediately around sewerage and is exposed to an aggressive atmosphere - 316 stainless steel is required.

(2) Welding shall be in accordance with Table 4.5.1 or Table 4.5.2 of AS/NZS 1554.6 and the surface finish of welds shall be Grade II (a) or (c) in accordance with Table 6.2.1 of AS/NZS 1554.6.

(3) Have a uniform texture on the external surface.

3.6 Ancillary extras

Door locks

Locking of cubicle doors, except for vandal resistant cubicles, shall be 3 point for all doors of height greater than 1000mm. Locks shall be cut with barrels allowing for QLDC contractor access. It should be noted that a different key is used to access Wanaka facilities from those in Queenstown.

Allowance shall be made for all internal doors to open at an angle of 90° when installed in the switchboard.

Padlocks are an acceptable method of securing external cabinet doors on electrical switchboards.

Mounting Pole for Antenna and Floodlight

The Electrical Contractor shall install a radio antenna on a mounting pole in accordance with drawing QLDC_WWPS_01

The mounting pole height shall be determined by the Telemetry Contractor and shall not be less than the height shown on drawing QLDC_WWPS_01

Mounting poles shall be manufactured from stainless steel in accordance with AS/NZS 4792.

Station Identification Signage

A station identification sign may be provided by the QLDC Chief Engineer. Where provided this shall be affixed to the switchboard enclosure by the Electrical Contractor in such a manner as to preserve the IP rating of the switchboard.

Electrical Danger Warning Sign

The Electrical Contractor shall supply and install a danger warning sign on the outside of one of the front doors of the switchboard enclosure. The danger warning sign shall be in accordance with AS 1319 and in particular clause 2.3.4 and shall be engraved "400 VOLTS" as per NZS 3000:2007.

Protection against shock

All electrical equipment installed within the pumping station switchboard shall be shrouded to IP 2X in accordance with AS/NZS 60529 to avoid accidental contact.

Electrical control equipment with an ingress protection rating less than IP 52 shall be mounted within metal enclosure(s) with an ingress protection rating of not less than IP 52 in accordance with AS/NZS 60529.

Service conditions

The equipment supplied shall be suitable and approved for operation in the following range of ambient conditions:

Maximum internal temperature	50°C
Minimum air temperature	-10°C

Equipment which is installed within the cubicle shall be protected against the effects of excessive temperature by either the equipment being de-rated to accommodate the higher ambient temperatures which are to be expected within the cubicles or the cubicles being ventilated to ensure that the cubicle internal temperatures do not exceed the temperature ratings of the equipment. Any ventilation shall not reduce the IP rating of the enclosure.

Forced ventilation or cooling

All cabinets exposed to direct sun should be shaded where possible or have a double skinned top / side.
Forced ventilation is only required when any Motor Control Centre (MCC) inside an electrical cabinet incorporates Variable Speed Drives (VSDs). The load banks inside VSDs result in the generation of additional heat output.
Cooling fans on both the internal enclosures and external cabinet are required in all instances when VSDs are mounted.

Electrical contractors are required to calculate the additional heat output resulting from VSD installations and ensure that this additional heat is dissipated and removed through installation of forced ventilation or cooling. No such cooling mechanisms are required where soft starters rated at ≤ 30kW are installed.

Cubicle Heaters

Cubicle heaters shall be in accordance with the following:

(1) Black heat strip heaters rated at approximately 20 watts per square metre of cubicle surface area and suitable for operation at 230 volts.

(2) Shall be of such a number and shall be installed so that heat from the heaters can readily circulate throughout the cubicles and that heat energy from the heaters will not damage materials or components adjacent to the heaters.

(3) Provided with a thermostat which will energise the heaters when the air temperature inside the cubicle is below 20°C. The thermostat can be either built-in or separate and shall preferably be adjustable. On long panels additional thermostatically controlled heaters shall be supplied and installed, if required, to ensure adequate temperature control within the switchboard or control panel.

(4) Heater and thermostat terminals shall be shrouded to eliminate the possibility of accidental personal contact.

Switchboard Light

An interior automatic LED lamp shall be provided to provide illumination in the switchboard enclosure when the front door is open. The light shall be installed in a location as shown on the electrical drawings QLDC_WWPS_01

4 CABLE SPECIFICATION

4.1 General

- Power, instrumentation and control cables shall be installed in accordance with this clause and AS/NZS 3000.
- The Electrical Contractor shall install all cables between the pumping station switchboard and the wetwell.

4.2 Cable Routes and Methods of Installation

- Unless specified otherwise, cable shall be installed underground in conduits with pits as specified.

4.3 Cable Pits

- Unless otherwise agreed or specified cable pits shall be provided for all underground cable runs where cables change direction and at intervals in straight runs so as to allow easy pulling of the cables.
- Cable pits shall be provided with drainage facilities.
- Cable pits in footpaths or where there is no vehicle traffic shall be provided with covers equivalent to Gatic light duty category.
- Cable pits located where there is vehicle traffic (or loading) shall be provided with covers equivalent to Gatic heavy duty category.

4.4 Cable Joints

- Intermediate joints in cables shall not be permitted.

4.5 Cable Handling

- Cables shall be handled carefully from cable drums or spools.
- Kinks shall not be allowed to develop during unwinding or during installation.
- Cables shall not be subjected to bending radii of less than twelve times the outside diameter of the cables or the manufacturer's recommended minimum radius (whichever is the greater) at any stage during installation of the cables.
- Care shall be taken during installation of cables that the insulation and/or sheathing of the cables is not cut, abraded or otherwise damaged.
- Any cables which are damaged during installation shall be repaired or replaced by the Electrical Contractor to the satisfaction of the QLDC Chief Engineer at the Electrical Contractor's expense.

4.6 Cable Termination

- Cables shall be terminated at the terminals provided in the switchboards and control panels and on the various items of equipment which are supplied and/or installed by the Electrical Contractor.
- Spare cores shall be terminated.
- Cables shall be supported as necessary at all points of termination to prevent undue mechanical strain on the terminations.

4.7 Instrumentation Cable Screens

- Screens of instrumentation cables shall be individually terminated at both ends at insulated terminals.
- The screen between the cable sheath and the terminal shall be insulated with heat shrink tubing.
- The cable screens shall then be earthed at the switchboard end only by looping an earthing conductor between terminals.

4.8 Labelling

- Individual cores of control or instrumentation cables shall be labelled with printed slip on type full circle ferrules.
- The core identification shall correspond with the wiring diagrams.
- Cables shall be identified at the ends by a corrosion resistant tag printed with the cable identification used on circuit diagrams.

4.9 Field Cables

Power Cables

- Power cables shall be in accordance with AS/NZS 5000.1 or 5000.2. Sheathed cables shall have a PVC sheath unless otherwise specified and shall be suitable for use underground.
- All cables shall be of multistrand construction with copper conductors.
- The minimum cross sectional area of any cable shall be 1.5 mm^2.
- The Electrical Contractor shall be responsible for selecting cable sizes in accordance with AS/NZS 3008.1.2.

Control Cables

- Control cables which are required to operate at low voltages shall be stranded PVC insulated PVC sheathed conductor cables manufactured in accordance with AS/NZS 5000.1 or 5000.2 and having a minimum conductor cross sectional area of 1.5 mm^2.
- Control cables which are required to operate at extra low voltage shall be rated for the voltages and currents which they have to carry.
- Conductor cross sectional area shall be not less than 0.5 mm^2.

- For cables which connect input contacts to the switchboard the conductors shall be coloured red or white (as applicable) for single core cables and red/white for two core cables.
- Red coloured cores shall be connected to the terminal nearest the supply or active and white cores shall be used for the switched wires.
- For cables which connect output devices the conductor insulation shall be coloured red or black (as applicable) for single core cables and red/black for two core cables.
- Red coloured cores shall be connected to the terminal nearest the supply or active.

Instrumentation Cables

- Instrumentation cables shall consist of either single pairs or multiple pairs with each pair being of twisted PVC insulated stranded copper conductors in either case.
- Each instrumentation cable shall have an overall screen with a stranded copper drain wire and PVC sheath.
- The conductors of each pair shall have a minimum conductor area of 0.5 mm^2.
- Multicore cables shall be provided with a number of spare pairs equal to not less than 25% of the total number of installed pairs rounded to the next higher whole number.
- All spare pairs shall be terminated in terminals.

Motor Cables

- Cables should be chosen and installed in accordance with best practice
- Shielded cables are to be used in combination with VSDs, unless otherwise approved by QLDC and supported by specific engineering justification.

5 INTERNAL WIRING

5.1 Type

- The Electrical Contractor shall be responsible for selecting cable sizes, in accordance with AS/NZS 3008.1.2.
- Wiring shall be insulated stranded copper conductor in accordance with AS/NZS 5000.1 or 5000.2. Insulation material selected to suit environment.
- The wiring shall be adequately sized to carry the current and the minimum conductor size shall be 0.5mm^2 except in the case of current transformer wiring which shall have a minimum size of 2.5mm^2.
- The ends of control wiring that terminate within the switchboard shall be fitted with bootlace ferrules and identification labels.

5.2 Colour Coding

The insulation of cables and wires shall be in accordance with AS/NZS 3000 and as follows:

(1) Low voltage ac power circuits and CT wiring to be colour coded in accordance with the phase to which they are connected, i.e. RED, WHITE, BLUE with neutrals coloured BLACK.

(2) Low voltage ac cables to be RED or WHITE or BLUE with BLACK neutral.

> ***Note:*** *Control supplies shall be derived from the white phase unless otherwise indicated.*

(3) Extra low voltage dc circuits to be coded GREY (+) and PINK (-).

(4) Extra low voltage ac circuits to be coded BROWN (phase) ORANGE (Neutral)

> ***Note:*** *For two wire dc systems a black wire shall be used for the "earthy" end of the supply, and a red or blue conductor used for the other end depending if the supply is positive or negative with respect to earth.*

(5) Instrumentation loop wiring (4-20 mA, 1-5 V) to be coded GREY where not included within screened cables. Core colours within screened cables may be to the manufacturer's standard.

(6) Earth cable to be GREEN/YELLOW.

5.3 Wiring Installation

Wiring of size 2.5mm^2 or less shall be run wherever possible in side slotted PVC ducts with snap on covers. Ducts shall be adequately sized to accommodate the wiring, including field wiring where applicable. Where ducting is impractical, wiring may be loomed using proprietary looming or sleeving.

5.4 Termination

Internal wiring shall terminate at relays, contactors, switches etc.

All other outgoing wiring shall terminate at rail mounted clip-on type terminal blocks.

All terminals shall be mounted within a PVC enclosure in the cabling cubicle and be adequately shrouded to prevent accidental contact.

5.5 Junction boxes

Junction boxes to be considered where either there is significant distance between the MCC and Wet well or on sites >30kW.

Above ground junction boxes shall be secure and lockable stainless steel cabinets and conform to relevant industry standards. The location of these junction boxes shall be between the switchboard and the wet well but shall not interfere with normal operations or introduce ergonomic or trip hazards.

6 MAJOR COMPONENTS

6.1 Motor Control Panel

The motor control panel shall be installed in the pumping station switchboard. The motor control panel shall be constructed of metal and have an ingress protection rating of not less than IP 52 in accordance with AS/NZS 60529.

The motor control panel is to have a mechanism that prevents access to the electrical wiring and components by unqualified personnel. This may be in the form of lockable handles, key locks, tool or other methods approved by the QLDC Chief Engineer.

The motor control panel shall house all controls for the pumping units. Operator control and indication equipment shall be located on the front panel of the motor control panel.

6.2 Remote Telemetry Unit

An RTU shall be installed in the pumping station switchboard by the Telemetry Contractor as shown on drawing QLDC_WWPS_01

The RTU shall be enclosed in a metal enclosure with an ingress protection rating of not less than IP 32 in accordance with AS/NZS 60529.

6.3 Earthing

Pumping station switchboard earthing shall be provided in accordance with AS/NZS 3000 and in particular the multiple earthed neutral (MEN) provisions of the rules. Any external earthing cables must be protected against mechanical damage.

6.4 Labelling

Controls and Indications

Controls and indications shall be labelled with titles provided in this Specification or, where these are not specified, titles which adequately and accurately describe the function of units.

The use of the manufacturer's standard escutcheon plates is permitted.

Purpose made labels shall be manufactured from engraved, laminated plastic which results in:

(1) white lettering on a red background for warning labels and

(2) black lettering on a white background for other labels.

The minimum lettering height for purpose made labels shall be 4mm.

Labels, other than manufacturer's standard escutcheon plates which shall be attached in accordance with the manufacturer's directions, shall be fixed to the surface by pins, screws.

Embossing tape shall not be used.

Contactors, Relays and Other Control Equipment

Contactors, relays and other components shall be labelled with the designation or label name used in the control circuits.

Labels shall be fixed by rivets, pins or screws.

Embossing tape shall not be used.

Terminals

Terminals shall be labelled with number corresponding to the control circuits and termination schedules.

Wiring

Wiring shall be labelled by means of slip on ferrules or heat shrink numbered to correspond with the control circuits. Jumper wires of less than 50 mm length and which are visible for their entire length need only be labelled once, but other wiring shall be labelled at each end.

6.5 Controls and Indications

General

Controls, indications and alarms shall be provided as required to operate the station.

Motor Protection

Motor thermal overload protection shall be provided as a minimum. Thermal overload protection shall be provided using a thermal overload relay or the soft starter/VSD inbuilt thermal protection. Where soft starter inbuilt thermal protection is used, the circuit shall be designed to ensure that the soft starter protection continues to monitor motor current when the soft starter is bypassed.

Control Voltages

Pump control circuits shall operate at 24 V dc, with the exception of the pump contactor coil circuits which where required to, may operate at 230 V ac.

Labelling

The following controls shall be provided and labelled (labels shown in upper case, colour shown in brackets) as a minimum:

(1) PUMP 1 MODE SELECTOR, AUTO/OFF/MANUAL

(2) PUMP 1 START

(3) PUMP 1 STOP

(4) PUMP 2 MODE SELECTOR, AUTO/OFF/MANUAL

(5) PUMP 2 START

(6) PUMP 2 STOP

(7) DUTY SELECTOR, 1-2/2-1/ROTATION

(8) PUMP STATION FAULT RESET (Black)

(9) MODE SELECTOR AUTO CONTROL / RTU CONTROL

Indications

The following indications shall be provided and labelled (labels shown in upper case, colour shown in brackets) as a minimum:

(1) PUMP 1 RUN (Green)

(2) PUMP 2 RUN (Green)

(3) PUMP 1 MOTOR FAULT (Red)

(4) PUMP 2 MOTOR FAULT (Red)

(5) PUMP 1 REMOTE LOCKOUT (Amber)

(6) PUMP 2 REMOTE LOCKOUT (Amber)

(7) PUMP 1 HOURS RUN

(8) PUMP 2 HOURS RUN

(9) PUMP 1 MOTOR CURRENT

(10) PUMP 2 MOTOR CURRENT

(11) SCADA (RTU) CONTROL ACTIVE (Blue)

(12) WETWELL HIGH LEVEL (Red)

(13) PUMP CONTROLLER FAULT (Red)

(14) WETWELL LEVEL (%)

(15) AC MAINS ON (White)

6.6 Control Circuits

Control Circuits shall be designed in accordance with the requirements of AS 60204.1 and AS 4024 and with this clause unless otherwise specified in the project Specification or shown on the Specification drawings.

Control circuits shall comply with the following:

(1) Local control circuits shall operate at 24 V dc.

(2) The following shall operate at 24 V dc:

a) Indicator lights.
b) Pushbuttons (with the possible exception of emergency stop pushbuttons).
c) Control and selector switches.

d) Other control equipment on cubicle front panels and false mounting panels.
e) Control relays.
f) Control wiring external to the switchboards or control panel.

(3) Alarm relays shall be energised in the non-alarm condition (failsafe).

(4) Phase Fail Relay to provide indication only where motor protection is provided by a Variable Speed Drive or Soft Starter. Where pumps are Direct Online (DOL) then the Phase Fail Relay shall ensure that the function unit is stopped and latched out if a power supply failure is detected. A delay shall be incorporated to ensure that short power “flicks” of less than 10 seconds duration are not considered as a power failure. Automatic fault reset shall be provided on power restoration for common controls and all functional units.

(5) Controls circuits shall be designed to ensure that all latched circuits are reset automatically and that items of equipment will be available to run without the need for manual resetting following a power failure.

(6) Control circuits and/or PLC programming shall be designed to ensure that starting of the first duty functional unit is delayed for an adjustable period of time after power is restored following a power supply failure (as detected by the phase failure and under voltage relay).

(7) Control circuits shall be designed to ensure that all faults are reset using a local FAULT RESET pushbutton. This local reset shall operate independently of any PLC installed and continue to operate if any PLC fails.

(8) Fault circuits shall be designed to ensure that items of equipment or functional unit alarms (once detected) remain active in the control system (following a fault sensing device reset) until the alarm is reset using the local FAULT RESET pushbutton or a remote fault reset function (when provided). This control system reset shall only be possible following resetting of the fault sensing device.

(9) Control circuits and switchboards shall be designed to ensure that manual resetting of all fault sensing devices (e.g. thermal overload, Soft Starter, VFD etc.) shall be possible from the front panel of (and external to) the switchboard (or false mounting panels where controls and indications are installed on the false mounting panel). This requirement does not apply to short circuit protective devices (i.e. circuit breakers) that are not providing motor overload protection (i.e. TOL protection).

(10) Control circuits for functional unit (e.g. a pump) shall be designed to ensure that RUN and FAULT (as a minimum) indicator lamps continue to operate when the functional unit has MANUAL mode selected and when any PLC installed fails. This requirement shall include functional units operated by variable speed drives (VFD’s) where the functional unit has MANUAL of OFF selected and is operated directly from the VFD (or the VFD control panel).

(11) Pump protection faults (e.g. No Flow) shall be latched and time delayed and shall continue to provide protection when the pump is operating in all modes (e.g. MANUAL mode).

(12) All functional unit faults detected shall activate the functional unit local and remote (e.g. SCADA and telemetry) fault indication signals.

7 INSTALLATION REQUIREMENTS OF ELECTRICAL COMPONENTS

7.1 Ratings

Where current and/or voltage ratings for components are specified and/or shown on the specification drawings, components shall have ratings not less than those specified or shown.

Where current and/or voltage ratings are not specified or shown then components shall have current and voltage ratings adequate for the duty which they are to perform.

When determining the ratings allowance shall be made for:

(1) frequency of usage,
(2) making and breaking currents,
(3) power factor (where applicable),
(4) prospective fault current and
(5) ambient temperatures which will occur at the point of installation.

7.2 Degree of Protection

The degree of protection of components which are mounted on the outside of switchboards or control panels shall be suitable for the location and application and shall not be less than that of the switchboards or control panels.

The degree of protection for electrical equipment installed within the switchboard shall provide a degree of protection of not less than IP2X in accordance with AS/NZS 60529.

7.3 Circuit Breakers

All circuit breakers installed shall be selected to ensure that they discriminate with, and operate prior to, the supplier of electrical energy fuses upon occurrence of a fault. Circuit breakers installed to protect pump motor circuits shall be selected in accordance with the manufacturer's requirements to meet this specification.

Discrimination

Where circuit breakers are installed in series, discrimination shall be provided for tripping currents up to the maximum prospective fault current for the installation.

Moulded Case Circuit Breakers

Moulded case circuit breakers shall be in accordance with either AS 2184 or AS 60947.2 and the following:

(1) Three pole.

(2) Suitable for 400 volt 3 phase 50 Hz operation.

(3) Quick make manual closing.

(4) Quick break manual opening.

(5) Trip free.

(6) Automatic opening on overcurrent and short circuit.

(7) Provided with mechanical status indication, i.e. open, closed and fault.

(8) Lockable in the open position.

(9) Provided with safety interlocks to prevent the compartment door from being opened with the breaker in the closed position and to prevent the breaker from being closed with the compartment door opened.

(10) Suitable for uninterrupted duty.

(11) Rated for the full load current of the circuit.

(12) Have a rated short circuit making capacity not less than the prospective short circuit current of the supply.

(13) Have a rated service short circuit breaking capacity not less than the prospective short circuit current of the supply.

(14) Provided with instantaneous tripping.

(15) Provided with inverse time delay tripping.

Miniature Circuit Breakers

Single pole and multi-pole miniature circuit breakers shall be in accordance with AS 3111 and the following:

(1) Shall have a current interrupting capacity suitable for the prospective fault current and not less than 6 kA symmetrical.

(2) 3 single-pole breakers shall be replaceable by 1 three-pole breaker and vice versa.

(3) Any miniature circuit breaker which is used to isolate its associated electric motor shall, in addition, be provided with facilities to padlock the switch in the OPEN or OFF position.

Surge Protection

Surge Arrestors to be fitted and have discharge current of 20kVa.

7.4 Residual Current Devices

Residual current devices shall:

(1) Be in accordance with AS 3190.

(2) Be type II devices in accordance with AS 3190.

(3) Be combined miniature circuit breaker/residual current devices in accordance with the requirements of the miniature circuit breaker requirements of this specification.

Residual current devices shall be tested before being placed into service to ensure that:

(1) the tripping current is set to the appropriate value; and

(2) the unit trips in less than 30 milliseconds at a test current of 10 mA.

7.5 Isolating Switches

Isolating switches must be provided for all electric motors. These shall be in accordance with AS/NZS 3133. Any switch which is used to directly isolate its associated electric motor by switching the phase conductors shall be a motor control switch as defined in the Standard and shall, in addition, be provided with facilities to padlock the switch in the OPEN or OFF position.

All single phase isolating switches which are rated at 20 A and above and all multiphase isolating switches shall include a positive indication, which shall include the words 'ON' and 'OFF', of the position of the switch.

7.6 Composite Fuse Switch Units

Composite Fuse Switch (CFS) units shall be in accordance with the air break switch requirement of this specification and the following:

(1) Accommodate HRC fuses.

(2) Triple pole units.

(3) Individual contacts separately and fully shrouded.

(4) Barriers included between fuse cartridges to reduce the possibility of a phase to phase or phase to earth fault occurring.

(5) Shrouds, barriers and the complete moving contact assembly shall be removable from the CFS enclosure for maintenance purposes.

(6) Provided with facilities to padlock the unit in the OPEN or OFF position.

(7) Provided with safety interlocks to prevent the compartment door from being opened with the CFS unit in the closed position and to prevent the CFS unit from being closed with the compartment door opened.

7.7 Low-Voltage Fuses

Low voltage fuses shall be in accordance with the general requirements of AS 60269.1, applicable requirements of AS 60269.2 and AS 60269.4 and the following:

(1) Suitable for use on a 400/230V 50 Hz supply.

(2) Fuse links shall:
   (a) have a rated breaking capacity of not less than 50 kA at 400 volts 50 Hz or the prospective fault level at the point of installation whichever is higher and
   (b) be of the 'gG' or 'gM' type unless otherwise approved by the QLDC Chief Engineer.

(3) Fuse holders shall:
   (a) have a rated current and a rated power acceptance suitable for the fuse links and

(b) have a protection rating of not less than IP2X in accordance with AS/NZS 60529 with the fuse carriers removed.

(4) Labels shall be fitted on, or immediately adjacent to, each fuse base or each 3 phase set of bases to identify the function and designation of the fuses and to specify the current ratings of the fuse links.

7.8 Meters

General

Where amps and voltages are not displayed on VSD or soft starter display panels, ammeters and voltmeters shall be provided. They shall be square bezel pattern, nominal size 96 mm with an approximate 240° movement. A multi-function meter may be used in place of individual voltmeter, ammeter, kilowatt meter etc. to measure and display the required parameters in a single unit.

Ammeters

Ammeters shall be in accordance with the following:

(1) Provided with a selector switch to allow selection of individual phase currents. An OFF position shall be provided.

(2) Accuracy of ±2.5% or better.

(3) Scaled to correspond to the rated primary current.

(4) Where used for measuring motor current, be overscaled to approximately 6 times the rated current of the associated motor. Full load current shall occur between 60% and 90% of full scale.

(5) Where used for other than measuring motor current, be overscaled to approximately two times the rated current of the circuit.

Voltmeters

Voltmeters shall be in accordance with the following:

(1) Provided with a voltmeter selector switch and potential fuses to allow selection of individual phase to phase voltages. No OFF position shall be provided.

(2) Accuracy of ±2.5% or better.

(3) Scaled to read between 0 and 500 volts.

Multi-function Meters

Multi-function meters shall be in accordance with the following:

(1) Measure and display voltage, current and power in a single integral unit at not less than ± 1% accuracy.

Additional parameters (energy, power factor, individual and total harmonic distortions etc.) shall be included as required by the project specification and/or drawings. The display shall be retained during power failure where used for energy measurement.

(2) Panel mounting.

(3) Suitable for monitoring a 3 phase unbalanced supply and load.

(4) Operation from a 230 V ac auxiliary supply.

(5) Provided with the following remote interfaces where required by the project specification:
   (a) Digital and analogue inputs/outputs programmable to represent the selected parameters.
   (b) RS-485 serial port with industry standard Ethernet protocol.

Hours Run Meters

Hours run meters shall be synchronous motor driven units with a display capable of registering not less than 999999 hours and shall be non-resettable.

Current Transformers

Metering Current Transformers

Metering current transformers shall be in accordance with AS 60044.1 and the following:

(1) Accuracy not lower than Class 0.2 or, where used with test sockets, kW meters, kWh meters or multi-function meters, not lower than Class 1M or higher as required by the project specification.

(2) Rated secondary current of 5 A.

(3) Rated burden sufficient to cover the burden imposed by the connected equipment including cables. Where a test socket is required, an additional burden of 5 VA shall be allowed for external equipment which may be plugged into the socket.

Protection Current Transformers

Protection current transformers shall be in accordance with AS 60044.1 and the following:

(1) Designated as 10P150F20 unless otherwise specified or required to suit the protection relay.

(2) Rated secondary current of preferably 1A.

(3) Transformer ratio shall be determined for correct operation of the associated relay under fault condition taking into consideration the rated accuracy limit factor of the transformer and the burden of the connected circuit.

(4) Provided with test taps where required to be used in conjunction with a test socket.

7.9 Control Relays

All control, interposing, latching and auxiliary relays shall be in accordance with AS 60947.5.1 and the following:

(1) If there is no control circuit or the voltage is not specified, then 24 V dc shall be used unless otherwise agreed by the QLDC Chief Engineer.

(2) Contacts shall be suitable for the type of duty required and shall have a current rating adequate for the load and, in any case, not less than 1 A.

(3) Plug in relays shall be provided with an LED status indicator.

If relays are of the plug-in type and mixed extra-low and low voltages are used within the relays, then all relays which have mixed voltages shall have a Certificate of Suitability from a recognised Statutory Authority for mixed voltage application. Such relays shall not be physically interchangeable with other plug-in relays within the system.

7.10 Timing Relays

Timing relays shall be in accordance with the following:

(1) Electronic type with an adjustable range.

(2) Suitable for operation on the voltage shown on the control circuit drawings or specified in the project specification. If there is no control circuit or the voltage is not specified, then 24 V dc shall be used unless otherwise agreed by the QLDC Chief Engineer.

(3) Contacts shall be suitable for the type of duty required and shall have a current rating adequate for the load and, in any case, not less than 1 A.

(4) Accuracy Class 1.5 or better.

7.11 Equipment Electronic Relays

Any electronic relays that are installed to control individual items of equipment (e.g. a pump) shall comply with the following:

(1) Have a minimum of 20% spare inputs and outputs installed.

(2) Be of the Make and Model specified in Appendix A, unless otherwise approved by the QLDC Chief Engineer.

(3) Operate from 24 V dc.

(4) A copy of all manuals including a disk copy of the program shall be provided.

(5) A copy of any programming software unless the software is the same as that used for programming the main control PLC.

(6) All hardware connectors necessary to allow for connection of a personal or laptop computer to the relay for making program changes shall be provided.

Float Switches

Float switches shall be of the make and model specified in Appendix A and shall contain both normally open and normally closed contacts.

Undervoltage and Phase Imbalance Relays

The relay shall be a combined phase imbalance and undervoltage type with a contact opening for the following:

(1) Voltage below 80% of nominal 400 V ac.

(2) Phase imbalance greater than value set. This value shall be adjustable from 5-15% and initially set at 10%.

Control Switching Devices and Indicator Lights

Pushbuttons, rotary switches and indicator lights shall be in accordance with AS 60947.5.1.

Indicator lights shall be high intensity LED type.

The colours of pushbuttons and indicator lights shall be in accordance with those defined in the project specification, this specification, or if not specified, in accordance with IEC 60073.

8 PUMP MOTOR CONTROL

8.1 Motor control mode

The mode and method of pump motor control shall be determined by the contract specification.
For small wastewater pump stations where this electrical and SCADA standard applies, soft starters are the preferential method of motor control. This assumes that the pumps shall only be required to run at full speed.

8.2 Motor Starting

Direct on line (DOL) starting may be used where allowed by the supplier of electrical energy if approved by the QLDC Chief Engineer. Soft starters/VSDs of the make and model specified in Appendix A and installed to manufacture recommendations shall be used for motor starting where the direct on line starting current exceeds the limitation on starting current set by the supplier of electrical energy. The use of VSDs over soft starters shall be approved by the Principal.

8.3 Motor Contactors

Motor contactors shall be in accordance with the following:

(1) 3-pole or where necessary 4-pole, air break, electromechanical type in accordance with AS 60947.4.1.

(2) Provided with Type 2 co-ordination with short-circuit protective devices in accordance with AS 60947.4.1.

(3) Utilisation category AC-3 and intermittent duty not less than Class 12 as defined in AS 60947.4.1, or a higher category and/or duty class to suit the specified operation requirements if required.

(4) A mechanical endurance of not less than 1 million operating cycles.

(5) Operating coils shall operate at 230 volts 50 Hz single phase.

8.4 Soft Starters

Soft starters shall be ac semiconductor type in accordance with AS 60947.4.2 and the following:

(1) Be of the make and model specified in Appendix A.

(2) Electronic starters are to be installed as per the manufactures recommendations.

(3) Provided with a bypass contactor to minimize energy loss and/or heat generation during operation unless otherwise agreed by the QLDC Chief Engineer.

(4) Be designed and constructed to operate satisfactorily with an emergency stop contactor installed between the starter and the motor. This requirement shall apply at all motor loads up to and including the full load rating of the soft starter.

8.5 Variable Speed Drives

The switchboard design, electrical drawings and line diagrams developed as part of this standard is intended to cover for electrical installations and MCC specification where submersible pump motors are controlled on soft start rather than variable speed drive.

Should the contract specification or principal to the contract identify a requirement for VSD controlled pumps, installation of VSDs should, at minimum, conform to the requirements below;

(1) Shall be of the make and model specified in Appendix A.

(2) Electronic starters are to be installed as per the manufactures recommendations.

(3) C-tick compliant with harmonic and RFI filters incorporating input ac chokes if necessary to comply with the limits of electromagnetic and harmonic disturbances in accordance with AS/NZS CISPR 11, be rated and suitable for use in the first environment in accordance with AS 61800.3 and meet with the requirements of the supplier of electrical energy.

(4) Electromagnetic immunity in accordance with AS/NZS 4252.1.

(5) Capable of sustaining not less than 110% rated output current for a minimum of 1 minute.

(6) Motor cables and wiring shall be in accordance with the variable frequency drive supplier's recommendations. Such requirements shall include the cable type and installation method to satisfy the radio frequency interference and other requirements specified in this Specification.

(7) Harmonic mitigation shall be provided in accordance with network requirements.

(8) Output filters shall be provided to ensure motor maximum voltages are not exceeded.

8.6 Motor Protection Units

Thermal Overload Units

Thermal overload units shall be in accordance with AS 60947.4.1 and the following:

(1) Triple pole, differential action to enhance the performance of protection against phase imbalance or phase failure.

(2) Incorporate ambient temperature compensation.

(3) Include a provision to allow the trip setting to be adjusted.

(4) Suitable for alternative manual or automatic reset and initially selected to automatic reset if the control circuit has a separate RESET pushbutton.

Electronic Motor Protection Relays

Electronic motor protection relays shall be provided for the protection of motors rated at 15 kW and above and a soft starter or VFD is not fitted. The protection relays shall be in accordance with the following:

(1) Provide protection and separate indication for each of the following:

(a) Overload

(b) Winding overtemperature by means of thermistors

(c) Single phasing and asymmetry.

(2) Have selectable current and trip time settings.

(3) Have a test feature.

(4) Suitable for operation from a 230 V ac supply.

(5) Provide finger protection for the terminals (IP 2X) other than the main connections.

(6) Unaffected by the passage of short circuit currents through the unit.

Directly connected units (i.e. without the need for external current transformers) are preferred.

Thermistor Control Units

Thermistor control units shall be used to monitor the operation of thermistors built into motors unless the thermistors are monitored by an electronic motor protection relay.

The control units shall be in accordance with AS 1023.1 and the following:

(1) Suitable for a 230 V ac supply voltage.

(2) Provide a visual indication that a trip has occurred.

(3) Match the type of thermistor, i.e. positive or negative coefficient type.

9 PUMP CONTROL SYSTEM

9.1 Pump configuration

The configuration of the pumps shall be determined at the design stage. This can be one of two configurations;

(1) Duty / standby. This set up will work to run only one pump at any one time. This may be as a result of constraints to power supply and / or hydraulic conditions. This set up will work to run a standby pump when the standby pump start level is reached. This will be as a result of duty pump failure and/or high inflow conditions. Under this configuration the duty pump has to stop running prior to standby start.

(2) Duty / assist. This set up will work to run an assist pump when the assist pump start level is reached. This may be as a result of duty pump failure and/or high inflow conditions. Under this configuration the assist pump can run together with the duty pump.

9.2 Duty rotation

The pump controller shall be programmed to rotate duty pump after each pump cycle. This is to ensure all pumps are regularly run.

Where this function is not a feature of the controller, a duty selector switch shall be installed and shall be labelled 1-2, 2-1.

When 1-2 is selected, pump 1 shall be the duty pump and operate from the duty 1 start and stop levels.

When 2-1 is selected, pump 2 shall be the duty pump and operate from the duty 1 start and stop levels.

The initial setting for the duty start and stop level setpoints shall be determined by the design.

9.3 Pump mode control

A mode selector switch shall be provided for each pump. The mode selector shall have an AUTO, OFF and MANUAL position.

- When pump 1 mode selector has MANUAL selected, pump 1 shall start. irrespective of the wetwell level or SCADA control systems.
- When pump 1 mode selector has AUTO selected, pump 1 shall operate off the primary level measurement device and pump controller.
- When pump 1 mode selector has OFF selected pump 1 shall not run.
- Control for the pump 2 mode selector shall be similar to that of pump 1.

- The operation of pumps when in MANUAL mode shall be independent of any electronic device(s) or common control components other than motor protection. and shall not be connected to such device(s) (e.g. manual running shall be possible during complete failure of the primary level measurement device and pump controller or SCADA system).

9.4 Pump control systems

Pumps shall start and stop depending on the sewage level in the wetwell as determined by set points programmed in the pump controller.

The pumping station shall be controlled by two independent pump control systems as follows;

(1) Primary pump control (operating off a pump controller and wet well level measurement device),

(2) Secondary pump control system (operating off 2nd wet well level device and RTU.).

Remote pump starting and stopping shall also be provided from the SCADA system using Control Outputs off the RTU.

Design of wastewater pump stations in this manner allows for a good level of redundancy should one of these pump control systems fail.

Primary pump control

The primary level measurement device and pump controller shall operate when the mode selector has AUTO selected.

Pump start and stop points shall be programmed into the pump controller and labelled as follows:

(1) START DUTY PUMP

(2) STOP DUTY PUMP

(3) START STANDBY PUMP

(4) STOP STANDBY PUMP

All of the above level setpoints shall represent wetwell level and shall be adjustable between 5% and 95% of wetwell level in 1% increments. All level settings shall be programmed in the pump controller and remain operator adjustable.

- The duty pump shall start when the sewage level increases to the START DUTY level and stop when the level falls to the STOP DUTY level.
- The standby pump will start when the sewage level increases to the START STANDBY level and stop when the level falls to the STOP STANDBY level.

Secondary pump control

The secondary pump control system shall operate from a 2nd wet well measurement device via the RTU. The control circuit shall be wired completely independently from the primary control system in order to provide a fully redundant pump control function.

This secondary pump control system is required to work when any component of the primary control system fails. The functional control of this secondary pump control system is required to achieve the following;

- Automatic switch over of duty / standby and assist pump control functions without intervention of operators,
- Secondary pump start set point configured to be higher than primary control duty start setpoint,
- Pump run signals to be communicated through to the RTU from the motor starter.
- SCADA alarm output to notify operators of the failure of primary pump control system.

Design of the secondary pump control system shall align with the pump configuration when in primary control mode.

RTU Control

Basic automated control of the pumps can also be achieved through pump control programmes downloaded to the RTU at site. The use of these programmes must be agreed by the QLDC Chief Engineer. The programmes shall be supplied by QLDC's SCADA system administrators.

This method of pump control differs from the primary and secondary control systems in that it requires manual selection by the operator on site via a control switch.

It is a useful mechanism for running the pump station in automatic control when the pump controller has failed but the level measurement device remains operational.

RTU control switch

In order to facilitate this feature, a push button between Local and RTU control is required to be installed. The push button is to be wired to a Digital Input on the RTU. This switch shall be labelled Level Control / Local - RTU

Activation of this switch to RTU control enables the following;

- Disengage of primary pump control system,
- Activation of RTU control outputs.
- Automated pump running off set points programmed into RTU.
- Remote manual control of pumps via the SCADA system (this should only be possible when the local pump control mode switches are in AUTO).

The pump run signal from the SCADA system shall operate the pump when the pump mode selector for that pump is in the AUTO position but shall not operate the pump if the pump mode selector is in the MANUAL or OFF position.

9.5 Remote fault resetting

High / low level resets

High and low level fault conditions shall be able to be reset manually or via the SCADA system. Floats will be an indication of level only and not provide any control over the pumps.

A pulse signal from the SCADA system shall be initiated from the base station which when activated will reset the pump station fault. This is a useful mechanism when the high and low level faults activate as a result of a level condition which clears itself.

10 PROGRAMMABLE LOGIC CONTROLLERS

Proprietary "off the shelf" controllers are preferred. A PLC should only be used where a proprietary controller is not suitable.

10.1 Specification

(1) Shall be of the Make and Model specified in Appendix A unless otherwise approved by the QLDC Chief Engineer.

(2) Ethernet link shall preferably be used for inter-PLC communications and for communications with a host SCADA system where applicable. Any PLC connected to a SCADA system shall be fitted with one (1) dedicated communication port for that purpose.

(3) An electronic copy of PLC ladder program shall be supplied unless agreed by the QLDC Chief Engineer.

(4) A copy of PLC manuals shall be supplied unless agreed by the QLDC Chief Engineer.

10.2 PLC Programming

The Contractor shall be responsible for programming the PLC.

The contractor should ensure all key parameters and set points may be operator adjustable by the operation and maintenance contractor to allow for adjustment in operational efficiency.

The contractor is advised to communicate the control philosophy of the pump station to the operation and maintenance contractor at the earliest opportunity in order that submersible pump operation is consistent with other pump stations across the Queenstown Lakes district.

At the conclusion of the project the contractor shall supply to QLDC a licensed copy of any software packages required to modify PLC programming. QLDC have copies of the following software and as such copies of the following are not required:

- RSLogix 500 8.40.00 (CPR9)
- RSLogix 5000 20.01.00(CPR9 SR5)
- Control Expert v14.1 - Small (S)

10.3 PID control

PLC control loops employing PID control shall be designed and programmed to ensure that the analogue PLC process variable output signal (i.e. pump speed control signal) is set equal to zero % and the PID calculations cease when the controlled device is not running (i.e. pump is stopped). The process variable signal shall commence calculations using signals that are present when the controlled device commences operation (i.e. "anti-reset windup" shall be programmed into the PLC). Such programming and calculations shall ensure that the process variable does not drive to full scale 100% when the controlled device is started.

When telemetry analogue output signals are used as inputs to the control system for setpoints or control setting, PLC programming shall be designed to ensure that only valid signals are accepted by the PLC. This shall be achieved using time based validation of input signals. The validation shall check input values at regular time intervals (expected to be in the order of 2-10 seconds) and accept the most recent valid value as the control variable. Time validation shall not be used on control signals that are used as feedback in PID control loops. If an invalid setpoint or control signal (e.g. signal < 4 mA or > 20 mA) is detected by the control PLC, the previous value of that signal shall continue to be used by the control system until the next different valid control signal is detected.

If PLC programmes are protected by password, then that password shall be noted in the site documentation and be recorded at the SCADA base station.

10.4 HMI Touchscreen

Any touchscreen installed shall be in accordance with the following:

(1) Shall be of the Make and Model specified in Appendix A unless otherwise approved by the QLDC Chief Engineer.

(2) All parameters above shall be easily viewable and adjustable from the front of the touchscreen.

(3) The Touchscreen shall communicate directly to the main control PLC.

(4) The touchscreen shall be provided with two levels of security access coding to restrict access to authorised personnel only. Level one shall be for all liquid level and flow setpoints and level two shall be for PID control parameters and PLC time delay settings in addition to flow and level setpoints. No security shall be required for viewing operational parameters and status information.

(5) The touchscreen shall be colour with a minimum screen size of 140 mm.

(6) The Contractor shall program the touchscreen and provide an electronic copy of the final program to the Principal.

(7) The Contractor shall design the touchscreen screen displays. All such screen displays shall be approved by the QLDC Chief Engineer.

(8) Draft versions of HMI screens are to be sent for peer review.

Any touchscreen installed shall be mounted in the common control cubicle of the switchboard.

The following information shall be displayed on the touchscreen as a minimum:

(1) The current duty selection status for each item of equipment.

(2) Operational status (e.g. run/stop, open/close) for each item of equipment.

(3) Status of all alarms installed for each item of equipment.

(4) Other operation parameters for each item of equipment.

(5) The duty setpoints for each item of equipment.

The touchscreen shall be used to interface and display the following PLC parameters:

(1) All level and flow operational values.

(2) Alarm setpoints.

(3) Control parameters.

(4) PID control parameters for all control systems.

Touch Screen to conform to following colours

Red – Fault

Yellow – Manual/Unavailable

White – Running

Green – Available

11 PUMP CONTROL HARDWARE

11.1 Pump controller

Approved pump controllers presently in use across the Queenstown Lakes District include the following devices;

- Siemens MultiRanger 200 (MR200) pump controller,
- MultiTrode MultiSmart pump controller.
- PLC type as specified in Appendix A.

Secondary pump control systems are a compulsory requirement of all pump station designs.

The pump controller shall provide for a 4-20 mA DC wetwell level input signal, a relay output with changeover contacts for Duty 1 pump run, Duty 2 pump run and level transducer fault.

If the pump controller is programmable, then the Electrical Contractor shall supply a device programmer or appropriate PC software and hardware to program the device.

QLDC have copies of the following software and as such copies of the following are not required:

- RSLogix 500 8.40.00 (CPR9)
- RSLogix 5000 20.01.00(CPR9 SR5)
- Control Expert v14.1 - Small (S)

11.2 Level measurement

Level measurement at QLDC wastewater pump stations is to be undertaken through use of a hydrostatic level transducer. They shall be suitable for use in wastewater and installed to manufactures recommendations.

The transducers shall be configured into any pump control module on site and also be connected to the RTU for remote monitoring via SCADA.

Primary level measurement requires a method of returning an analogue level well level % back to the SCADA independent of the output from the pump controller. This is to ensure remote monitoring of well level can be observed where the pump controller is not operational.

11.3 Installation

The level sensor shall be mounted in accordance with the manufacturer's instructions. Hydrostatic level transducers need to be installed in stilling tubes mounted inside the pump station.

The purpose of the stilling tube is to protect the sensor. The stilling tube shall be made of PVC or stainless steel in order that it is suitable for use in wastewater. It shall be hydraulically linked to the well level in order that sensor measurement accurately reflects well level.

The stilling tube shall be attached to a side wall of the wet well and allow for easy access for operators to remove and clean the transducer inside. All mounting brackets, bolts, nuts and washers shall be manufactured from grade 316 stainless steel.

The level sensor shall be located such that the level sensor and mounting equipment shall not interfere or foul with the pumps during their removal and reinstatement in the wetwell or with the normal removal of any safety grid installed in the wetwell.

- The wetwell level sensor shall be hard wired to the pumping station switchboard.
- Power for all level sensors shall be provided from the switchboard.
- All cables shall be in accordance with this Specification.
- If the level sensor is a non contact type then the level sensor shall be located such that the beam does not detect pumps, pipes and other obstacles in the wetwell.
- Electrical installation of this instrument requires the analogue input signal to be split between RTU and pump controller.
- This is to be achieved using a signal isolator in order that each of these circuits remain separate from each other.

11.4 Level display

A local level display of well level (%) shall be mounted on the control panel of the switchboard in order that operators are able to determine the level of liquid in the pump station without the need to dial into the SCADA system.

11.5 Scaling

Configuration of the level measurement device to the pump controller is required as part of local pump control commissioning. The span of the level measurement (metres) is a critical value and allows QLDC and the maintenance contractor to correlate liquid level with volume for the purpose of engineering design and performance.

- The span of the level transducer should reflect the depth of the wet well from a point above the invert level to the emergency storage chamber to the bottom of the wet well. This is to ensure that any overflow to the emergency storage chamber is captured via the level measurement device.

- The electrical contractor shall supply this value to the maintenance contractor during the commissioning phase.

11.6 Operation

- The hydrostatic level transducer shall operate from a DC battery-backed supply so that it continues to operate and provide a wetwell level signal to the telemetry system during times of power failure.
- The level transducer shall be capable of measuring level over the whole height of the wetwell in which it is installed.
- Where the level transducer 4-20 mA signal has a fixed range, that range should be chosen to correspond as closely as possible to the actual wetwell full level.
- The 4-20 mA signal shall be calibrated such that 4 mA is the wetwell empty level and 20 mA corresponds to overflow level.
- If the level sensor is a non-contact type then the unit shall have in built temperature compensation and be suitable for the conditions inside the wetwell.
- The unit shall have an ingress protection rating of not less than IP 65 in accordance with AS/NZS 60529.

12 BACK UP FLOATS AND PROBES

Back up float switches and/or level probes have an important role to play in the signalling of critical pump station levels to the operator. These are generally set up in order that low level and high level alarms are generated when the liquid of sewage reaches certain levels in the main wet well.
Back up float signals are required to be connected through to the RTU for SCADA alarming. Any high or low level float switches installed need to be independent of the main level measurement device for the purpose of autonomous status feedback.

This standard allows for high and low level liquid detection through the use of two alternative instruments;

- Float switches as per the Make and Model specified in Appendix A unless otherwise approved by the QLDC Chief Engineer,
- Liquid level probe, as per the Make and Model specified in Appendix A unless otherwise approved by the QLDC Chief Engineer.

12.1 Float Switches

Two float switches are generally required to provide indication of pump station status. These floats are designed to operate independently of the primary level control system and are linked through to the RTU for SCADA alarming.

- High level
- Low level

Float switches shall be the type specified in Appendix A or equivalent suitable for specific gravity of 1.0 and with cable length to suit the application.

High and low level floats will manual PUSH TO RESET buttons mounted on the switchboard to allow for local reset.
Remote reset of high and low level fault conditions shall also be made available through the SCADA.

Float switches shall be mounted on a float hanger as shown in Drawing QLDC_WWPS_01 The Contractor shall supply and install a float hanger which is similar in design to QLDC_WWPS_01, with float supports to prevent movement and entanglement.

12.2 Liquid level probes

The level probes allow for a floatless level relay system to be installed with the benefit that one probe can provide a number of outputs.

The probes are available with up to 10 sensors for multi functional alarming and back up pump control. The more basic model, with three sensors, allows for standard high and low level alarming with the potential for a third set point to be configured against an overflow point or back up pump start level.

13 FLOW AND PRESSURE MONITORING

13.1 Flowmeters

All QLDC pump station facilities are to be installed with electromagnetic (magflow) flowmeters on the discharge rising main in order to monitor pump station performance.

Magflow meters installed should be installed to the following standard;

- Make and Model specified in Appendix A unless otherwise approved by the QLDC Chief Engineer
- Be installed full bore on the common rising main,
- Be of a diameter that matches the rising main so as not to incur flow restriction or dynamic head losses,
- Mechanical installation via flange connection to the rising main,
- Be mechanically installed to manufactures recommendations conforming the requirement of 5 x dia straight line lengths upstream of the flowmeter and 2 x dia straight line lengths downstream of the flowmeter.
- Be installed inside a manhole or chamber. QLDC recommends use of 1050mm dia manholes for magflow meters of 200mm dia or less.
- Manholes to be installed with 2 x 50mm conduit running between manhole and pump station switchboard or building (one for power, one for signal cable).
- Transmitter or head units to be mounted inside pump station switchboard or building to allow for operators to determine pump flow
- Transmitter or head units to be hardwired with analogue connection through to RTU for remote flow measurement.
- Flowmeter scaling to be determined by Veolia. Veolia shall provide a scaling range (litres/sec) that shall be configured to the 4-20mA range of the magflow meter installed.
- Transmitter or head units to be hardwired with analogue connection through to RTU for remote flow measurement.
- Pulse output from magflow meter to be configured so that 1 pulse count = 1m3 pumped volume.
- Flowmeter scaling to be determined by Veolia. Veolia shall provide a scaling range (litres/sec) that shall be configured to the 4-20mA range of the magflow meter installed.

- Analogue and digital inputs for magflow connection to be pre-determined by SCADA I/O schedule issued by Veolia or 3 Waters contractor.

13.2 Pressure transducers

All QLDC pump station facilities are to be installed with pressure transducers tapped onto the discharge rising main in order to monitor pump performance and pipeline integrity.

Pressure transducers should be installed to the following standard;

- Make and Model specified in Appendix A unless otherwise approved by the QLDC Chief Engineer.
- Measuring range of transducer to be appropriate to anticipated pipeline pressures modelled for.
- Connection of transducer to be allowed for via ½' BSP female threaded tapping point above isolation valve mounted on the rising main.
- Pressure transducer to be connected through to SCADA for remote monitoring only. No local display is required.
- Pressure transducers may be hardwire connected through to RTU or through use of alternative protocols such as Modbus. This is because this measurement is considered non critical.
- Analogue inputs for pressure monitoring connection to be pre-determined by SCADA I/O schedule.

14 SCADA AND TELEMETRY

14.1 Roles and responsibilities

Electrical contractors engaged to connect submersible wastewater pump stations to the QLDC SCADA network should be aware of the contractors involved in the administration and management of the SCADA system;

- Countrynet: QLDC telemetry network provider
- Arthur D Riley : QLDC SCADA hardware and software supplier
- QLDC: SCADA system asset owners
- Veolia: QLDC 3 Waters Contractor and SCADA administration / management for QLDC sites. SCADA and SCADA software provider.
- Fulton Hogan Central: QLDC 3 Waters Contractor and SCADA administration / management for the Lake Hayes Scheme
- Switchbuild; Lake Hayes Scheme SCADA hardware and SCADA software provider

Liaison with Veolia for QLDC sites and Fulton Hogan for Lake Hayes sites at the start of this process is recommended in order to confirm all aspects of SCADA design, installation and commissioning.

14.2 SCADA

Veolia or Fulton Hogan shall be responsible for delivery of the following items associated with the installation of SCADA hardware and subsequent connection of the site to the QLDC SCADA system;

- Selection of communication protocol (RTU to SCADA base station)
- Selection of telemetry hardware required
- Development of SCADA I/O schedule
- Allocation of RTU address
- Commissioning checks on all SCADA I/O
- Allocation of SCADA alarm signals
- Configuration of the base station including datalogging, reporting and alarms.
- Development of SCADA GUI screen/s

14.3 SCADA work required of contractor

Any electrical contractors engaged to connect a remote facility to the QLDC SCADA system shall be required to complete the following;

- Supply and installation of the RTU
- Connection of control hardware to RTU
- Installation of telemetry hardware
- Connection of telemetry hardware to RTU
- Connection of local digital and analogue signals to RTU
- End to end signal testing
- Commissioning checks on all SCADA I/O

14.4 RTU supply and installation

The QLDC SCADA system uses Abbey Systems Swampfox Remote Telemetry Units (RTUs) to communicate with remote pump station facilities.

The QLDC Lake Hayes Scheme SCADA system uses Kingfisher Remote Telemetry(RTU's) to communicate with remote pump station facilities.

Installation of these RTUs shall conform to the following standards;

- Installed to manufactures recommendations
- Installed with back up 24v DC UPS
- Installed inside a dedicated telemetry panel at eye level.
- There must be a minimum of 75mm clearance around the remote telemetry unit and the radio transmitter.
- All connections to the RTU shall be via a telemetry terminal strip.
- Assignment of terminals to field I/O shall be in accordance with Appendix B.

RTU wiring

All contact signals must be voltage free (rated at not less than 24 V dc 0.5 A, 2 wires per signal).

All field wired 4-20 mA signals shall be isolated for connection to the RTU, and shall comply with the following:

(a) Linear with the respect to the measured variable.

(b) Capable of driving a load of 750 Ohms.

(c) Two wire, shielded with shield earthed at the switchboard end.

Backup power supply for RTU

QLDC require all RTUs to be installed with a backup power supply in order that remote monitoring of the pump station can continue in the event of a power outage (mains fail).

This shall be achieved through the use of a DC UPS with capacity to supply the RTU and critical instruments for four hours.

14.5 Signal transmission and telemetry hardware

Signal transmission from the pump station to the SCADA base station shall involve the installation of an antenna.
The type and size of antenna to be installed shall be determined by the 3 Waters Contractor or the radio survey (see below).
The most common form of hardware installed at pump stations across the Queenstown lakes district includes;

- Microwave dish,
- Cellular antenna

Antenna installation

Installation of antenna shall be undertaken to the following conditions;

- Conformance against relevant standards
- The antenna shall be mounted on a stainless steel mounting pipe.
- All fastening and securing brackets, nuts, bolts, washers etc. shall be manufactured from grade 316 stainless steel.
- The radio antenna installation shall be designed and constructed to withstand the prevailing conditions and wind speeds of 120 km/h.
- All cabling to be glanded through the switchboard.
- IP rating of the switchboard shall not be compromised by the mounting of the antenna.
- The antenna shall not be mounted less than 3m above ground level.

Communication method

QLDC 3 Waters Contractors will advise of the preferred method of communication between pump station and SCADA base station. Method of protocol may vary depending on geographical location.

Methods of communication between RTU and SCADA base station used across Queenstown lakes district include the following;

- IP radio
- Cellular

Radio Path Survey

It should be noted that it may be necessary for the electrical contractor to conduct a radio path survey to determine the availability of an acceptable radio path from the base station to the pumping station.

The results of this survey shall be provided to the 3 Waters Contractor who will liaise with the contractor as to an agreed specification for the communication system prior to its installation.

14.6 SCADA I/O

The following signals shall be provided to the telemetry terminal strip for input to the RTU using the terminal numbers specified in Appendix B:

Digital inputs

(1) AC POWER FAILURE (opens on fault: from under-voltage and supply failure relay)

(2) HIGH LEVEL ALARM (opens on fault, from wetwell level device)

(3) LOW LEVEL ALARMS

(4) PUMP 1 RUNNING (closed when running, from motor starter)

(5) PUMP 2 RUNNING (closed when running, from motor starter)

(6) PUMP 1 FAULT (opens on fault)

(7) PUMP 2 FAULT (opens on fault)

(8) PUMP 1 AUTO SELECTED (closed when auto selected)

(9) PUMP 2 AUTO SELECTED (closed when auto selected)

(10) PUMP CONTROL FAULT (opens on fault)

(11) FLOW VOLUME (totaliser pulse from flowmeter)

(12) SCADA CONTROL (on when pulsed)

(13) UPS Alarms

14.7 Analogue inputs

(1) MOTOR 1 CURRENT (Amps)

(2) MOTOR 2 CURRENT (Amps)

(3) WETWELL LEVEL (% full)

(4) INSTANTANEOUS FLOW (litres/sec)

(5) DISCHARGE PRESSURE (kPa)

14.8 Digital outputs

The following signals shall be provided from the output of the RTU to the telemetry terminal strip. This allows for some remote operation and control of the site.

(1) SCADA RUN PUMP 1 (closed when pump to run)

(2) SCADA RUN PUMP 2 (closed when pump to run)

(3) HIGH / LOW LEVEL RESET

(4) RTU Control Enabled

14.9 Analogue outputs

No analogue outputs are required for wastewater pump station operation.

15 SCADA SOFTWARE CONFIGURATION

15.1 SCADA administration

The SCADA software provider is responsible for software configuration of the pump station to the SCADA base station. Pumping station measurements and status shall be stored and archived for performance monitoring and engineering design requirements by QLDC and third parties.

Veolia shall provide the following:

(1) A graphical user interface (GUI) at the SCADA base station for the pumping station.

(2) The calculation, display and logging of alarms at the base station (both pump station and telemetry generated).

(3) Configuration of all remote signals and measurements as specified in Appendix B.

15.2 Graphical User Interface (GUI)

The SCADA software provider shall produce and make operational the GUI for the pumping station. The GUI shall display all critical pump station and measurements to ensure pump station performance can be monitored remotely by network operators.

The SCADA software provider shall configure and test all alarms and indications included on the pumping station GUI. Testing of these shall be made in conjunction with the electrical contractor on site.

15.3 Pump station alarms

The SCADA software provider shall configure the SCADA base station such that the following pumping station alarms are displayed on the GUI, appear in event logs and activate the appropriate pager(s) in accordance with existing alarm classes, where appropriate, or as determined by the QLDC Chief Engineer:

(1) High Level.

(2) Power Fail.

(3) Pump 1 Fault.

(4) Pump 2 Fault.

(5) Wetwell Level Device Fault.

16 INSPECTION AND COMMISSIONING

16.1 General

All electrical equipment manufactured under the Contract shall be tested at the manufacturer's works to ensure that the equipment complies with this Specification.

Witness tests may be carried out in the presence of and to the satisfaction of the Principal inspecting officer.

The Electrical Contractor shall give the QLDC Chief Engineer a minimum of ten (10) working days' notice of the manufacturer's intention to conduct tests.

All works testing costs, including the supply of plant, materials, gauges and instruments shall be the responsibility of the Contractor. All test instruments shall have current calibration certificates, if applicable, and all certificates shall be made available for checking by the inspecting officer.

16.2 Commissioning format

Veolia have developed a structure for testing of new pump station facilities vested to QLDC. The format of this commissioning follows a logical review of the operation and functional testing of all major mechanical and electrical components and instruments. A recommended format for facility commissioning is as follows;

- Civil works and structures
- Pipework and valving
- Switchboard construction to specification
- Pump performance
- Fault conditions
- Primary pump control
- Secondary pump control
- Local pump control
- Auto pump control
- Remote pump control
- High and low level alarming
- Instrumentation
- SCADA communication
- SCADA signals (local vs SCADA)
- SCADA measurements

16.3 Pump station functionality

Works tests shall be carried out to thoroughly test out functions of control and back up pumping systems, alarm outputs, local and remote status indication, pushbutton and reset functions.

Testing shall include, but not be limited to, the following

Pump performance

- Duty flow output vs design curve
- Discharge pressure vs design curve
- AUTO/ MANUAL / OFF mode switches

Fault conditions

- Pump RUN / pump FAULT
- High and low level faults alarm outputs and control outputs (if any)
- Primary pump control fault
- Level measurement fault

Primary pump control

- Duty pump start / stop set points
- Standby pump start / stop set points
- Assist pump start / stop set points
- Duty pump rotation (method)

Secondary pump control

- SCADA alarm outputs
- Duty pump start / stop set points
- Standby pump start / stop set points
- Assist pump start / stop set points

16.4 Switchboard inspection

At the completion of the installation or at the completion of agreed subsections of the work, the Electrical Contractor shall, in the presence of the inspecting officer conduct site acceptance tests on all equipment which has been supplied and/or installed as part of the Contract. The testing shall be in accordance with the Specification and to the satisfaction of the inspecting officer.

The Electrical Contractor shall give the inspecting officer not less than ten (10) working days' notice of his intention to undertake the tests.

The provision of all necessary equipment for testing shall be the responsibility of the Contractor. All test instruments shall have current calibration certificates, if applicable, and all certificates shall be made available for checking by the inspecting officer before testing commences.

16.5 Switchboard testing

The Electrical Contractor shall, in the presence of the QLDC Chief Engineer inspecting officer, carry out site tests to demonstrate that the installation is in accordance with the specified requirements and that the installation operates correctly.

Equipment which has been satisfactorily performance tested or witness tested in the manufacturer's works need not be site tested except to:

(1) check the installation and interconnections;

(2) check for any damage or deterioration which may have occurred since the works tests; and

(3) demonstrate that the system functions in accordance with the Specification.

Control circuits / local distribution

The tests shall be carried out in accordance with the relevant Standards and shall include the following where applicable:

(1) insulation resistance tests

(2) earth resistance tests

(3) continuity tests

(4) polarity tests

(5) calibration checks

(6) sequencing tests

(7) functional tests

The series of test below are required demonstrate the integrity and correct operation of the system including protective devices and remote operations, indications and controls.

Protective units, relays etc. which allow current injection or similar to check their settings shall, during testing, have each function tested and calibrated.

Units which may be adjusted (e.g. thermal overload relays) shall be adjusted to the appropriate settings in accordance with the manufacturer's written instructions.

SCADA Testing

The Electrical Contractor shall liaise with the SCADA software provider ~~Veolia~~ throughout SCADA testing to ensure local pump station status is reflected through the SCADA system

The inspection and tests shall include, but not be limited to the following:

(1) SCADA comms check to ensure strength of signal and protocol type allows for robust signalling and communication back to the SCADA base station,

(2) Performance tests to ensure that all inputs and outputs confirm to the SCADA I/O schedule.

(3) Instrument checks to ensure mapping and scaling ranges are accurately determined and match.

(4) Remote control checks to ensure all control outputs installed at site map through to the correct local functionality.

Test Results

The results of all site tests shall be neatly and legibly recorded during the progress of the test on the approved test sheets. A copy of the test sheets, co-signed by the Electrical Contractor and the inspecting officer, shall be handed to the inspecting officer on completion of the tests.

Sign off on SCADA signalling, controls and alarms is required by both the maintenance contractor and electrical on-site contractor.

An example of a generic test sheet is provided in Appendix D. The test sheet shall be modified by the Contractor to include any additional tests required to demonstrate compliance with this specification and any variations approved by the QLDC Chief Engineer.

Commissioning sheets should be provided in the O & M manual in order to provide operators with a record of pump station performance results during testing and commissioning.

17 ELECTRICAL DRAWINGS

17.1 General

All drawings produced shall be in accordance with AS/NZS 1100, AS 1101, AS/NZS 1102, AS/NZS 4383 and AS/NZS 60417 as applicable.

Contractors Drawings shall be prepared using a CAD system.

Drawings shall be plotted at the same scale as they were drawn/composed (1:1) to maintain the original intended line and text attributes.

The drawing shall be A1 or A3 size in accordance with (AS/NZS 1100 Part 101).

17.2 CAD Files

- The Contractor shall provide CAD files for all electrical and instrumentation Final Contractors Drawings. CAD files shall be provided to the QLDC Chief Engineer at the same time as the Final Contractors Drawings.
- Each CAD drawing file shall contain all information used to produce the drawing including externally referenced information (e.g. AutoCAD X'refs should be bound into the drawing file).
- Drawings produced using AutoCAD shall be supplied in .DWG format. All other CAD files shall be supplied in DXF format.
- Drawings produced using AutoCAD shall, where possible, be produced using QLDC Chief Engineer drafting defaults (a copy of the Principal defaults file shall be made available to the Contractor on request). Each drawing produced using AutoCAD and not using the Principal standard defaults shall be supplied with an individual plotter setup file(s) to enable reproduction of the original drawing.
- CAD files (including .PC2, .PC3, .CTB or .STB files) shall be named with the drawing number in accordance with this clause except that the dash "-" shall be replaced with an underscore "_" (e.g. 00_4031.DWG).
- CAD files (including .PC2 files etc.) shall be named with the drawing number.

17.3 Drawing Details

Drawings produced by the Electrical Contractor shall show the following information, where applicable:

(1) Detailed material and parts list.

(2) Electrical power and control circuit schematic drawings which shall:

- Give ratings of all components.
- Show all cable types and sizes.
- Be drawn as vertical ladders with each line numbered.
- Show cross referencing of remote contacts etc. using line numbers and other drawing numbers if required.
- Identify spare cores of field cables by their respective cable, core and terminal numbers where applicable.

Drawing GENERAL 09-01 has been included as a means of establishing quality standards required for electrical schematic drawings. Circuitry shown is not an indication of facilities or methods required to achieve requirements.

(3) Layouts of the pumping station switchboard and motor control panel.

17.4 Submission of draft electrical drawings

The Electrical Contractor shall:

(1) Submit a copy of the scaled drawings to the QLDC Chief Engineer for examination prior to manufacture or commencement of work.

(2) Allow time in his/her program for the QLDC Chief Engineer to examine, or subsequently re-examine in accordance herewith, the drawings submitted by the Electrical Contractor. The time to be allowed to the QLDC Chief Engineer for such examination shall be not less than ten (10) working days.

Upon examining the drawings, the QLDC Chief Engineer may direct comments or queries to the Electrical Contractor on those drawings. If drawing modifications are required as a result of the examination, the Electrical Contractor shall supply revised drawings for re-examination.

(3) Not depart from the details shown on drawings examined by the QLDC Chief Engineer in accordance with this Clause unless the Electrical Contractor has first amended the drawing accordingly, submitted it for re-examination in accordance with this Clause and had it returned by the QLDC Chief Engineer signifying approval to proceed.

If manufacture or construction commences prior to approval from the QLDC Chief Engineer, any re-work shall be at the Electrical Contractor's expense.

17.5 Submission of final electrical drawings

Prior to the date of practical completion, the Electrical Contractor shall provide two (2) sets of Final Contractors Drawings which have not been folded, punched or marked to the QLDC Chief Engineer. The QLDC Chief Engineer shall determine if copies submitted as Final Contractor Drawings are of an acceptable quality. If the drawings are deemed by the QLDC Chief Engineer to be unacceptable, the Electrical Contractor shall re-submit drawings which are of an acceptable standard.

Final Contractors Drawings shall:

(1) Be provided for all equipment and structures included in the Contract.

(2) Include all "As Constructed" information which shall include all changes brought about during manufacture, installation, construction, testing and commissioning.

(3) Show signatures of authorising and/or approving personnel.

(4) Be on white paper not less than 80 gsm thick and shall be suitable for reproduction by conforming with the requirements of AS/NZS 1100.

One copy of the Final Contractors Drawings protected by a protective sleeve shall be left in the pumping station switchboard.

18 OPERATIONS AND MAINTENANCE MANUAL

18.1 Format

The Electrical Contractor shall supply to the Engineer's Representative three (3) copies of Operations and Maintenance Manuals ("O&M Manuals") which shall be prepared according to the content requirements provided in Appendix D.

A first draft copy shall be submitted to QLDC 3 Waters contractor, for review as part of the process to ensure all pertinent information is included.
Operations and Maintenance Manuals shall be in accordance with the following requirements:

(1) Wholly in the English language, clear, legible and contain all pertinent information relating to the functional control, operation and maintenance of the facility and its components.
(2) Be presented in a format that matches the example contents page in Appendix D.
(3) Include the manufacturer's manuals for all supplied equipment. This includes but is not limited to manuals for installation, configuration, programming, maintenance and troubleshooting.
(4) Include complete parts listing which shall include the manufacturer's name, parts catalogue number and, where applicable, the local agent's name, address and telephone number.
(5) Include drawings of the actual equipment supplied, including detailed ladder and schematic circuit diagrams.
(6) Include any relevant safety procedures.
(7) Where PLCs are supplied, hard copy program listings in ladder format shall be provided. In addition, electronic copies of the PLC programs and supporting files shall be supplied on CD ROMs.
(8) Any passwords or codes required for access.

18.2 Content

The operating component of the Operations and Maintenance Manual shall include a description of the operation of the equipment and clear and logical instructions for the operator.
The operating manual shall describe the operation of the equipment under manual and under remote and/or automatic control.

The instructions shall include:
(1) starting, running and stopping procedures;
(2) functional control processes;
(3) sequencing and control logic descriptions;
(4) measured parameters;
(5) Fault conditions and SCADA alarms.

The maintenance component of the Operations and Maintenance Manuals shall contain all relevant information for the maintenance and repair of the equipment and shall include:

(1) Identification of items of equipment, including model and serial numbers.
(2) A brief description of the equipment and its operation.
(3) All necessary setting up procedures.
(4) All maintenance procedures including suggested preventative maintenance schedules.

18.3 Asset register

Veolia and QLDC wish for any electrical contractor installing switchgear at a submersible pump station to document the components installed for the purpose of recording within QLDCs HANSEN Asset Management System.

The list of components and instruments detailed on this list should reflect the 'big ticket items' mirrored in the switchboard specification in Section 3.2

Contractors may wish to seek additional information on this requirement from both Veolia and QLDC.

Contractors shall be required to populate an Excel spreadsheet issued by QLDC titled; Asset register template for consultants/ contractors/ project managers (Sept 2015, Version 9).

This register seeks to quantify the components installed in newly vested facilities and capture their cost (both capital and installation).

Costs of big ticket items are required for QLDC insurance purposes.

18.4 Provision of additional documentation

All relevant documentation generated as a result of testing, inspection and certification of installation shall be supplied by the electrical contractor. This shall include, but not be limited to, Declaration of Conformity Statements and Electrical Certificates of Compliance.

APPENDIX A

EQUIPMENT DATA SHEET

Note : Compatible alternatives may be considered with the approval of QLDC Chief Engineer

Component	Equipment Standard	Comment
Panel Operators	Schneider 22mm ZB5 Rockwell 800F	
MCB's and RCD's	Schneider Acti 9	
Motor Circuit Breakers	Schneider GV2 Rockwell 140m	
Signal Isolators	Weidmuller	
Interface Relays	Omron Rockwell	
Contactors and Overloads	Schneider LC1 – LRD series Rockwell 100 – 193 series	
Surge	Weidmuller	
Terminals	Weidmuller	
Complex Selector Switches	Kraus and Naimer	
RTU: QLDC Sites	Abbey Systems Swampfox SF-3	
RTU: Lake Hayes Sites	Kingfisher	

DC UPS	Phoenix Trio UPS. 5Amp minimum. With fault, mains and battery monitoring.	
Communications	Swampfox SF-3 Microwave IP – Countrynet Cellular – Veolia supplied modems.	
Pump controller	Siemens MultiRanger 200 (MR200). Panel mount MultiTrode MultiSmart pump controller.	
Wetwell Level Device	Endress & Hauser FMX21 Hydrostatic Level Transducer (4-20mA HART)	
Soft Starter/VSD	Danfoss MCD Series Aucom EMX Danfoss VLT Aqua VSDs Schneider	
PLC	Schneider M340 Allen Bradley Micrologix Series (1100 or 1400)	
HMI	Schneider Magelis	
Floats	Flygt ENM-10	
Level probe	MultiTrode level probe	
Magflow meter	Endress and Hauser Promag (remote)	
Pressure transducer	Endress & Hauser Cerabar T PMP131 (4-20mA)	
Generator Plug	C From 63A or 125A	Compatible alternatives may be considered
Switchboard Enclosure	Switchbuild Dunedin Ltd Phone 03 466 4281 Email sales@switchbuild.co.nz Bremca. 25 Bond St, Invercargill. Phone 03 218 8038	
Switchboard Locks	Flush mounted internal lock with QLDC tumbler pattern	

APPENDIX B

SCADA STANDARD I/O TEMPLATE

DIGITAL INPUTS

0	*kwh pulse*	
1	*P1 Run*	
2	*P2 Run*	
3	*Flow Pulse*	
4	*P1 Auto*	
5	*P2 Auto*	
6	*P1 Fault*	
7	*P2 Fault*	
8	*Hi Level Alarm*	
9	*Lo Level Alarm*	
10	*RTU Control On*	
11	*Critical High Level Alarm*	
12	*Phase Fail*	
13	*Critical Low Level Alarm*	
14	*Seal Fail Pump 1*	
15	*Seal Fail Pump 2*	
16	*Surge Alarm*	
17		
18		
19		
20	*Multiranger Fault*	
21	*UPS Fault*	
22	*UPS Online Mains Fail*	
23	*UPS Battery Low*	
24		
25		
26		
27		
28	*Gen Run*	
29	*Gen on Load*	
30	*Gen Fuel Low*	
31	*Generator Fault*	
32	*PLC Fail*	
33	*Flow Fail*	
34	*Low Pressure*	
35	*RTU Control Enabled*	

ANALOG INPUT SIGNALS

AI		
0	Well Level (by pressure)	
1	P1 Current	
2	P2 Current	
3	Flow L/s	
4	*MR Level by ultrasonic*	
5	*P3 Current*	
6	*P4 Current*	
7	*P1 Speed*	
8	*P2 Speed*	
9	*P3 Speed*	
10	*P4 Speed*	
11	*Pressure*	

DIGITAL OUTPUTS

DO				
0	General Reset	pulse		
1	Start/Stop P1	On/Off		
2	Start/Stop P2	On/Off		
3	P1 Reset	pulse		
4	P2 Reset	pulse		
5	Standby Stop	pulse		
6	Duty 1-2 = Off, 2-1 = On		On/Off	
7	RTU Control Enable		On/Off	
8				
9				
10	-			
11	-			
12	-			
13	-			
14	-			

Items listed below are derived from digital inputs				
Pulse				
0	kwh			
1	*P1 Run Hrs*			
2	*P2 Run Hrs*			
3	*Flow*			
4	-			
5	-			
6	-			
7	-			
8	-			
9	-			
10	-			
11	-			

APPENDIX C

OPERATIONS AND MAINTENANCE MANUAL REQUIRED CONTENT

INTRODUCTION

WASTEWATER PUMP STATION OVERVIEW

- Site Location
- WWPS Criticality

PRINCIPAL COMPONENT DESCRIPTIONS

- Pump Chamber / wet well
- Submersible Pumps
- Valve Chamber
- Electrical cabinet & switchboard
- Soft starters
- Pump controller
- Hydrostatic level transducer
- Power metering
- Magflow meter
- Telemetry
- Generator
- Generator controller
- Rising Main

PUMP CONTROL & SCADA

- Pump controls
- Fault lamps
- Pump configuration
- Pump operation
- Duty / standby pump operation
- Manual / auto operation
- Remote pump operation via SCADA
- Primary pump control
- Secondary pump control
- High and low level alarms
- SCADA I/O
- Digital Inputs
- Digital Outputs
- Analogue Inputs
- Pulse counts
- SCADA Alarms and Operating Responses

ASSET REGSITER

WWPS OPERATIONS & MAINTENANCE

- Monthly Operating / Maintenance Activities
- Yearly Operating / Maintenance Activities
- Troubleshooting
- Pump chamber Level High alarm response
- Pump fault
- Soft starter fault
- Adjusting pump set points on the MultiRanger
- Adjusting pump set points on the SCADA
- Odour complaint
- Wastewater overflow response
- Unblocking a partially or fully blocked pump
- Generator fault
- Loss of SCADA signal

OPERATIONS & MAINTENANCE PROCEDURES

- Cleaning the pump chamber
- Cleaning the level sensor
- Cleaning & maintenance of pressure transducer
- Lifting a pump
- Installing a pump into the pump chamber
- Pump fault troubleshooting
- Isolating plant and equipment
- Unblocking the check (non-return) valves
- Electrical service check
- Pump maintenance & service
- Test running the generator
- Standby generator service

HEALTH & SAFETY

- Risk Assessment

As-Builts

- Electrical, Pump Station and Rising Main

APPENDIX D

WWPS COMMISSIONING TESTS AND CHECK SHEETS

SUBMERSIBLE WASTEWATER PUMPING STATION

TESTING & COMMISSIONING PROCEDURES

TEST/COMMISSIONING PROCEDURES

The following procedures will be used as a basis of commissioning/testing the pumping stations.

Other tests considered necessary to establish the correct operation of the plant and equipment installed shall be performed during commissioning at the discretion of the Veolia commissioning officer(s) as required.

No. PROCEDURE PAGE

TEST EQUIPMENT REQUIRED (Supplied By Contractor)

Note : It is the responsibility of the Contractor to provide current calibration certificates for the test equipment used during commissioning.

The following test equipment will be required for the testing.

1. Insulation resistance tester (1000V).
2. Earth continuity testing instrument.
3. RCD test equipment.
4. Power factor measuring instrument.
5. Digital multimeter.
6. Low current instrumentation ammeter/calibrator (4-20 mA).
7. Clamp on ammeter (rated for full load current of pump motors).

1. SWITCHBOARD CONSTRUCTION

Objectives:

To establish general compliance with construction requirements of specification.

Test Procedure:

- Check construction of switchboard including material 316 SS construction.
- Check switchboard rating is IP rating.
- Check main switchboard including IP rating.
- Check motor control panel including IP rating.
- Check RTU including IP rating.
- Check component ratings for pump CB's, soft starters, bypass contactor are the same.
- Check switchboard constructed from stainless steel.
- Check controls and indications are provided as per design drawings.
- Check plinth hot dipped galvanised secured with 316 SS anchors.
- Check high security locks are fitted with QLDC tumbler.
- Check internal wiring PVC and minimum size & colour coding as per specification.
- Check wiring installed in PVC ducts and terminated in terminals.
- Check controls & indications are labelled as required.
- Check relays, terminals and cables are labelled as required.
- Check current transformer wiring is 2.5 mm^2.
- Check terminal enclosure is installed and manufactured from PVC.
- Check miniature circuit breakers are lockable in the OFF position.
- Check that an RCD was installed on the GPO circuit.
- Check Current Transformers are class 2M or better (2M or less).
- Check that Current Transducers are class 1M or better (1M or less)
- Check ammeter selector (if installed) fitted with an OFF position.
- Check hours run meter has 5 digits minimum.
- Check surge arresters have a discharge current of 20kA.
- Check indicator lamps are 22 mm dia.
- Check phase imbalance relay adjustable from 5 to 15 %.
- Check floodlight is rated at 5000 Lumens

Acceptance Criteria:	Results
• Switchboard constructed from 316 SS.	

• Switchboard exterior appears to be IP 56. • Main switchboard is IP 32. • Motor control panel is IP 52. • RTU is IP 32. • All components rated for (15 or 30 kW). • Switchboard constructed from stainless steel. • Controls and indications are as per design drawings. • Plinth is hot dipped galvanised secured with 316 SS anchors. • High security swing locks fitted. • Internal wiring PVC, min. 1.5 mm^2 (control) and 2.5 mm^2 (power), colour coding grey for LV & violet for instrumentation. • Wiring installed in ducts and terminated in terminals. • Controls & ind. labels to be engraved plastic 4 mm high letters. • Relays, terminals and cables are labeled as required. • Current transformer wiring is 2.5 mm^2. • Terminal enclosure is installed and manufactured from PVC. • Miniature circuit breakers are lockable in the OFF position. • RCD is installed on the GPO circuit. • Current Transformers are class 2M or better (2M or less). • Current Transducers are class 1M or better (1M or less) • Ammeter selector (if installed) fitted with an OFF position. • Hours run meter has 5 digits minimum. • Surge arresters have a discharge current of 20kA. • Indicator lamps are 22 mm dia. • Phase imbalance relay adjustable from 5 to 15 %. • Floodlight is rated at 150 Watts minimum.	
Test Result Pass Fail	
Accepted by **Passed By (Contractor)** ________________________ **Date :** __________	

Passed By (Veolia Water)	Date :

2. SWITCHBOARD GENERAL EQUIPMENT TESTS

Objectives:

To establish switchboard general equipment complies with specification.

Test Procedure:

- Automatic Switch on cubicle light switch in switchboard.
- Check operation of switchboard light.
- Switch on floodlight switch in switchboard.
- Check operation of floodlight.
- Check anti-condensation heater and thermostat fitted.
- Connect measuring meter, turn thermostat temperature down.
- Check that 230V is applied to anti-condensation heater.
- Reset thermostat to operating temperature.
- Test operation of 230V GPO on switchboard.
- Test operation of GPO RCD using RCD test equipment.
- Activate LAMP TEST pushbutton and check all lights operate.

Acceptance Criteria:	Results
• Switchboard light installed and operates when door is opened. • Floodlight operates as required. • Anti-condensation heater fitted and operating. • Anti-condensation heater operating. • Switchboard GPO operates. • RCD operates at required test current. • LAMP TEST operates all lamps correctly.	

Test Result **Pass** **Fail**

Accepted by

Passed By (Contractor) ____________________ **Date :** __________

Passed By (Veolia Water) ____________________ **Date :** __________

3. SWITCHBOARD PROPRIETARY TESTS	
Objectives: To establish that proprietary test have been conducted.	
Test Procedure: • Disconnect main power supply. • Check MEN earthing system used. • Perform insulation resistance test on main busbars. • Perform earth loop impedance test on main earthing system.	
Acceptance Criteria: • MEN earthing used. • Insulation resistance above 1.0 MΩ. • Earth loop impedance less than 0.5 Ω.	**Results**
Test Result Pass Fail	
Accepted by **Passed By (Contractor)** ____________________ **Date :** __________ **Passed By (Veolia Water)** ____________________ **Date :** __________	

4. GENERATOR CONNECTION TESTS

Objectives:

To establish correct connections of generator plug. Tests to be undertaken using QLDC supplied generator.

Test Procedure:

- Ensure generator is not plugged in.
- Ensure that Main Isolator is closed.
- Check that Generator Isolator can not be closed.
- Switch off Main Isolator.
- Perform conductivity test between all phases of generator plug to main busbars.
- Check that Red, Yellow and Blue phases are connected correctly.
- Close generator isolator.
- Check that Main Isolator can not be closed.
- Open Generator Isolator.
- Close Main isolator.

Acceptance Criteria:	Results
• Generator Isolator can not be closed when Main Isolator is closed. • Red, Yellow and Blue phases connected correctly. • Main Isolator can not be closed when Generator Isolator is closed.	

Test Result Pass Fail

Accepted by

Passed By (Contractor) ____________________ **Date :** __________

Passed By (Veolia Water) ____________________ **Date :** __________

5. PHASE FAILURE RELAY TESTS

Objectives:

To establish correct operation of phase failure relay.

Test Procedure:

- Check that AC POWER OK lamp is illuminated.
- Remove one wire from phase failure relay.
- Check that AC POWER OK lamp goes out.
- Replace wire on phase failure relay.
- Check that AC POWER OK lamp is illuminated.

Acceptance Criteria:	**Results**
• AC POWER OK lamp goes out on phase failure. • AC POWER OK lamp on when power restored.	

Test Result **Pass** **Fail**

Accepted by

Passed By (Contractor) ______________________ **Date :** __________

Passed By (Veolia Water) ______________________ **Date :** __________

6. PUMP OPERATION & MOTOR CURRENT TESTS

Objectives:

To establish correct pump and motor current instrumentation operation.

Test Procedure:

6.1 Motor Direction

- Connect main power supply.
- Start Pump 1 and check for correct operation (rotation direction).
- Start Pump 2 and check for correct operation (rotation direction).
-

6.2 Motor Current

- Connect low current ammeter (4-20 mA) to motor current transducer on Pump 1.
- Measure Pump 1 motor current using clamp on (tong) ammeter.
- Observe Pump 1 motor current on switchboard ammeter.
- Compare motor current readings for Pump 1.
- Connect low current ammeter (4-20 mA) to motor current transducer on Pump 2.
- Measure Pump 2 motor current using clamp on (tong) ammeter.
- Observe Pump 2 motor current on switchboard ammeter.
- Compare motor current readings for Pump 2.

Acceptance Criteria:	Results
6.3 Motor Direction • Pumps run correctly and pumps. **6.4 Motor Current** • Pump 1 panel ammeter and analogue the same. • Pump 2 panel ammeter and analogue the same.	

Test Result **Pass** **Fail**

Accepted by

Passed By (Contractor) ____________________________ **Date :** ____________

Passed By (Veolia Water) ____________________________ **Date :** ____________

7. PUMP OPERATING MODE TESTS

Objectives:

To establish correct operation of the pump mode selector switches.

Test Procedure:

7.1 Off Mode

- Select OFF on the Pump 1 and Pump 2 MODE SELECTOR switches.
- Allow sump level to increase.
- Check that pumps do not run.

7.2 Manual Operation

- Select RUN mode on Pump 1 mode selector.
- Check that Pump 1 starts.
- Select OFF mode on Pump 1 mode selector.
- Select RUN mode on Pump 2 mode selector.
- Check that Pump 2 starts.
- Run pump(s) until sump is empty (below duty 1 start level).
- Select OFF mode on Pump 2 mode selector.

7.3 Pump 1 Automatic Duty 1 Operation

- Select DUTY 1-2 on the DUTY SELECTOR switch.
- Select AUTO on Pump 1 and Pump 2 MODE SELECTOR switches.
- Allow sump level to increase.
- Check that Pump 1 starts at DUTY 1 start level.
- Check thatPump 1 stops at DUTY 1 stop level.

7.4 Pump 2 Automatic Duty 1 Operation

- Select DUTY 2-1 on the DUTY SELECTOR switch.
- Allow sump level to increase.
- Check that Pump 2 starts at DUTY 1 start level.
- Check that Pump 2 stops at DUTY 1 stop level.

7.5 Pump 1 Automatic Duty 2 Operation

- Select DUTY 2-1 on the DUTY SELECTOR switch.
- Select OFF on the Pump 2 MODE SELECTOR switch.
- Allow sump level to increase.
- Check that Pump 1 starts at DUTY 2 start level.

7. PUMP OPERATING MODE TESTS

- Check that Pump 1 stops at DUTY2 stop level.
- Select AUTO on the Pump 2 DUTY SELECTOR switch.

7.6 Pump 2 Automatic Duty 2 Operation

- Select DUTY 1-2 on the DUTY SELECTOR switch.
- Select OFF on the Pump 1 MODE SELECTOR switch.
- Allow sump level to increase.
- Check that Pump 2 starts at DUTY 2 start level.
- Check that Pump 2 stops at DUTY 2 stop level
- Select AUTO on the Pump 1 MODE SELECTOR switch.
- Allow sump to be pumped down to DUTY 1 stop level.

7.7 Rotation Operation

- Select ROTATION on duty selector switch.
- Ensure that Pump 1 & 2 have AUTO mode selected.
- Allow sump to fill.
- Observe which pump is started at DUTY 1 start level.
- Allow sump to be pumped down to DUTY 1 stop level.
- Allow sump to fill.
- Check that the duty rotation changes and the other pump now starts at DUTY 1 start level.

Acceptance Criteria:	Results
7.8 Off Mode • Pumps do not run start when OFF selected. **7.9 Manual Operation** • Pump 1 starts on manual start. • Pump 2 starts on manual start. **Pump 1 Automatic Operation** • At DUTY 1 start level Pump 1 starts. • At DUTY 1 stop level Pump 1 stops. **Pump 2 Automatic Operation** • At DUTY 1 start level Pump 2 starts. • At DUTY 1 stop level Pump 2 stops. **Pump 1 Automatic Duty 2 Operation**	

7. PUMP OPERATING MODE TESTS	
• At DUTY 2 start level Pump 1 starts. • At DUTY 2 stop level Pump 1 stops. **Pump 2 Automatic Duty 2 Operation** • At DUTY 2 start level Pump 2 starts. • At DUTY 2 stop level Pump 2 stops. **Rotation Operation** • Duty rotation alternates correctly between pump starts.	
Test Result **Pass** **Fail**	
Accepted by **Passed By (Contractor)** ______________ **Date :** ________ **Passed By (Veolia Water)** ______________ **Date :** ________	

<table>
<tr><td colspan="2">8. PUMP POWER AND INDICATION TESTS</td></tr>
<tr><td colspan="2">Objectives:
To establish correct operation of the starter, contactors and run indications.</td></tr>
<tr><td colspan="2">Test Procedure:
• Connect power factor measuring instrument to main supply.
8.1 Pump 1
• Select RUN mode on the Pump 1 MODE SELECTOR.
• Check Pump 1 hours run meter is operational.
• Check that PUMP 1 RUN indicator lamp is illuminated.
• Check Power Factor to ensure that it is not less that 0.95 lagging.
• Select OFF mode on the Pump 1 MODE SELECTOR.
• Check that Pump 1 is stopped using soft starter pump control.
Pump 2
• Select RUN mode on the Pump 2 MODE SELECTOR.
• Check Pump 2 Hours Run Meter is operational.
• Check that PUMP 2 RUN indicator lamp is illuminated.
• Check Power Factor to ensure that it is not less that 0.95 lagging.
• Select OFF mode on the Pump 2 MODE SELECTOR.
• Check that Pump 2 is stopped using soft starter pump control.</td></tr>
<tr><td>Acceptance Criteria:
Pump 1
• Pump 1 hours run meter is operational.
• PUMP 1 RUN indicator lamp illuminates.
• Power Factor is not lower that 0.95 lagging.
• Pump 1 is stopped using soft starter pump control.
Pump 2
• Pump 2 Hours Run Meter is operational.
• PUMP 2 RUN indicator lamp illuminates.
• Power Factor is not lower that 0.95 lagging.
• Pump 2 is stopped using soft starter pump control.</td><td>Results</td></tr>
<tr><td colspan="2">Test Result   Pass   Fail</td></tr>
<tr><td colspan="2">Accepted by</td></tr>
</table>

8. PUMP POWER AND INDICATION TESTS	
Passed By (Contractor)	Date :
Passed By (Veolia Water)	Date :

9. PUMP SOFT STARTER & FAULT CIRCUIT TESTS	
Objectives: To establish correct operation of the soft starters and pump fault circuits.	
Test Procedure: **Pump 1** • Ensure that no faults are present. • Check that Pump 1 alarm relay is energised. • Select OFF on Pump 1 mode selector. • Adjust the soft starter overload current to minimum Amperes. • Select RUN on Pump 1 mode selector. • Check that Pump 1 alarm relay de-energises. • Check that Pump 1 Fault indicator is illuminated. • Select OFF on Pump 1 mode selector. • Press Pump 1 RESET pushbutton. • Check that Pump 1 alarm relay re-energises. • Check that Pump 1 Fault indicator is not illuminated. • Adjust the soft starter overload current to motor current. • Select AUTO on Pump 1 mode selector. **Pump 2** • Ensure that no faults are present. • Check that Pump 2 alarm relay is energised. • Select OFF on Pump 2 mode selector. • Adjust the soft starter overload current to minimum Amperes. • Select RUN on Pump 2 mode selector. • Check that Pump 2 alarm relay de-energises. • Check that Pump 2 Fault indicator is illuminated. • Select OFF on Pump 2 mode selector. • Press Pump 2 RESET pushbutton. • Check that Pump 2 alarm relay re-energises. • Check that Pump 2 Fault indicator is not illuminated. • Adjust the soft starter overload current to motor current. • Select AUTO on Pump 2 mode selector.	
Acceptance Criteria: **Pump 1** • Fault relay is energised with no fault present.	**Results**

9. PUMP SOFT STARTER & FAULT CIRCUIT TESTS	
• Fault relay de-energises on fault. • Pump 1 Fault indicator illuminates on fault. • Fault relay energises when RESET operated. • Pump 1 Fault indicator not illuminated when reset. **Pump 2** • Fault relay is energised with no fault present. • Fault relay de-energises on fault. • Pump 2 Fault indicator illuminates on fault. • Fault Relay energises when RESET operated. • Pump 2 Fault indicator not illuminated when reset.	
Test Result Pass Fail	
Accepted by **Passed By (Contractor)** ______________ **Date :** ________ **Passed By (Veolia Water)** ______________ **Date :** ________	

10. LEVEL DEVICE TESTS

Objectives:

To establish correct operation of the level indicator/controller & associated controls.

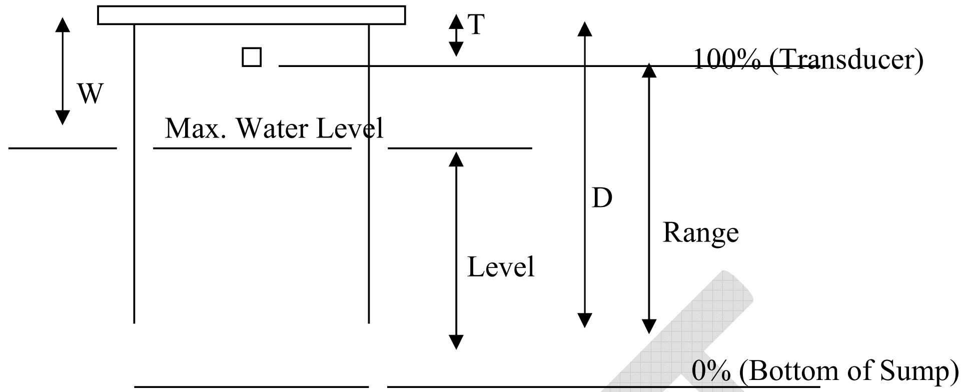
Test Procedure:

- Ensure that power is switched on to switchboard.
- Check that sump level is displayed on the Level Device.
- Switch off power to switchboard.
- Check that level is displayed on the Level Device using battery backup power.
- Connect low current ammeter (4-20 mA) into analogue output.
- Switch pumps on and empty sump.
- Check that sump level reads 0 %.
- Check that High Level Alarm relay is energised.
- Switch pumps off and allow sump to fill.
- Check that de-energises at HLA setpoint on controller.
- Check that HIGH LEVEL ALARM light is illuminated.
- With sump level just below overflow pipe, measure distance from top of sewerage to top of sump and calculate sump level in %.
- Check that sump level is the same as level displayed on level device.
- Select RUN mode on Pump 1 and 2.
- Check that Level Device Faulty relay is energised.
- Simulate sump level device fault condition.
- Check that de-energises.
- Check that SUMP LEVEL SYSTEM FAULT light is illuminated.
- Select AUTO mode on Pump 1 and 2.

Acceptance Criteria:	Results
• Level displayed with power on. • Level displayed with power off (using 12 V battery). • Sump level reads 0 % with empty sump. • energised below HIGH LEVEL sump level. • de-energises above HIGH LEVEL sump level. • HIGH LEVEL ALARM light operates. • Actual sump level the same as displayed sump level.	

• Level device fault is energised with no fault present. • Level device fault de-energises when fault exists. • SUMP LEVEL SYSTEM FAULT light operates when level device fault exists.	
Test Result **Pass** **Fail**	
Accepted by **Passed By (Contractor)** ______________________ **Date :** __________ **Passed By (Veolia Water)** ______________________ **Date :** __________	

General Sump Details



Measured & Operational Site Details

LEVEL	mm	Value
DEVICE SETUP & CALIBRATION DETAILS		
Bottom Of Transducer To **Top** / **Bot** Of Sump Cover		T
Sump Depth To **Top** / **Bot** Of Sump Cover		D
Level Device Range		
Maximum Water Level Measurement (Water level to cover)		W
Level Device Reading at Maximum Water Level		
Required Current at Maximum Water Level		
Actual Current at Maximum Water Level		
SETTING DETAILS		
Overflow Level Float		
Emergency Start Float		
Emergency Stop Float		
High Level Alarm		
Start Duty 2 Pump		
Start Duty 1 Pump		
Stop Duty 2 Pump		
Stop Duty 1 Pump		

Formula

Level Device Range = D - T

Sump level = D – W

$$\text{Required Current at Maximum Water Level} = \left[\frac{D - W}{\text{Range}} \times 16\right] + 4$$

11. EMERGENCY FLOAT SYSTEM TESTS

Objectives:

To establish correct operation of the emergency float system.

Test Procedure:

Emergency Level Float System

- Ensure that pump station has been operational.
- Disconnect battery power to Level Device.
- Switch power off to Level Device.
- Select AUTO on Pump 1 and Pump 2 mode selectors.
- Check that both pumps do not run.
- Check that Emergency Start Float Relay is de-energised.
- Allow sump level to increase.
-
- Replace battery power to Level Device.
- Switch power on to Level Device.

Overflow Level

- Lower Overflow Level Alarm float into sewerage.
- Check that the Overflow Alarm Relay energises and OVERFLOW ALARM is illuminated.
- Reset Overflow Float to correct level.

Acceptance Criteria:	Results
Emergency Level Float System • Pumps do not run when level below emergency start. • Emergency start relay is de-energised. • Emergency start relay energises when level reaches Emergency Start Level and Pump 1 starts. • After a time delay and Pump 2 starts. • Pump 1 and 2 stop when level falls below Emergency Stop Level. **Overflow Level** • Overflow alarm relay energises and OVERFLOW ALARM is illuminated.	

Test Result **Pass** **Fail**

Accepted by

Passed By (Contractor)	**Date :**
Passed By (Veolia Water)	**Date :**

<table>
<tr><td colspan="2">12. SCADA CONTROL TESTS</td></tr>
<tr><td colspan="2">Objectives:
To establish correct operation of common control circuits.</td></tr>
<tr><td colspan="2">Test Procedure:
SCADA Control
• Ensure that SCADA control is not active.
• Check SCADA Control Relay is de-energised and SCADA CONTROL ACTIVE indicator lamp is off.
• Initiate SCADA control.
• Check SCADA Control Relay is energised and SCADA CONTROL ACTIVE indicator lamp is on.</td></tr>
<tr><td>Acceptance Criteria:
• SCADA Control Relay de-energised & SCADA indicator lamp off when SCADA control is not active.
• SCADA Control Relay energised & SCADA indicator lamp on when SCADA control is active.</td><td>Results</td></tr>
<tr><td colspan="2">Test Result   Pass   Fail</td></tr>
<tr><td colspan="2">Accepted by
Passed By (Contractor) ______________________ Date : __________
Passed By (Veolia Water) ______________________ Date : __________</td></tr>
</table>

<table>
<tr><td colspan="2">13. SCADA TESTS</td></tr>
<tr><td colspan="2">Objectives:
To establish all SCADA signals returned correctly to base.</td></tr>
<tr><td colspan="2">Test Procedure:
SCADA Control
• Review historical logs / alarm logs for all the tests above.
• Check that power fail, pump run, pump fault, emergency level control active, level device fault, high level, pump currents and well level all indicate correctly.
• Check alarms generated to pager for power failure, pump fault, level device fault, emergency level control active and high level alarm.</td></tr>
<tr><td>Acceptance Criteria:
• Power fail indication and alarm paged out</td><td>Results</td></tr>
</table>

• Pump 1 and Pump 2 run indication paged out • Pump 1 and Pump 2 fault indication and alarm paged out • Emergency level control active indication and alarm paged out • Level device fault indication and alarm paged out • High Level alarm paged out • Overflow alarm paged out • Pump 1 and Pump 2 currents indicated correctly • Wet well level indicated correctly	
Test Result **Pass** **Fail**	
Accepted by **Passed By (Contractor)** ______________ **Date :** ________ **Passed By (Veolia Water)** ______________ **Date :** ________	

14. FLOWMETER TESTS	
Objectives: To establish the flowmeter is working accurately to measure and record pumped flow output from the wastewater pump station.	
Installation check procedure: **Mechanical installation** • Check that magflow meter is installed to manufactures' recommendations and observes the minimum straight line dimensions required upstream and downstream of the sensor. • Check that the magflow meter is installed with grounding disks where installation has been performed in pipelines made of plastic, concrete or those with an insulated lining or coating metal. • Check that rubber gaskets are installed on both sides of the grounding disk as per manufactures recommendations. • Check that the flowmeter is installed in a manhole or similar chamber to allow for any operation or maintenance checking required.	
Acceptance Criteria: • Transmitter or head units to be hardwired with analogue connection through to RTU for remote flow measurement.	**Results**

• Transmitter or head units to be mounted inside switchboard to ensure a visible local display is available for operators to view. • Scaling range (4-20Ma) is greater than the maximum flow out of the pump station by a factor of ≥ 1.2 • Scaling range is communicated through to SCADA supervisor. • Pulse output from magflow meter to be configured so that 1 pulse count = 1m3 pumped volume. • Local display to match SCADA flow measurement. Commissioning officers and SCADA supervisor to check. • Analogue and digital inputs for magflow connection to be pre-determined by SCADA I/O schedule • No local alarming or control outputs are required to be configured from flow measurements from the magflow meter. • Any relevant alarming or low / high (abnormal) flow conditions are to be configured against the analogue value returned to SCADA.	
Test Result Pass Fail	
Accepted by **Passed By (Contractor)** ______________________ **Date :** __________ **Passed By (Veolia Water)** ______________________ **Date :** __________	

APPENDIX E

DRAWINGS

QLDC_WWPS_	QLDC Pump Station Standardisation
QLDC_WWPS_01	REG Electrical Drawings Register
QLDC_WWPS_01	GA - General Arrangements
QLDC_WWPS_01	LDL1 - Label Schedule
QLDC_WWPS_01	01- Wiring Schematics

CONTENTS

1 INTRODUCTION

The Water Supply Pumping Station Design Standard provides a standardised guide for public water supply systems which presents, as far as practical, uniform concepts for water system design. It offers some flexibility, enabling design engineers and consultants to consider alternative designs for specific situations whilst still delivering the optimum design.

1.1 SCOPE

The key issues addressed in these standards are

- i. General design principles;
- ii. Pumps and pump station design;
- iii. Pipeworks and valving;
- iv. Hydraulic considerations;
- v. Mechanical and electrical design;
- vi. Building construction;
- vii. Telemetry and SCADA control systems;
- viii. Generators and power back-up;
- ix. Landscaping requirements;
- x. Testing and commissioning requirements;

2 DESIGN AND CONSTRUCTION REQUIREMENTS

2.1 SITE REQUIREMENTS:

- > Not be subject to flooding
- > Be readily accessible at all times
- > Be shaped to divert stormwater around the wells, pumps and structure
- > Be protected to prevent vandalism

2.2 ACCEPTANCE OF ALTERNATIVE DESIGNS

For operational reasons it is a requirement that there be a large degree of uniformity among the Council's water supply pumping stations. Council will consider alternative designs on their merits, where the design results in an equivalent or better performing infrastructural development than that complying with this standard. Any acceptance of alternative designs applies to that particular proposal only.

Alternative designs may be considered:

- i. To provide flexibility to meet the circumstances and requirements of the site
- ii. As a means of encouraging innovative design
- iii. To produce a lower life cycle costing and / or greater operational reliability or
- iv. To provide the required resilience in case of land movement due to seismic events

2.3 OPERATION AND MAINTENANCE

Design all system components for safe and convenient operational and maintenance procedures:

- i. Keep all equipment out of hazardous environments where possible and keep the number of confined spaces generated through the construction of the new facilities to an absolute minimum
- ii. Lay out the site, including vehicular access, to allow easy access to the infrastructure components
- iii. Locate pipework to facilitate access to and maintenance of equipment. Provide an uninterrupted accessway around pumps and detail any pipework crossing this path either below floor level in ducts with suitable removable gratings or fixed above head height.
- iv. Mount surface pumps on a plinth 200mm above floor level.
- v. Detail cables to be either below floor level in ducts with suitable removable gratings or fixed above head height.

vi. Place equipment to facilitate visual inspections and routine maintenance
vii. Specify guard rails or chains around the top of any potential hazard of falling
viii. Consider potential future expansions and make provisions for such
ix. Design the control and alarm system to enable operators to react quickly and properly in emergencies
x. Size and select equipment that facilitates a long service life, low operational costs and low maintenance requirements
xi. Keep the system as simple as possible but as sophisticated as necessary, whilst considering the implications of a rural versus an urban setting;
xii. Prepare complete and useful records - system and equipment drawings and specifications, system calculations, hydraulic models, user manuals and manufacturer/supplier contacts, flow charts, diagrams and Process and Instrumentation Diagrams (P&IDs), legal survey plans and address maps, etc. and include this information in the Operations and Maintenance Manual

2.4 PIPE HYDRAULICS

Design pressure pipelines and fittings to minimise hydraulic.

Velocities in pipes must not be greater than 2.0 m/s unless appropriate water hammer analysis has been done.

Provide a surge and fatigue analysis on all critical plastic pipelines including all pressure mains and where velocities in plastic pipes are greater than 1.0 m/s. Provide action points or mitigation measures to deal with the identified surges

2.5 WALL AND FLOOR PENETRATIONS:

Provide a water stop puddle flange, centred in the concrete for all pipes passing through walls below ground level

2.6 FIXINGS RESTRAINTS AND SUPPORTS

Design restraints, fixings and supports to the fittings, including the ability to withstand the required seismic loading. Where these items are not detailed on the drawings, ensure that the Contractor designs and supplies these fixings to comply with the Building Code.

All fixings to concrete or masonry shall be by bolts, cast-in fixings or chemical. Terrier and powder charged fixings shall not be used.

Specify corrosion protection on fixings, which exhibits equivalent or better corrosion resistance than the material to which they are connected.

Detail clamping to connect fixings to structural steelwork rather than welding or drilling.

2.7 SEISMIC DETAILING

Design flexible connections into pipework on the external side of exterior walls, to allow for relative movement during seismic events. Locate these joints no further than 1.0m from the external wall where possible. Consider punching shear when detailing both the pipework and the wall construction. Flexible connections can be provided by rubber joints, polyethylene pipe or mechanical couplings. If rubber bellows are used, specify that the flexible element is EDPM rubber.

2.8 HEALTH AND SAFETY SIGNAGE

Provide safety signage (no smoking, confined spaces, power, speed limits, potable/non potable water sources, hearing protection areas, site visitor instruction board, rotating machinery etc.) on all facilities prior to commissioning.

Detail confined space warning signs for pump house accesses that are considered a confined space.

Provide a noise hazard warning sign on the personnel door if there are pumps or diesel inside.

2.9 SECURITY

Vandalism is likely at all sites. Detail the building architecture, façade, features and external equipment to discourage vandalism and to minimise damage. Provide an external security light, controlled by a passive infrared sensor for all but simple electrical cabinet installations. Fence all facilities for site delineation and where necessary to restrict access by humans or animals where: ·

i. There is a safety issue for any person that is on the site
ii. Significant vandalism or damage to the site could be expected, or
iii. There is potential for theft or sabotage

Landscaping to afford visibility of the whole site and so to prevent anti-social, unsafe or destructive behaviour.

2.10 LOCKS

Provide standard Council locks to all buildings, chambers and pits, gates and any sensitive or dangerous areas to prevent unauthorised access. Detail locking systems that prevent levers or bolt cutters being used to remove the locks.

3 BOOSTER PUMPS

Booster pumps may be in an open or closed system. Therefore, design the booster pump to either fill a reservoir or to directly supply the network. Each booster pumping station should contain at least two pumps (one duty pump and one standby pump).

Design in-line booster pumps so that:

- Negative Pressure Is Not Produced In their Suction Lines
- Total dynamic head and flow for the system curve can be obtained by all combinations

3.1 NUMBER OF PUMPS

When designing the pumps, include an extra pump over the required number for redundancy i.e. small pump stations shall have a minimum of two pumps. Ensure standby pumps are available for service at all times. Where possible, pumps in a pump set should be identical for operational purposes.

As a guide, where the pump station has the minimum three pumps, the likely set-up and operation may be as follows:

i. Two duty pumps and one stand-by:
   a. Both pumps on VSD - The pump will run up to close to its maximum before the VSD is disengaged and the pump runs at constant speed. The second pump will pick up and provide additional demand up to its maximum duty point
ii. One pump on VSD and one on a Soft start
   a. Once the first pump reaches close to its maximum duty point, the VSD is disengaged and the soft start pump will start and run at its full speed
   b. The VSD pump will then start again and provide any additional capacity required up to the maximum

In both cases the standby pump will be called on if one of the duty pumps goes down. Provide an optimal control scenario for the specific pump station. This approach ensures that the pumps are operated at the maximum possible efficiency for the duties.

Specify 3-phase 415 volt pumps if their motors are greater than 3 kW. Specify water detection and over temperature detection in the motor housing of pumps larger than 3kW. Rate pumps to achieve their design output at no more than 2900 rpm.

3.2 PUMP FEATURES

Specify pumps with hard metal-to-metal face mechanical seals, high quality stainless steel or high tensile steel shafts and high grade bronze, stainless steel or cast iron impellers.

Specify a dynamically balanced unit to ensure long life and vibration-free operational conditions, confirmed by specifying a vibration test to ISO 10816 on the installed unit to confirm alignment, vibration and base harmonics.

Detail grease lubricated, heavy duty ball or roller bearing type bearings and renewable shaft sleeves and wear rings.

For dry-well mounted pumps, specify:

i. Suctions with easy access to clear the impellor eye. This can be a special access cover or an easily removable section of pipe. For example, pumps with suctions greater than 200 mm diameter can be fitted with inspection plates for hand access into the volute and impellor.
ii. End suction pump sets complete with a substantial base plate to mount the pump and motor. Detail the mounting plate to ensure correct alignment at all times and to minimise harmonic vibrations.
iii. "Back pullout" design end suction pump sets, with the motor and wet end of the pump able to be slid out of the volute with minimal work.

For in-line pumps ensure that:

i. The inlet and outlet are placed at the same level where the inlet and outlet pipe diameters are the same.
ii. Accessibility is easy when the pumps are installed in parallel as the pipework can be in the way.
iii. Pumps are installed in a position to permit proposer lubrication and servicing

3.3 ALLOWANCE FOR FUTURE CAPACITY OR EXTENSION

For staged developments such as in Greenfield areas, pump stations can be staged with fewer pumps in the early stage(s) and provision made for the ultimate development scenario. Size these early stage pumping units for the ultimate design flow rate. If an intermediate design flow rate is required, select the pumping units for both conditions, intermediate and ultimate development.

Consider the feasibility of using smaller pump impellers for the earlier stages and upsizing the impellers for the later and ultimate development stages as this could be cost effective if the higher duties can be achieved without overloading the pump. Additional future capacity could also be achieved by replacing pumps installed in the early stages with larger pumps. The starters could be sized for the larger pumps from the start and fitted with circuit breakers and overloads.

If additional pumps are required, make provision for these pumps in the pump station building, the manifold pipework and switchgears. Analyse the various pumping combinations to arrive at the most cost effective combination of staging options.

3.4 WELL PUMP AND MOTOR INFORMATION

Provide the details of all proposed pumps and motors with the Design Report, specifically:

- Make and model
- Physical information (mass, dimensions, delivery diameter etc.)
- Mechanical details (materials, bearing and seal types etc.)
- Manufacturing and testing standards
- Guaranteed performance details (Q/H curves, total pumpset efficiency, rpm
- Minimum operating speed for a variable speed set-up and the reason for this limit
- Rating (kW, rpm, voltage)
- Maximum starts per hour
- Confirmation of continuous rating
- Methods of protection

4 PUMP SUCTION AND DISCHARGE

Design the suction and discharge manifold for future flows without having to take a pump out of service for extended periods of time. Design and size suction pipework so that:

i. It is one size larger than the pump inlet size
ii. Suction pipe is easily accessible to clear any blockages
iii. Suction pipe velocities in table 1 are not exceeded
iv. Allowed on short-term basis (e.g. emergency conditions)
v. Suction cavitation is avoided by flooded suction or having a NPSHA > NPSHR
vi. Eccentric reducers have the obvert horizontal to prevent air entrapment.
vii. Suction lift is within allowable limits for the pump.

Design and size discharge pipework so that:

i. It is one size larger than the pump inlet size.
ii. Discharge pipe velocities in table 1 are not exceeded. Higher velocities should only be allowed on short-term basis (e.g. emergency conditions).
iii. It can withstand the total maximum pressure (including surge)

Suction and Discharge Velocities (m/s)

Pipe Diameter	Velocity (m/s)
Suction Pipe Velocities	
≤ 250 mm ≤1.0	≤1.0
>250 mm ≤ 1.5	≤ 1.5
Discharge Pipe Velocities	
≤ 250 mm ≤ 1.5	≤ 1.5
>250 mm ≤ 2.0	≤ 2.0

5 PUMP MOTORS

Select motors with sufficient capacity to drive the pump. Ensure the motor is non-overloading over the range of duties at which the pumps is expected to operate. Where these requirements cannot be met, submit a non-conformance report to Council.

Do not unnecessarily oversize the motors to achieve the above requirements or the future capacity requirements. Select motors with care as efficiency and the power factor drops in motors running below the load rating.

6 PUMP STATION SCADA

Veolia is Council's manager / operator of the SCADA system.

Provide instrumentation and control at pump stations to measure, control, and monitor the pumping system, as covered in Electrical & SCADA Standard.

Swampfox RTU manufactured by Abbey Systems shall be installed to allow for remote monitoring and alarming functionality (details of IO template for SCADA signals shown in the Electrical & SCADA Standard).

- Developer to provide proposed method of RTU communication to Veolia for approval
- The developer is responsible for all costs associated with the provision of the SCADA communication
- Swampfox to be purchased from Abbey Systems and have area radio channel pre-configured
- Developer is required to use Veolia for all changes required for the software configuration to Council's SCADA system and includes graphical interface, pump station reports and pump station generated alarms

7 APPURTENANT DESIGN

If the pump station's electrical panel is located in a building as defined by the Building Code, specify as a minimum:

i. 4.5 kg fire extinguisher
ii. Approximately A3 size blackboard on wall by personnel door
iii. Lectern, or hinged plan table if space allows

7.1 PRESSURE GAUGES

Specify the installation of pressure gauges which read in kPa, with a pressure range such that the maximum pressure reading is around 50% to 60% of the range. Specify test points on the pump inlet and on ALL delivery pipes. Detail test points that are:

- 1/4 inch BSP female thread
- Fitted with a pipe plug
- Installed as close to the pump as possible
- On the pump side of any valves where possible
- With an accuracy to ±5% or better

Specify test points flush with the inside wall of the pipe, with the test point positioned to minimise the potential for the various velocities or turbulence inside the pipe to affect the gauge reading.

Detail a hole diameter through the test point fitting of less than 4mm to minimise turbulence. This diameter can be increased at distances greater than 4mm from the inside pipe wall.

7.2 WATER SAMPLE POINT

Provide lockable water sampling points that located in an easy and safe access to enable safe collection of water samples for both bacteriological and chemical analysis. These shall be located

On the outside of the Pump station building.

8 FLOW METERS

Specify a Mag-flow meter on the pressure main from the pumping station. Meter type shall be as detailed in QLDC the Water Meter Policy dated August 2015. Meter display shall be located with switch board cabinet.

9 VALVING

Detail sufficient isolation valves to enable the pump station to operate while one pump, or any other major plant item, is being serviced. Specify valves rated to PN16.

Reflux valves to be installed downstream of the pump and upstream of the isolation valve. These should ideally be inside the pump station building. Wafer type non-return valves can be specified for smaller pump headworks (<80 mm pipe diameter).

Locate isolation valves on the discharge pipe at least three pipe diameters from the pump control valves. As far as practicable provide each section of piping which may be isolated with a valved pipe drain.

Install pump control valves (valves to control flow during the start-up or shut-down of the pump) even when a variable speed drive is provided. Configure and connect the control valves so that:

- The pump starts on a closed valve
- They open slowly during start-up
- When the pump is signalled to stop the pump continues to run whilst the control valve slowly moves to the shut position, to avoid water hammer.

10 BUILDING CONSTRUCTION

Design the building to adequately house and allow the efficient operation, servicing and removal of all equipment in the building.

Provide adequate space to move tools and equipment required to perform the entire spectrum of operation and maintenance procedures. Consider future expansion in the design of the building.

Provide a minimum clearance around and between pumps, diesels, open cabinet doors and extended racks of 600 mm.

Locate electrical equipment away from wet areas.

Design a minimum 1.2m wide x 2.0m high personnel service door. Specify solid timber or aluminium doors, with heavy-duty hardware. Detail that large doors fitted for machinery access will open from the inside.

Specify pre-painted long run steel roofing.

Protection of Equipment, Surfaces, Coatings and Dissimilar metals, considering the site’s context.

Do not build over pipes or fittings as they require replacement at a future date. If pipes are built over, detail a service pit to contain them, which is large enough for workman to replace the pipe without any excavation or demolition

11 ELECTRICAL AND INSTRUMENTATION DESIGN

Design the electrical installation, including the generator and diesel engines, the motor starters and the three phase generator inlet plug, in compliance with electrical standard.

12 NOISE, VENTILATION AND AIR CONDITIONING

Design ventilation to the pump station and control temperatures inside the room regardless of the outside temperature to a range of:

- Minimum of 5°C
- Maximum of 40°C,.

Consider heat contributions from all sources inside the building or cabinet. Design the ventilation in tandem with the soundproofing, as ventilation may increase external noise levels directly or indirectly.

If air conditioning is required to control the maximum temperature in an electrical room, include measures to maintain internal relative humidity between 40% - 60%, to avoid condensation and static electrical shock.

For intermittent ventilation i.e. active only when there are personnel inside the pump station, specify a fan capable of 30 complete air changes per hour.

Noise generated by the pumping station shall not exceed the Council District plan permitted levels. The design shall include measures to reduce noise appropriately.

13 GENERATORS – BACKUP POWER SUPPLY

Backup generators are required on most pumps. Whether or not a proposed project will require a backup generator will be confirmed by Council and will depend on the risks associated with power failure. Generators may be permanent and fixed or portable as discussed with and agreed to by Council.

As a minimum specify a unit capable of powering the largest pump, plus all auxiliary equipment (ventilation fans, battery chargers, lighting etc.). It must be capable of powering the pump sets from stand still and zero reticulation pressure and, if required, of starting the standby pump when the duty pump is already running at full load.

Size the generator to match the load and method of starting employed at the pumping station. The generator must be a minimum size in relation to VSDs and must have advanced speed control in order to avoid "hunting" of the generator. The generator set must be able to run continuously at the rated output for several days at a time.

Where an onsite generator is not required by Council a mobile standby generator connection shall be provided and located on the outside of the building. Ensure there is sufficient space for parking a standby generator adjacent to the pump station and way from the footpath or carriageway.

14 TESTING AND COMMISSIONING

Council Pumping and Control staff must witness any commissioning work and testing. Involve specialist suppliers and contractors as necessary. Provide at least five working days' notice of the SCADA functionality checking, any commissioning or testing to Council. Also notify Council of the expected date of handover of operation of the pumping station.

Pre-test any work required to be tested in the presence of Council, to prove it is satisfactory. Prior to pre-testing, ensure that:

i. The installation is in accordance with the specification and drawings, except as varied by accepted non-conformances
ii. All equipment is in proper working order
iii. Programming and settings have been completed and checked
iv. Any automatic controls that might invalidate the tests have been overridden
v. The testing and commissioning schedule (including has been prepared and presented to the commissioning personnel and to Council two weeks before the start of commissioning
vi. Rotation of installed pumps is correct
vii. The outstanding work/defect list is completed

Specify a water test for all concrete tanks and below ground structures to Testing Reinforced Concrete Structures for water tightness where testing is practical.

Provide draft Operations and Maintenance Manuals (OMM) and as-built plans to Council at least 5 days prior to commissioning.

Provide generator load tests.

Provide pump tests to confirm that the finished station meets the design flows.

QUEENSTOWN LAKES DISTRICT COUNCIL

CONTENTS

1 THE GOALS OF THE STREET TREE PLANTING GUIDELINES ARE:

1. To establish minimum expected standards, specifications, and work procedures.
2. To communicate these expectations to all persons and agencies engaged in the planting of street trees within Queenstown Lakes District.
3. To ensure high quality and consistent work practices that results in a healthy, sustainable and aesthetically pleasing urban forest.

1.1 INTRODUCTION

Queenstown Lakes District Council (QLDC) is responsible for the planting, maintenance and replacement of council reserve trees throughout the district. These public and often highly visible trees form an important element of QLDC's asset which is managed by the Property and Infrastructure Team.

Following consultation with QLDC regarding species choice, location and planting methodology, the majority of new street tree planting within new subdivisions are planted as an integral component of any new development, usually requiring the developer to adhere to a fixed maintenance period. Following the completion of this maintenance period, QLDC assess the condition and quality of the new planting and accepts responsibility for the trees and their ongoing maintenance.

This guideline has been produced to provide a minimum standard and direction for the planting of new trees specifically within council's road corridor. It is designed for new sub divisions, retrofitting into existing streets, car parks and all other suburban areas under the maintenance of QLDC.

The processes and expectations laid out in this document will provide clear guidance on planting the right tree, in the right environment and in the right place to provide a valuable tree asset that will enhance the local environment and benefit residents while requiring a minimal ongoing maintenance burden for QLDC and its rate payers.

QLDC is committed to protecting and enhancing the valuable tree asset that is within its area of responsibility. QLDC is also committed to future collaborative working with developers in order to ensure the sustainability of the tree asset for the benefit of future generations. QLDC recognise that amenity trees are planted on the basis of the multitude of social, cultural, economic and environmental benefits they provide for the community and are a significant element in meeting community driven expectations and outcomes.

1.2 BACKGROUND

The Queenstown Lakes District is recognised both nationally and internationally for its enviable environment that is further enhanced by the presence of many magnificent trees and hedgerows which during Spring provide a beautiful display of blossom and emerging new foliage, in Summer welcome shade, in Autumn a spectacular display of rustic colours and in Winter an intricate weave of bare colourful twigs.

Overall, the majority of the districts urban forest trees have attained maturity, with many trees entering senescence and nearing the end of their safe useful life. Therefore it is imperative that all new tree planting is appropriate to the location, successful and sustainable in order for successive tree generations to mature and continue the districts tree heritage into the future.

QLDC has inherited many tree related issues that cause conflict with existing services, residents and the surrounding built environment. Unsuitable species, poor planting location and the lack of available space for roots to extend resulting in hard surface defects as a result of natural root development and expansion (direct damage). This is a common problem throughout the Queenstown Lakes District and beyond.

1.3 STREET TREE PLANTING & CLIMATE CHANGE

How do street trees help combat climate change?

- Trees sequester carbon dioxide directly from the air and transform it into living matter - trunks, branches, roots, leaves, and flowers.
- Deciduous trees planted in strategic locations conserve energy by shading buildings during the summer months. This directly results in a reduced requirement for artificial cooling of buildings and corresponding reduced energy use which means reduced greenhouse gas emissions onsite and from power plants.
- An effective tree canopy in towns and cities helps reduce urban heat island effect, where heavy concentrations of buildings and asphalt adsorb heat and raise urban temperatures by as much as 10°. Lower temperatures mean less energy use for artificial cooling and reduced emissions.
- One large mature tree will sequester 8–10 tons of carbon dioxide from the atmosphere over its lifetime.

The overall effect of urban trees is to cool the local environment during the summer months. Deciduous trees provide summer shade that helps to filter some sunlight from reaching the surface below their canopies. When trees shade buildings, this can reduce summer demand for air conditioning, which in many towns and cities is powered by greenhouse-gas-emitting fossil fuels, such as natural gas or coal. Shade around air-conditioning units can also reduce energy use by partially pre-cooling air before it enters the building. During winter months, deciduous trees provide a spectacular display of autumn colours before they shed their leaves and allow sunlight to penetrate through the canopy, allowing buildings to benefit from the natural warmth of the winter sun.

Beyond their climate change mitigation role, trees also reduce pollution, slow down the water cycle and are important wildlife habitat.

2 TREE PLANTING GUIDANCE

2.1 SITE ASSESSMENT

All trees require fundamental environmental resources. Many sites considered for tree planting are unable to provide these resources, which can contribute to eventual tree decline and failure.

There are many factors to be considered when planting, particularly in the urban environment, therefore a process is necessary to methodically assess the many variables that will be encountered. This stage of planning is essential as these factors impact on soil water retention and movement, drainage, nutrient availability, the severity of soil compaction and root development. Tree roots require very specific conditions in order to thrive and support the tree both structurally and physiologically. Perhaps the most important factor is to ensure that the soil is not overly compacted which can severely inhibit the natural ingress of air allowing gaseous exchange to occur.

Natural factors to be assessed and considered can include:

- Heat and exposure - Increased temperature and sun scorch
- Low temperature, chilling and frost
- Drought
- Mineral deficiency
- Water logging
- Competition for light, water and nutrients
- Acid pH of soil and water
- Exposure to high winds and turbulence
- Soil compaction

Man-made factors to consider can include:

- Above ground factors - Proximity to buildings, utilities, distances to adjacent trees, visibility splays and distance back from kerb edge are significant factors that will determine the appropriate tree species for the location.
- Surrounding surfacing - Roads, pavement, car parking, driveways, new sub division/development site (usually a highly modified environment), berms, verges. The interaction of pavements and berms/verges is a common issue for tree root development.
- Underground factors – Utilities and services will require investigation to establish suitable placement of tree planting locations, or the services should be located away from planned tree planting locations in all new sub-

divisions. Development of the rooting environment will need to ascertain whether any utilities are potentially affected by the proposed tree planting. Mitigation and protection may be required, however, incorporation of services through tree pits is widely accepted where appropriate.

The existing soil should always be considered for use in the tree pit, though it may require soil improvements and/or decompaction, this will vary to individual site requirements and it is recommended that discussions take place with a professional arborist to establish a suitable outcome. The top soil is often removed as part of development. The underlying soil that's left should not normally be considered suitable for tree growth.

2.2 TREE SPECIES SELECTION

When choosing the species of tree to plant, it is recommended that guidance is sought from a suitably qualified professional arborist experienced in the local climatic conditions. Although it is desirable to plant large trees in the urban environment due to their eventual visual benefits to the streetscape, it is not always practical as a result of man-made restrictions such as overhead services and proximity to buildings and highways.

Therefore careful consideration needs to be taken before deciding on the eventual species of tree to be planted.

There are many variables to be considered when choosing a species for any particular site. These variables relate to both the trees to be planted and the conditions in which they are to grow. Design demands are often paramount, but cannot be considered in isolation from all the other factors involved in suitable species selection. All potential impacts on the likely success and longevity of any new planting should be considered.

Nursery catalogues are a useful source of information regarding a species or cultivar to be used. However, catalogues are primarily designed to sell trees and the information contained in them is often partial and incomplete, there are many publications available describing tree species and their characteristics. Local experience and knowledge of young tree performance is often as valuable, and there are occasions when specialist advice is needed.

Trees are adaptive and respond to the local environment in which they are growing, often producing modifications of form which do not match the nursery catalogue description. Site constraints are likely to affect the eventual form, development, speed of growth and eventual longevity of the young tree.

It is imperative that before any decision is made regarding species choice for planting within any QLDC reserve, an early consultation process is initiated with QLDC and the final decision on species choice is agreed with QLDC.

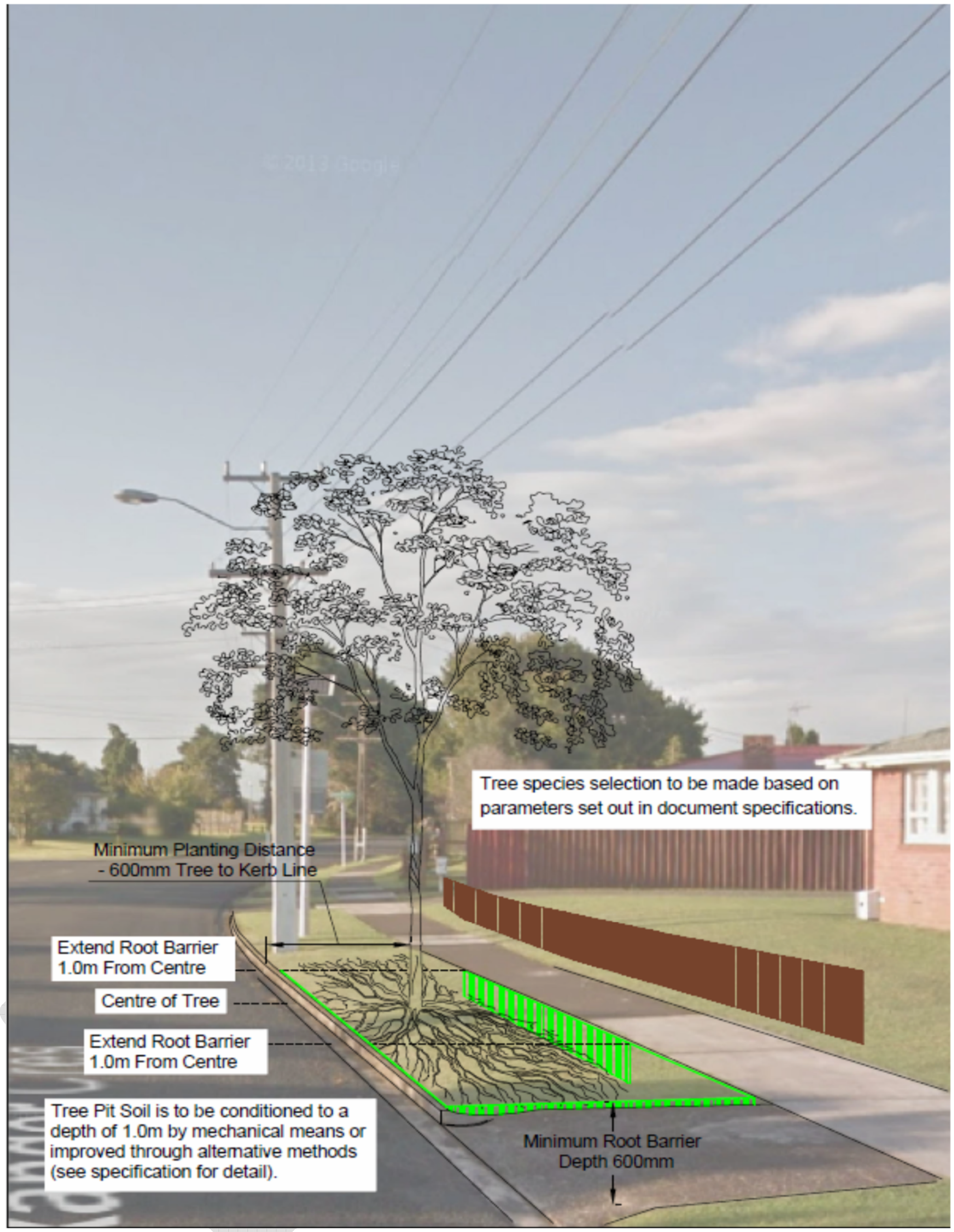
2.3 THE PARAMETERS FOR NEW STREET TREE PLANTING

The following parameters are set out to provide a guide to aid the correct selection of species for the location.

In all locations the following must be adhered to,

- No tree shall be planted closer than 600mm from the inside edge of the road kerb.
- No tree shall be planted to obscure visibility splays.
- No square tree pit opening shall be less than 1200x1200mm and when suitable no less than 1500x1500mm.
- Appropriate, vertically ribbed root barriers or root deflection systems shall be installed and be no less than 600mm deep. In a berm/verge situation the root barrier shall be installed at linear meter either side of the tree centre, longitudinally adjacent the footpath and road kerb. When a square tree pit opening is created the root barriers or deflection system shall be installed at the outer edge of the tree pit.
- Where practicable, the rooting environment shall be manipulated to provide no less than 8 cubic meters of good usable and uncompacted growing medium to encourage the tree to establish and develop to its full potential (Note: final tree pit sizes to be negotiated with QLDC dependant on site constraints and surrounding soil type). Where achievable the soil volume provision shall be greater than 8 cubic meters (advice from a suitably qualified professional arborist should be sought in the relevant amount of soil volume per tree species and the combination of trees per pit).
- In situations where established adjacent trees are already in situ, it is essential that no root damage occurs to any existing trees during planting and the ultimate dimensions of both trees should be considered.
- The distance to potential obstructions are required to be measured or calculated at the planning stage. Such restrictions can include overhead services, adjacent buildings, highways, road signage, lighting columns, power lines and street furniture.
- When new or renewal footpath construction is being undertaken the pavement layout should maximise the space available for the rooting environment of the tree. Flexible pavement options shall be incorporated to protect pavement deflection.
- Once the tree list has been selected for the planting location no other species list shall be used. As new varieties and cultivars are made available that are suitable to each of the species lists they will be populated into the appropriate list.

New street trees shall not be planted where the projected mature canopy spread is within 5 meters of any street light or overhead services.



Example of berm/verge tree selection and protection (Image created by Arborlab)

2.4 TREE STOCK SELECTION

Tree production is the first link in establishing healthy and sustainable street tree planting. Its importance is obvious, and planting projects have often failed through using poor quality trees. Healthy landscape trees are derived from high quality nursery stock. Ensuring that high quality trees are supplied for planting is essential to the successful long term sustainability of any street tree planting programme and an understanding of nursery production systems is therefore critical to enable differentiation between nursery trees of a high or low quality.

If plant quality is sacrificed for superficial looks, stock is sometimes forced to reach a saleable size in the shortest possible time, and while it might be large, it is not necessarily hardy or physiologically ready for planting.

Tree longevity in the landscape begins not at the planting site but at the nursery. The selection of physiologically healthy, mechanically sound and resilient trees is fundamental. Poor production practices on the nursery can cause problems years or even decades after the tree has been growing in the landscape.

The production of young trees is a specialized and complex process, and expert advice is needed when evaluating nursery production systems and good practice. The choice of production system is the responsibility of the specifier and is inextricably linked to the individual site constraints.

2.5 TREE PIT FORMATION

2.5.1 Planting in 100% Engineered Environment – Footpaths, Car Parks, New Roads, Road Upgrades & Combined Tree Storm Water Applications

Based upon a basic conflict of principals between the compaction required for engineering and uncompacted soil environment requirements for root development, provision in areas where the compaction levels are likely to be high will require additional mitigation for the successful integration of trees into the engineered environment.

This Guideline sets a desired minimum requirement, where practicable, of 8m3 of good usable growing medium per tree in these environments (final tree pit sizes to be negotiated with QLDC dependant on site constraints and surrounding soil type).

Combining these factors is achievable through various methods. All of these methods have a higher installation cost associated with them when compared with traditional methods of planting, however it is essential to integrate both the trees requirements and those of the engineered environment to provide a long term benefit. If the rooting environment cannot be manipulated to provide a positive and sustainable rooting environment then no planting should be undertaken.

It is essential that all underground utilities and their locations are confirmed as they may need to be relocated during the installation phase of the tree planting (see drawing 1 below). Research shows that when an adequate soil volume is provided and the infrastructure is correctly built the root development will have very limited interactions with underground services.

Integration of soil into the engineered environment can currently be achieved via three main options, all have been tested worldwide:

- Soil cells
- Vault or rafting
- Structural Soils

Soil cells are the most widely available and a simple way of integration. There are several manufacturers with similar products.

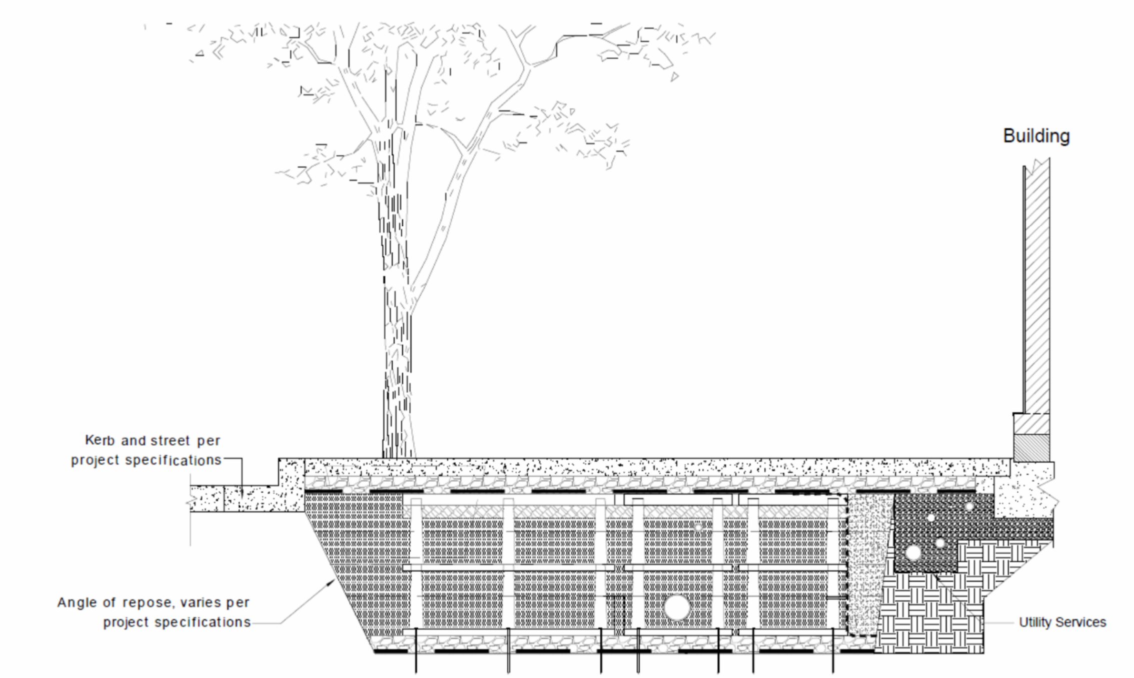
Vaults and rafts are widely used throughout North America (particularly Canada). They require pre cast or cast concrete, as a result they are normally purpose built due to the varying on site factors.

Structural soils blend an aggregate with a clay based soil that allows the blend to have a surface placed over it. More suited for pavements or foot traffic, this system is not suitable for heavier applications such as car parking.

The proposed soil to be integrated into either the soil cells or raft/vault system will require confirmation.

Combined tree and storm water applications are now often an additional benefit when planting trees in engineered tree pits. The emphasis of the soil being uncompacted allows the ingress of water into the proposed solution/pit for temporary holding.

The trees will utilise water runoff from the surrounding area, the soil will release the water at a slower rate post rainfall event and also potentially provide water cleansing affects. The method of integration of water into the engineered tree pit is required to be illustrated, clearly showing how water enters, exits and integrates to the storm water network. Dependant on the soil volume, soil type and potential expected outcomes for the project, the total storm water potential from the proposed engineered tree pit shall be estimated and form part of the information provided to QLDC.



Drawing 1 - Example of engineered tree pit cross section (Image created by Arborlab, amended from DeepRoot drawing)

QUEENSTOWN LAKES DISTRICT COUNCIL

Integration of trees and infrastructure.

Example of soil cells being laid out into tree pit areas. Image courtesy of Paul Malcolm, MetroGreen.

Tree pits and car parking combined

Use of vertical / slot drainage to combine trees and storm water.

Good species selection in line with the proximity of the building. As the trees develop, some pruning required, for buildings and power line for proposed tram network.

2.5.2 Planting in Partially Engineered Environment – Berms/Verges with Areas of Soft Landscape, Central Median Areas of Roads

Many roads and streets throughout the Queenstown Lakes District have footpaths that have a concrete path, flanked with grass. It is common place for trees to be planted in these areas. The total width of the berm/verge including both areas of concrete and grass needs to be considered when proposals of new street planting is taken into account. There are various layouts of these across Queenstown with differing dimensions of pavement to berm ratios. Prevention of root damage to the surrounding footpath is required. This can be achieved in various ways such as position of planting, root barriers, soil amelioration and flexible pavement options.

The underlying soil type and geology is a critical factor. Soil in situ is likely to need some degree of amelioration. In areas the soil amelioration will require more detailed information. If the soil is not improved or at the very least broken up the roots are unable to penetrate. This leads to surface rooting causing issues with the surrounding infrastructure.

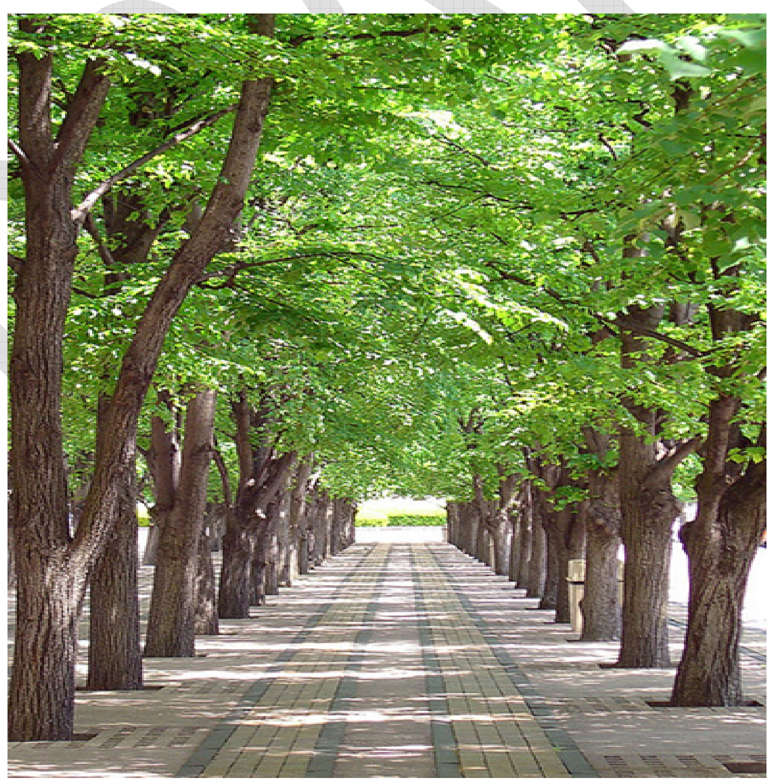
Root barriers will require 1 linear meter either side of the tree stem adjacent all footpaths, road kerbs and other likely areas potentially affected by the rooting matter within 3m of the stem of the tree. The root barriers shall have suitable vertical ribs, this will direct the roots down and prevent girdling that can have long term detrimental effects to the trees development to a depth of 600mm

Consideration to directing the rooting material of the tree under the pavement will provide additional rooting environment and therefore aid the trees development. Pile and beam footpath constructions or the use of soil cells under the pavement, along with the other amelioration techniques illustrated provide integration with minimised defects in the future (see drawing 2 & 3 below).

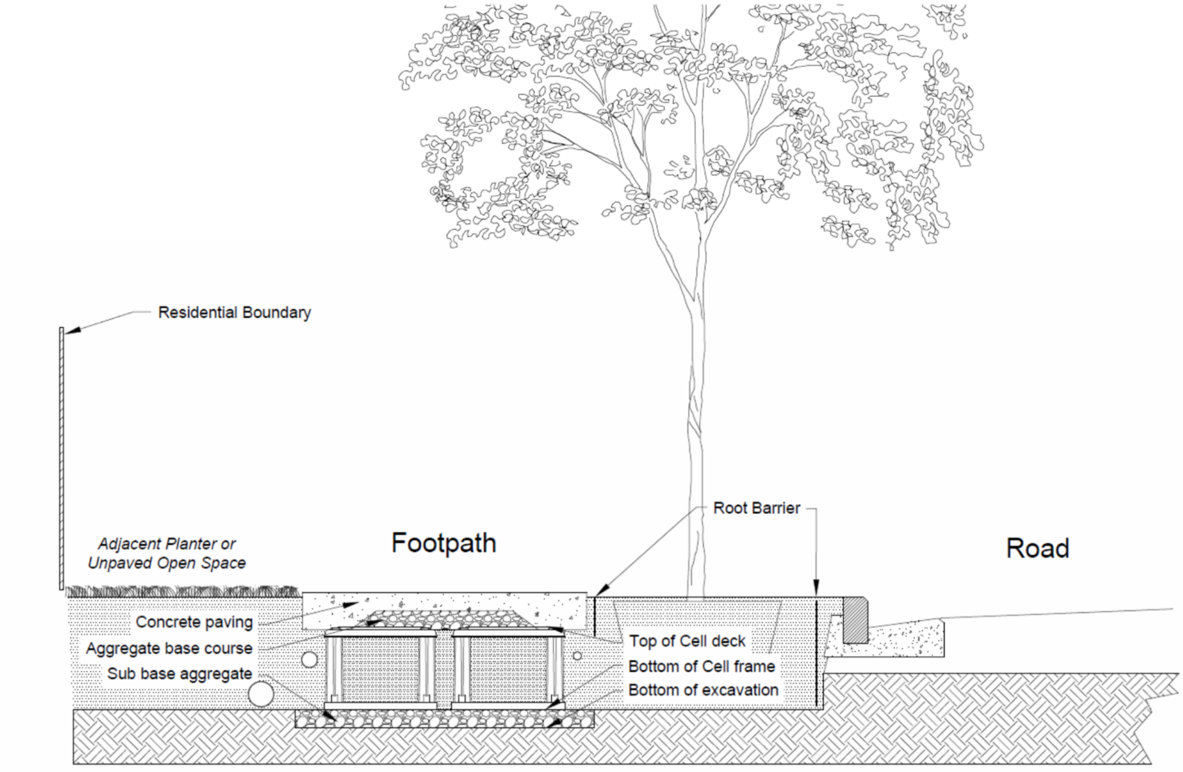
Flexible pavement options that allow movement of the pavement can also be considered e.g. http://www.tripstop.net/

<u>Partially engineered check list</u>

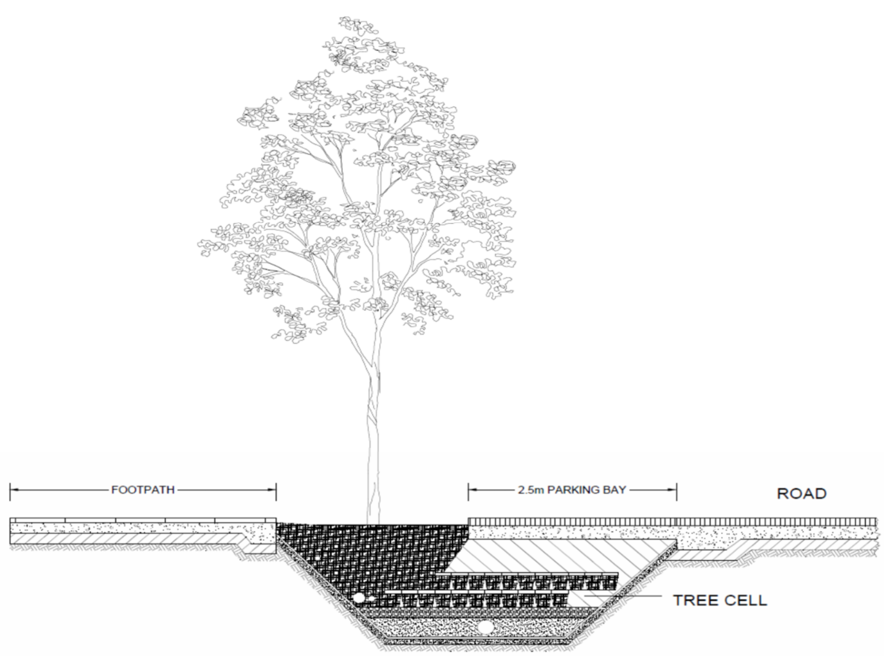
- Soil type ascertained
- Degree of soil amelioration required and proposed
- Root barriers and pavement construction methods proposed to integrate trees



Urban trees successfully growing within an engineered tree pit environment



Drawing 2 - Partially engineered example – Directing roots underneath pavements (Image created by Arborlab, amended from DeepRoot drawing)



Drawing 3 - Partially engineered example – Directing roots underneath parking bay (Image created by Arborlab, amended from MetroGreen drawing)

2.5.3 Planting in Areas of Soft Landscape Greater Than 3m Away From Kerbs, Pavements & Other Engineered Obstructions

In areas of soft landscape away from infrastructure the emphasis will require a suitable species to fit the location. A proposal of the planting specification and soil amelioration will need to be submitted to QLDC for approval.

Soft landscape check list

> Soil type ascertained
> Degree of soil amelioration required and proposed

2.6 PLANTING METHODOLOGY

A planting methodology shall be presented to QLDC for assessment which shall include such details as:

- Planting pit specification
- Soil type (existing and replacement soil)
- Irrigation specification details (if irrigation is to be installed prior to the formation of access driveways, this shall be installed at a depth of no less than 75cm to avoid damage)
- Tree support (normally 3 stakes supporting the new tree at a point no higher than 1/3rd of the trees height)
- Ground treatment around the base of the tree e.g. mulch, hard surfacing, grill

Only when QLDC is satisfied with the proposed planting methodology shall planting works proceed.

2.7 STREET TREE MAINTENANCE AND ASSOCIATED REQUIREMENTS

- Post-planting maintenance and management is important to ensure the establishment and sustainability of all new street tree planting. A full tree management programme with budgetary provision should be in place for all planting schemes. This management programme should be in place for a minimum period of three years (this maintenance period is usually stipulated as a condition of consent).
- The timing and frequency of any irrigation should take into account the prevailing weather conditions, soil moisture release characteristics, and the response of the tree species to water deficits. Regular monitoring must be undertaken to assess the effectiveness of any irrigation.
- *NOTE Nursery trees produced in ideal conditions can take time to adapt to localized planting conditions.*
- Any given volume of soil has the capacity to hold a given volume of water. The water holding capacity of the soil should be established and taken into account when assessing irrigation needs.
- In addition to water-holding capacity, the amount of water available to the tree should be established. Assessing all newly planted trees is impractical, but sample assessments should be made
- The frequency of irrigation is more important than the volume of water given at any one time. This should be accounted for in irrigation plans. Irrigation plans should also take into account the assessments made at the original site assessment and the subsequent species choice made.
- Formative pruning should be carried out as required throughout the early years of a tree's life in the landscape. Some of the nursery-prepared branching structure is temporary and formative pruning should continue until a permanent structurally sound scaffold system of branches typical of the species and appropriate to the site circumstances is produced.
- A formal assessment of young tree health and development should be carried out every six months. This assessment should include foliar appearance, leaf size and density, extension growth and incremental girth development. Continual assessment on an ad hoc basis should be carried out throughout the year.
- All stakes and ties should be checked at least every three months to ensure that the root system remains stable and firm in the ground, and that ties are still effective and not causing any damage to the tree. Any stakes and ties that are found to be not fit for purpose should be adjusted or replaced.
- All stakes and ties should be removed as soon as the developing root system is strong enough to support the tree.
- *NOTE Three full growing seasons are usually long enough for this to occur.*
- Where underground guying systems are used, the wires or straps should be cut as soon as the tree is self-supporting.
- The area around the base of the tree should be maintained in a weed-free condition. The use of herbicides should be avoided and wherever possible aged mulch should be used.

> All mulches should be replenished and hand-weeded as necessary and at least once annually. The mulched area should be enlarged, if practicable, as the tree develops.
> All grilles, grids, guards and other protective furniture should be checked at least annually. Such furniture should be removed as soon as it is no longer necessary to protect the tree, or where there is a risk of physical damage to the tree.
> The soil around newly planted trees should be regularly inspected for soil capping or compaction. Remedial action should be taken as necessary.
> *NOTE Inspections can be visual, but where conditions are extreme, on-site testing and amelioration might be necessary. This can include manually loosening the pit surface with hand tools or more extensive action using an air spade or equivalent. Mulching can prevent further compaction.*
> All trees should be checked on a regular basis for mammal, human and other external damage. Remedial action, where this is possible, should be implemented as soon as practicable following discovery.
> All trees should be checked on a regular basis for pests and diseases. Remedial action should be taken promptly on discovery, where necessary.
> Unless specific nutritional deficiencies are identified, no fertilizer should be applied to newly planted trees.

NOTE If visual inspection reveals symptoms of nutrient deficiency such as leaf scorching, pale foliage or necrotic spots, then further investigation will be necessary with remedial action taken. Remedial action may, in addition to fertilizer application, include pH testing, assessment of organic content and levels of compaction.

> Any tree that fails during the maintenance period shall be replaced with a new tree of the same species and specification.
> The details of all new street tree planting shall be recorded in such a way as this information may be transferred to Queenstown Lakes District Councils GIS software, the information required shall include:
  - Planting locations
  - Tree species planted and size
  - Photographs of the individual trees at the end of the three year maintenance period
  - All maintenance works undertaken during the three year maintenance period

2.8 WORLDWIDE CASE STUDIES

http://www.deeproot.com/silvapdfs/caseStudies/LidlCarPark.pdf

http://www.youtube.com/watch?v=8jcLtlbRuRs

http://www.youtube.com/watch?v=mLffDaa2Pak

http://www.youtube.com/watch?v=TlJDJXqwNyA

http://www.deeproot.com/silvapdfs/caseStudies/Charlotte%20Suspended%20Pavement.pdf

http://water.epa.gov/polwaste/green/upload/stormwater2streettrees.pdf

http://www.vtfpr.org/urban/documents/Main%20Streets%20to%20Green%20Streets.pdf

http://urbanforestry.frec.vt.edu/stormwater/Resources/TreesAndStructuralSoilsManual.pdf

http://vancouver.ca/files/cov/StreetTreeGuidelines.pdf

http://www.fao.org/uploads/media/Trees_for_parking_lots_and_paved_areas.pdf

2.9 ENGINEERED TREE PIT EXAMPLES

Soil cells
www.deeproot.com
www.metrogreen.co.nz

Vaults & rafts
http://www1.toronto.ca/city_of_toronto/parks_forestry__recreation/urban_forestry/files/pdf/TreePlantingSolutions_BestPracticesManual.pdf - Section 3.1

Structural Soils
http://www.hort.cornell.edu/uhi/outreach/pdfs/custructuralsoilwebpdf.pdf

2.10 INTERNET BASED INFORMATION

http://thefield.asla.org/2014/04/24/planting-trees-in-suspended-pavement/

http://thefield.asla.org/2014/05/06/rethinking-runoff-shrubs-stormwater/#more-2576

http://thefield.asla.org/2014/01/30/structural-soil-part-1/#more-2176

http://thefield.asla.org/2014/02/19/structural-soil-part-2/#more-2185

http://thefield.asla.org/2013/09/10/soak-it-up-design-competition/#more-1863

http://edmonstonmd.gov/files/Greening_DecaturSt_inclAddendum_v1.0.pdf

http://www.landscapeirrigation.com/ME2/Audiences/dirmod.asp?sid=&nm=&type=Publishing&mod=Publications%3A%3AArticle&mid=8F3A7027421841978F18BE895F87F791&tier=4&id=38FD064F957F4EFAA4BE57F5E7838420&AudID=AC361F5928F54864BFCBBD93E5B8624D

QUEENSTOWN LAKES DISTRICT COUNCIL

CONTENTS

1 INTRODUCTION

The Queenstown Lakes District Council administers over 180km of cycle trails and tracks. These trails and tracks are a valuable asset to the Lakes District and the purpose of this standard is to ensure greater consistency and quality in the development of all new trails. For simplicity, trails (as called in Wakatipu) and tracks (as called in Wanaka) will collectively be referred to as trails by this document.

The development of a cycle trail design standard is being driven by the increasing development of cycle trails in the Queenstown Lakes District and in particular trails developed as part of private land development projects as well as those created by volunteer organisations.

The Council has recently taken over ownership of numerous sections of cycle trail in both Wanaka and Queenstown and many of these have been built with significant design and construction defects which results in the ratepayer funding realignment and repair works. Council is looking to minimise this cost and ensure better quality trails are developed in the future to be fit for purpose.

This standard is intended to guide cycle trail designers and developers to achieve consistently high standards of cycle trail best suited to meet long term community needs (network connections and latent demand) and minimise ongoing maintenance costs to Council, as the trail owner.

The guide has been developed to closely mirror the New Zealand Cycle Trail (NZCT) "Cycle Trail Design Guide", 2010 with minor changes to take into account changes in design and construction that have arisen during the course of the National Cycle Trail projects. The changes are in maximum gradients, surface finish and additional detail on trail geometry that was not dealt with by this previous standard.

The NZCT guide implemented and widely publicised the 1-6 trail grading system used by the mountain biking community. In terms of trails developed within the QLDC, these will be graded 1-3 with tracks graded 4-6 being purpose built mountain bike tracks and not cycle trails. Development of mountain bike tracks is outside of the scope of this standard.

Additionally, the Department of Conservation (DOC) also have track design guides. These mainly relate to walking track construction and are available on the DOC website. DOC has adopted the NZCT grading system of rating trails as 1-6.

2 OVERARCHING GOAL OF THIS DESIGN STANDARD AND CONSTRUCTION SPECIFICATION

To guide land developers and trail designers to achieve a high quality cycle trail specifically designed and built to cater to the needs of the community(s) it connects and serves and that minimises future maintenance costs to Council.

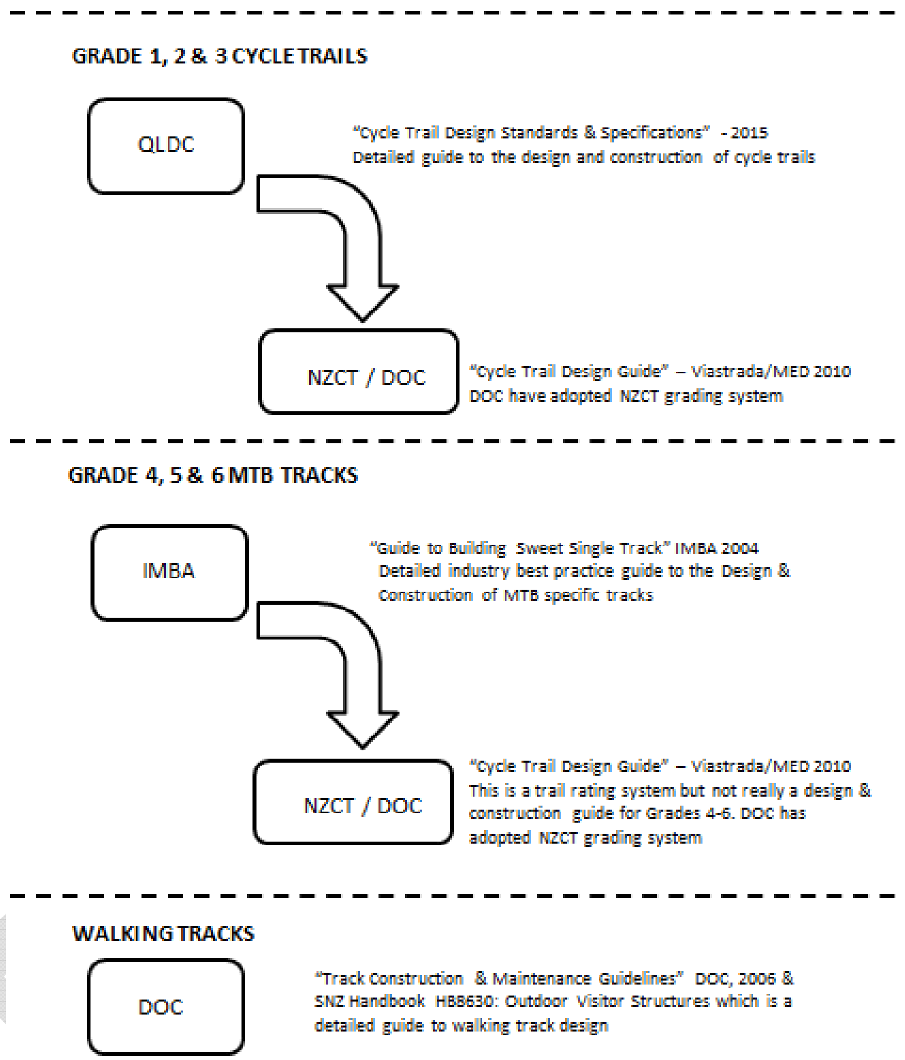
3 SCOPE OF THIS GUIDE

The design and construction of Grade 1-3 cycle trails. The design and construction of 'mountain bike' tracks (Grades 4-6) is very well covered by the IMBA "Guide to Building Sweet Singletrack" 2004 design guide (Refer references section). DOC's track design guides are best suited for the design of walking tracks only.

The design and construction of trails suited to horses has not been considered as part of this guide.

QUEENSTOWN LAKES DISTRICT COUNCIL

4 OVERVIEW OF TRAIL AND TRACK DESIGN STANDARDS



5 TRAIL GRADING & USER GROUPS

The New Zealand Cycle Trail Project (NZCT) commissioned a design guide in 2010 as part of the nationwide cycle trail development project. Completed by Viastrada this guide is the best starting point in the identification of a cycle trail grading system. (See Cycle Trail Design Guide 2010 – Ministry for Economic Development)[1].

Over the intervening 5 years we have refined this system and present the refined grading technical specifications as follows:

I. Grade 1 – Easiest; gentle grades up to 2 degrees (1: 28) with short sections <100m up to 3 degrees, wide (2.5m+) and smooth trail ideal for all user groups. No fall hazards. These are ideal for connecting communities and where families and novice cyclists are likely to be present.

II. Grade 2 – Easy; Some gentle hills up to a maximum of 4 degrees (1: 14), wide (2-2.5m) with some short (<50m) narrow sections of minimum width 1.5m, smooth surface with critical fall hazards within 2m of track edge fully protected. These are ideal for connecting communities and where families and novice cyclists are likely to be present but where Grade 1 gradients cannot be achieved due to terrain constraints.

III. Grade 3 – Intermediate; gradients 0-4 degrees typically, more regular hills acceptable up to a maximum 6 degrees (1: 10) where unavoidable terrain, width 1.2-1.5m and extended narrower sections of minimum width 1.2m. Critical fall hazards at track edge protected only. This is essentially an easy mountain bike track.

The majority of trails within the QLDC network are classed as Grade 1-2 with a few being Grade 3. Table 1 gives a breakdown of the various grades for existing local trails.

In order to provide the greatest accessibility to any new trails, every trail should be designed to meet Grade 1 or 2. Grade 3 should only be considered where the users are predominantly not commuters, families or novice cyclists and the trail is not forming part of a connective network to link communities or part thereof. In other words, not a critical linkage to the cycling network.

6 COMPARISON WITH NZCT/DOC GRADING SYSTEM

DOC has adopted the now widely used Kennet Brothers/NZCT trail grading system using numbers 1 to 6 to classify trails according to trail difficulty. Below is a brief overview of the difference to this standard:

- NZCT Grade 1 – Same except grades not allowed to be steep if ridden in one direction only.
- NZCT Grade 2 – Allows maximum grade of 6 degrees (leading developers to use this as a default grade), allows surface roughness like roots and rocks (not suited to rider group), topcourse aggregate of 30mm particle size (too course for good surface finish – Max 20mm)
- NZCT Grade 3 – Allows grades up to 5 degrees (too steep, likely to cause rutting) and maximum grades of 9 degrees (too steep for most riders, ruts badly)

In summary, this new standard responds to the desire of many trail developers to seek the shortest and steepest line for their trails. Setting lower grade limits and including trail geometry and cross fall details in the design specification is aimed at reducing the most common trail defects noted in this region.

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[1] http://www.nzcycletrail.com/about/resources

7 DETAILED TRAIL GRADE SPECIFICATIONS

The minimum specifications for each trail grade can be expanded as follows:

Grade 1

- A minimum width of 2.5m allowing for side by side riding. This makes passing and overtaking easy, and provides sufficient width for novice riders to feel secure. The minimum width may be reduced to protect historic features, or for environmental or visual amenity reasons. Width also caters for 4wd vehicle access for maintenance purposes.
- Maximum prolonged gradient of 2 degrees (1:28). Maximum gradient of 4 degrees (1: 14)
- Maximum out-slope cross fall of 3% for straight sections of track.
- Corners shall have a minimum inner radius of 6.0m and in-slope gradient or cross-fall of 6-8% except hair pins which must not exceed Typical Detail Sheet R4030_E3_3 of 2.5m
- Minimum structure width of 2.0m clear. Clear means between the closest parts of the barriers.
- A clearly sign posted, well defined trail from beginning to end so visitors can easily find their way in both directions and during inclement weather
- A compacted, well bound smooth riding surface with suitable camber to provide a pleasurable and easy riding experience. Riders should never feel they are going to slide off the trail. Minimum compacted aggregate depth of 75mm
- All water courses to be culverted or bridged
- All areas of fall hazard (exposure) shall be protected with barriers that meet the building code.
- No stiles are to be used. All fences are to be crossed using cattle stops/bollards
- Sight lines – a minimum of 15m clear sight distance is to be achieved around all corners

Grade 2

- A minimum width of 2.0m but generally 2.5m wide allowing for side by side riding. This makes passing and overtaking easy, and provides sufficient width for novice riders to feel secure. The minimum width may be reduced to protect historic features, or for environmental or visual amenity reasons. Width also caters for 4wd vehicle access for maintenance purposes.
- Maximum prolonged gradient of 4 degrees (1:14) but where length >100m it must be broken with flat recovery sections 10m long minimum at 50-75m spacing's. Maximum gradient of 6 degrees (1: 10) for no more than 30m without a flatter recovery section of equal or greater length
- Maximum out-slope cross fall of 3% for straight sections of track.
- Corners shall have a minimum inner radius of 6.0m and in-slope gradient or cross-fall of minimum 6-8% (to be suited to the trail geometry to ensure slip free riding at design speed) except hair pins which must not exceed Typical Detail Sheet R4030_E3_3 of 2.0m
- Minimum structure width of 2.0m clear. Clear means between the closest parts of the barriers.
- A clearly sign posted, well defined trail from beginning to end so visitors can easily find their way in both directions and during inclement weather
- A compacted, well bound smooth riding surface with suitable camber to provide a pleasurable and easy riding experience. Riders should never feel they are going to slide off the trail. Minimum compacted aggregate depth of 75mm

- All water courses to be culverted or bridged
- Areas of significant fall hazard shall be protected with barriers that meet the building code. Areas of exposure where there is not a significant hazard may be protected with fencing, bunding, vegetation or signage
- No stiles are to be used. All fences are to be crossed using cattle stops/bollards
- A minimum of 10m clear sight distance is to be achieved around corners, or additional warning/speed calming measures may be required to avoid user conflict.

Grade 3

- A minimum width of 1.2m but generally 1.5m wide allowing for comfortable single file riding only. The minimum width may be reduced to protect historic features, or for environmental or visual amenity reasons over short (50m) sections. Width caters for quad bike access for maintenance purposes.
- Maximum prolonged gradient of 6 degrees (1: 10) for sections not longer than 100m with flat sections of minimum 25m length between. Maximum gradient of 9 degrees (1: 6) for no more than 30m without a flat recovery section of equal or greater length
- Maximum out-slope cross fall of 3-6% for straight sections of track.
- Corners shall have a minimum inner radius of 3m and in-slope gradient or cross-fall of minimum 8-15% (to be suited to the corner, speed and trail geometry) except hair pins which must not exceed Typical Detail Sheet R4030_E3_3 of 1.2m
- Minimum structure width of 1.2m clear. Clear means between the closest parts of the barriers to ensure quad bike access.
- A clearly sign posted, well defined trail from beginning to end so visitors can easily find their way in both directions and during inclement weather
- A compacted riding surface of either insitu gravels or imported gravel to provide an all-weather surface. Minimum depths to suit ground conditions
- Trail cross fall to provide an enjoyable riding experience for intermediate riders. Riders should never feel they are going to slide off the trail due to incorrect cross slope.
- Water courses may be crossed with fords or be culverted or bridged if required. Any areas of soft or boggy ground shall be made all weather to prevent mud and damage to the trail surface
- Areas of significant fall hazard shall be protected with barriers that meet the building code. Areas of exposure within 1m of the trail edge where there is not a significant fall hazard may be protected with fencing, bunding, vegetation or signage
- Stiles may be used but preference should be given to using Cattle stops for convenience and maintenance purposes. Where a stile is used a gate is required adjoining for maintenance use.
- A minimum of 5m clear sight distance is to be achieved around corners, or additional speed calming measures (trail alignment, sag, etc.) are required to avoid user conflict.

8 CYCLE TRAIL DESIGN CONSIDERATIONS

8.1 STEP 1: IDENTIFY THE USER GROUP & REQUIRED TRAIL GRADE

If the proposed trail is connecting communities and will form part of a larger network, then the minimum standard will be Grade 2 (Always design to achieve the best grade where possible).

The user groups for Grades 1 and 2 are as follows:

a) Families including small children

b) Novice riders who either have never ridden or ride infrequently

c) Cycle tourers and commuters*

d) Mountain bike riders

e) Accessibility users

Groups (a) and (b) require a safe enjoyable cycling experience that is accessible with limited/no cycling skill. The trail must be designed with the needs of the most discerning user group in mind. For the above this would be families and novice riders. Cycle tourers, commuters and mountain bikers have a higher degree of skill and experience making them able to handle less well formed trails2.

Having identified the user group, the designer should aim to achieve the flattest grade possible to meet the highest Grading. This ensures the maximum utility and accessibility to the community irrespective of other aspects of the design.

8.2 STEP 2: DESIGN ALIGNMENT

The designer needs to consider how to fit the trail into the land to minimise gradients, minimise hairpins, control storm runoff and drainage, climb hills, design and integrate structures and achieve the required width and finish that creates or results in a desire line.

8.3 DESIRE LINE

The designer needs to understand where the trail users are coming from (How do they access the trail) and going to (where will they leave the trail network) as well as how will the riders respond to the trail alignment in order to understand the desire line. Desire line refers to the preferred alignment for trail users and manifests itself in riders cutting corners or short cutting sections of trail they consider 'undesirable' when it has not been achieved.

An example of an error in desire line is making curves across a flat open section of terrain when a straighter piece of trail would suffice. Riders are likely to cut corners in this situation. Each section of trail should be considered from the rider's perspective to ensure that desire line is achieved as much as possible.

Ultimately desire line can be hard to predict. A designer needs to consider this especially in open country where riders can see the destination.

8.4 HAIR PINS OR SWITCHBACKS

It is often necessary to use hair pins (corners of ~180 degrees) to negotiate steep terrain. The use of hairpins needs very careful consideration to avoid rutting, erosion damage and safety issues for novice or inexperienced riders.

Hairpins should be graded such that the longitudinal grade through the corner is no more than 2 degrees with the cross-fall sloped to the inside to match the speed of travel such that the corner at the design speed feels safe and secure without sideways slipping.

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2 Commuter tracks require slightly different design considerations outside of the scope of this guide

Hairpin radius should be as wide a possible within the terrain constraints but not less than the minimum specified in design drawing R4030_E3_3 attached in Appendix 2.

The approach to a hairpin should provide enough sight distance for riders to slow down prior to the corner without locking their brakes and skidding. This requires that the approach gradient is quite flat (0-2 degrees) and the surface is well compacted. It is unacceptable to have a constant 4 degree grade into and through a hairpin as the approach will rut causing operational and maintenance issues. Designers may use a rolling-up grade dip (sag) to slow riders naturally prior to a corner. This reduces the likelihood of skidding and loss of control through the corner.

8.5 CURVES, HILLS AND CROSS-FALL

In hilly terrain, curves should follow the terrain. Additionally the terrain should be used to assist drainage with low points in gullies and higher points near ridges. This promotes drainage towards gullies.

The trail surface cross-fall should reflect the terrain and trail geometry. Out sloped corners (very dangerous) are to be avoided at all costs. When a corner is properly designed and built a rider feels well connected to the trail through adequate cross-fall for the design speed and side friction. Refer to the typical cross sections attached for guidance. There are no set rules, but the designer must ensure that the completed trail rides without inducing side slip or fear in the target user group.

8.6 GEOTECHNICAL ASSESSMENT OF TRAILS

At the initial scoping stage it is desirable to undertake a desktop assessment of available information to pin point any possible areas of instability where a trail is proposed. This allows appropriate planning and funding to be included at the design stage. Additionally the designer should walk the trail alignment to confirm no obvious areas of instability

During the design stage known areas of instability should be addressed by specific design or alignments. If avoidable, this is the preferred option. However, as most trails are built on public land adjoining water ways, often the only option is to build over these areas.

As part of the following approval process, areas of instability should be clearly identified on the design plans together with site assessment and solutions. Council wish to avoid ongoing maintenance issues relating to instability in cycle trails and it is hoped such planning will reduce the incidence.

8.7 DESIGN APPROVAL BY QLDC

Prior to any works commencing on the site, the trail designer shall submit the trail design plan, long section (if available – for large projects it is often not possible or cost effective to prepare detailed terrain models), typical cross section, trail design user group and outline of how the trail caters to the user group and fits the trail network together with construction specifications to QLDC for approval prior to commencing any trail works on site.

Additionally the designer shall ensure the proposed trail is marked out on site with flagging tape at no more than 20m intervals and staked in detail for hairpins and curves to ensure the proposed alignment is able to be assessed in detail. The assessment will include a minimum of alignment and gradient checks.

QLDC shall have the opportunity to inspect the trail alignment on site with the designer. Any amendments requested by the Council shall be addressed to Council's satisfaction prior to approval of the works.

While the approval process is designed to identify errors in the design and layout of the trail, it is not possible to anticipate every issue. Further, due to terrain constraints, vegetation cover and access, it may not be possible to assess and design every section of trail in a cost effective manner. Therefore, the design approval does not in itself reduce any liability on the trail developer to achieve the standards and riding requirements detailed in earlier sections of this standard.

8.8 TRAIL CONSTRUCTION & COMPLETION

At the completion of works, the trail contractor and developer shall certify the works as complete and issue a completion certificate in the form of NZS 4404:2010 Schedules 1B & 1C. The Council shall then inspect the works to confirm the completed trail meets the needs of the user groups/community the trail serves. This shall include test riding the completed trail, measuring grades and cross falls and corner radius. The completion inspection is not solely a compliance check but a confirmation of achieving the needs of the trail user.

Where the trail is found to be deficient in terms of grades, alignment, cross fall or other defects (see defects section), the trail developer shall remedy the defect prior to Council signing the s224c certificate and/or taking over the trail asset. Alternatively the trail developer may enter into a cash bond for the value of the works in accordance with Council's bonding policy for land development works.

For trails involving structures that do not require a building consent the trail developer shall submit the following to Council:

> NZS 4404:2010 Schedule 1B (contractors completion)

> NZS 4404:2010 Schedule 1C certificate (Construction review)

> Typical design details for the structure

Where a structure requires a building consent, the trail developer shall supply Council's Parks Department a copy of the building consent documents including PS1, PS3, PS4 and Code Compliance together with design drawings and/or as-built drawings prior to sign off/acceptance of the asset. While this may be a double up on the BC process, often the design detail is not readily accessible and the purpose is to ensure the Parks Department has a complete set of documents for ongoing operation and maintenance.

Additionally all trails and structures including bridges, culverts, signs, bollards, cattle stops, fences etc. shall be accurately surveyed and an as-built plan prepared and submitted in accordance with Council's land development standards to detail all trail related assets being taken over by Council.

8.9 THE DEFECTS PERIOD

Once the works have been signed off by Council as complete, the trail developer shall be responsible for a 12 month defects period. At the completion of the defects period, Council shall be advised and a final inspection undertaken. The final inspection shall assess the trail as if it were in the new as-built state. That is the trail developer shall be required to present the trail in an as-new condition at the end of the defects period.

If the trail requires changes to alignment to avoid or remedy rutting, surface erosion or desire line errors, the trail developer shall be responsible for such modifications at their cost prior to Council taking over responsibility irrespective of whether these were noted at the time of the design approval or completion inspection as often it takes time for errors in design and construction to manifest through use of the trail.

The following parameters shall be achieved for completed trails at the end of the defects period:

> The trail shall have good flow and speed control that does not result in rutting or surface erosion from skidding

> Finished surface shall be interlocking at the end of the defects period and free from loose gravel.

> The surface of the gravel and +0.5m either side of the formation edge shall be clear of all weeds. If there are weeds within the surface gravel, this shall be considered a defect and the developer shall be liable to remedy by mechanical removal.

> Within all the earthworked areas adjoining the trail, all noxious weeds shall be removed

> All verges shall be mown/cut to a maximum 350mm height up to +0.5m off the edge of the formation

> Any stormwater erosion shall be stabilised with rock protection or matting

> Adverse cross fall shall be rectified

> Any silting of culverts or debris in culverts or water tables shall be cleared

> Full design width shall be presented

> Vegetation shall be clear 1.0m beyond the edge of the trail and 2.5m above the trail

9 TRAIL CONSTRUCTION SPECIFICATION – GRADE 2

Attached as Appendix 1 is the standard Construction Specification for a Grade 2 Trail. The specification outlines the standard work methodologies required to complete a cycle trail to Council standards.

Where designers are forming a Grade 1 or Grade 3 trail, the specification shall be modified in accordance with the section "Detailed Trail Grade Specifications" to take account of differing maximum gradients, curve radius, surface and so forth.

10 TRAIL CONSTRUCTION – TYPICAL CROSS SECTIONS & DETAILS

Attached as Appendix 2 are typical cross section and detail plans ref R4030_E3_1-4. These provide design detail in relation to typical cross sections in different terrain, use of curves and hairpins and other typical details used in cycle trail construction but are not intended to cover every aspect of trail construction.

11 REFERENCES

- International Mountain Bicycling Association (IMBA) "Guide to Building Sweet Single Track"
- Standards New Zealand NZS HB 8630:2004 – Tracks and Outdoor Visitor Structures
- "Cycle Trail Design Guide" 2010 Viastrada/MED, prepared for the New Zealand Cycle Trail Project
- QLDC Cycleway Maintenance Specifications c.2010
- Standards New Zealand NZS 4404:2004 – Land Development & Subdivision Engineering
- "Track Construction & Maintenance Guidelines" 2006, Department of Conservation

APPENDIX 1 – CONSTRUCTION SPECIFICATIONS

QUEENSTOWN LAKES DISTRICT COUNCIL

GRADE 2 - CYCLE TRAIL CONSTRUCTION

Technical Specification

Overarching Requirements

Trail Construction must be compliant with QLDC District Plan requirements for example Earthworks, and have the appropriate Consents, be that Building Consent or Resource Consent. It is the Developer and Project Managers responsibility to ensure that the construction is compliant in this regard.

1. TRACK CONSTRUCTION

1.1. Track Alignment

1.1.1. The track alignment is marked on site with RED/WHITE flagging tape. Markers are generally spaced at 20-50m intervals.

1.1.2. The Contractor is responsible for setting out and constructing the track following these markers.

1.1.3. If the Contractor wishes to deviate the track formation more than two meters either side of the design line, specific approval shall be obtained from the Engineer for every deviation.

1.1.4. Deviation from the design line up to two meters either side may be made to avoid living trees, archaeological features, fallen logs, rocks or adverse ground conditions. Approval from the Engineer is not required in such instance.

1.1.5. The Contractor shall be responsible for ensuring the maximum track gradient requirements in this specification are not exceeded on the track. If the Contractor believes this cannot be achieved on the design line or within two meters of this then he shall advise the Engineer.

1.1.6. The constructed formation shall follow the most practical line to achieve the design grades and to create an enjoyable riding experience appropriate to a Grade 2 trail (See QLDC Cycle Trail Design Standards 2015).

1.2. Formation Earthworks, Width & Grade

1.2.1. During construction compliance with the QLDC Land Development and Subdivision Code of Practice is a requirement, attention is drawn to the following key points;

- During construction sediment control measures should be put in place such as keeping drains clear of loose soil and the use of silt fences, traps or bunds around water bodies. Efforts to revegetate battered slopes and cleared land should be made as soon as possible. Long term options include draining to sediment retention ponds where high levels of sediment run off are expected
- Dust mitigation should be used during construction or on any maintenance areas left exposed for extended periods of time. Mitigation incudes wetting ground and long term; use of vegetation on bare land
- Earthworks undertaken must be stable and not prone to erosion

1.2.2. All organic material shall be removed from the track formation area prior to commencing any formation earthworks. Where possible, leaf litter and top soil shall be retained adjacent to the track for spreading over exposed earthworks on completion of the formation.

1.2.3. Tree roots up to 100mm diameter shall be removed where necessary to enable formation excavation.

1.2.4. Where the track is constructed on a cross slope of less than 3 horizontal to 1 vertical, the track bench may be constructed using a combination of cut and fill formation or fill formation as shown on the drawings. Excavated material from the formation may be used to fill the outer edge of the track bench provided it is compacted in place with suitable equipment.

1.2.5. Where the track is constructed on a cross slope of greater than 3 horizontal to 1 vertical, a full cut formation (full bench) detail shall be used as shown on the typical detail. Cut slope batters may be constructed with a max height of 2m with a 1m horizontal bench if higher slope is required. Slope angles (H:V) of 2.5:1 for silt, 2:1 for sand and, 1.5:1 for gravels can be used. Vertical faces can be used for intact rock only, consult Engineer for non-intact rock faces otherwise revert to 1.5:1 specification.

1.2.6. The track formation shall be shaped to achieve the required track width and to ensure the track longitudinal grade is within the required maximum limits. The maximum grade on any section of track shall not exceed the following:

- 1 in 14 (4°) on regular sections of track for lengths less than 100m, otherwise 10m flat sections are to be placed ever 50-75m. Short 30m sections of 1 in 10 (6°) may also be used in conjunction with at least equal length of flatter sections.
- 1 in 30 (2°) on switchbacks and structures
- Or as directed by the Engineer

1.2.7. The required 'usable cycling surface' width shall be 2.0m unless otherwise specified by the Engineer. This shall consider horizontal clearances required from cut/fill batter slopes, handrails (0.5m), trees (0.5m) etc. as detailed in Section 3.5 of NZCT Cycle Trail Design Guide Feb 2010.

1.2.8. Final shaping of the track surface shall take place **after** the installation of culverts.

1.3. Filling

1.3.1. There should be no vegetation or other organic matter in fill material that forms part of the track formation.

1.3.2. Fill material shall be placed in layers not exceeding 300mm loose depth and shall be compacted using appropriate mechanical equipment. Where the slope exceeds 3 horizontal to 1 vertical a bench shall be formed to enable fill material to key into the existing ground and facilitate compaction.

1.3.3. Fill material shall not be used where the moisture content is at or above the plastic limit as densification cannot be achieved. Such material shall be placed outside the track formation.

1.3.4. Fill materials should have an even grading with no segregation, the image below is an example of a non-complying material

1.3.5. Fill slopes shall be left in a smooth and tidy condition. It shall be the contractor's responsibility to make good any batter slumping or subsidence which occurs during the operation of this contract and including during the defects liability period.

1.3.6. Where fill is intended to be placed onto soft or swampy ground, the Engineer may advise the Contactor to lay geotextile material to separate the fill material. Geotextile shall be laid in accordance with manufacturers recommendations.

1.4. Track Drainage

1.4.1. Rolling grade dips (grade reversals) shall be formed in the track surface to divert surface water on sloping sections of track at

1.4.2. ≤30m spacing's where water tables are not installed. Grade reversals shall be 2-3m in length and be of a smooth profile to ensure a smooth ride for cyclists.

1.4.3. Water tables in accordance with the typical details shall be installed on each section of track formation prior to placing top course metal.

1.4.4. Water tables shall have a grade of >1% towards the discharge point (if any). A discharge point shall be provided anywhere there is a sag point in the track.

1.4.5. Water table discharge points shall be installed at the following spacing's or as directed by the Engineer:

1.4.6. 50m where the track grade is ≤ 20:1 (3°)

1.4.7. 15m where the track grade is between 10:1 and 20:1 (3°-6°)

1.4.8. Water table discharge shall consist of minimum 250mm smooth walled culvert under the track to direct water to lower ground on the down slope side of the track.

1.4.9. Culvert pipes shall be installed with a minimum 5% fall to the outlet and a minimum of 150mm cover to the finished track surface.

1.4.10. The inlet to culverts installed for the discharge of water tables shall have a 200mm x 200mm x 250mm minimum deep sump at the culvert inlet which has an invert level at least 100mm below the culvert pipe invert. A 300mm long stop bank shall be provided after the sump pit to force water into the pipe.

1.4.11. Culverts shall be of sufficient length to pass under the track and extend beyond any fill.

1.4.12. The outlets of culvert pipes shall discharge at ground level without a free fall from the end of the pipe. Where the outlet slope is on steep loose material, a rock apron shall be provided to prevent scour.

1.4.13. Culverts shall be smooth bore Farm Tough type colored black of minimum 250mm internal diameter or similar as approved by the Engineer.

1.4.14. The inlet and outlet of culverts that discharge continuous water flows shall include local stone/mortar headwalls.

1.4.15. Where the culvert discharges only stormwater and the inlet or outlet may be subject to maintenance vehicle loads (that is they are within 300mm of the track edge), the headwalls shall be mortared.

1.4.16. For all other culverts where the inlets and outlets are not able to be driven on, headwalls are optional

1.4.17. Lintel rocks for headwalls shall have a minimum diameter (or long side) of not less than 2x culvert diameter for pipe sizes 250- 500mm diameter.

1.5. Track Shaping

1.5.1. Prior to placement of track surfacing aggregate, the track sub- grade shall be shaped as follows

- Crowned surface having a **maximum 3%** fall to each side from the centerline for straight sections in flat country.
- Single slope formation with a 3% fall to the downhill side for straight sections in hilly country or where side drains are not provided.
- Single cross slope formation with a **5-10% fall to the inside of corners** for winding sections.
- If after rain, water is left sitting or pooling on the surface at more than 20mm depth, this will be considered a defect and require rectification by the contractor.

1.6. Pavement Surfacing

1.6.1. Prior to placement of track surfacing, the strength and density of the track sub-grade shall, wherever possible, be improved by the use of suitable compaction equipment such as vibrating rollers or plate compactors.

1.6.2. Suitable surfacing material shall be a crushed & well graded AP2O (or smaller) type aggregate having a maximum particle size of 20mm and be supplied from a weed free source. The stone particles shall be durable with at least 50% crushed faces. Rounded particle river gravels or beach gravels are not acceptable as a track surfacing aggregate.

1.6.3. Ideally the track surfacing aggregate shall have a range of particle size distribution including between 5-8% by weight portion of clay content to facilitate binding the surface.

1.6.4. A sample of aggregate shall be provided to the Engineer for approval prior to placement.

1.6.5. The track surface layer shall have a minimum compacted depth of 75mm minimum (equates to 100mm loose). This layer shall be placed and compacted in a single layer or where additional material is added after compaction the original layer shall be scarified prior to placement of the additional aggregate.

1.6.6. A 5-10mm layer of crusher dust shall be used to cap the aggregate layer and provide a smooth riding surface.

1.6.7. The aggregate shall be placed in such a way as to minimize segregation of the particle sizes. Shovels, beam rakes or excavator buckets should be used to move material if required.

1.6.8. The surface shall be shaped to achieve the required cross fall and longitudinal smoothness with a grader or similar machine. Grading with an excavator is not acceptable.

1.6.9. The aggregate surface shall be compacted after placement with a plate compactor or other vibrating equipment to achieve a well bound surface suitable for cycling. The cross fall of the finished track surface shall be as stated in Section 4.5.1.

1.6.10. To achieve optimum compaction, water shall be sprayed onto the aggregate surface. Compaction will be deemed complete when a well bound pavement surface is achieved which is free of voids and loose stone.

1.6.11. The completed track surface shall be free from loose stones (interlocking mosaic is required) and **surface undulations** to achieve a smooth & comfortable riding experience. Wavy or corrugated surfaces shall be deemed a defect and shall not be acceptable. The final test shall consist of riding a standard non- suspended bicycle along the completed surface to check for such defects. A clegg value of 27 is required on the finished surface (prior to crusher dust application)

1.7. Rock Excavation & Blasting

1.7.1. Areas requiring rock excavation are not necessarily shown on the design drawings.

1.7.2. Blasting of rock may be used where it is not practical to break or remove rock by mechanical means and achieve a solid level surface finish for the formation.

1.7.3. Any rocks that are too large to move whole shall be drilled and blasted.

1.7.4. All blasting shall be carried out in accordance with the Department of Labor Code of Practice for Construction Blasting Safety.

1.7.5. The Contractor shall provide the Engineer with at least 48 **hours' notice before blasting operations are to commence.** The Ministry of Business Innovation & Enterprise shall be notified at least 24 hours prior to the blasting commencing.

2. HERITAGE & ENVIRONMENT

2.1. Archaeological Matters

2.1.1. If any archaeological evidence in the form of mining relics, stacked stone tailings, water races, sluicing, shell, bone, charcoal, greenstone, hangi stone, or artefact is uncovered during any construction, work must cease in that particular area and the Engineer must be notified immediately.

2.1.2. Work in the vicinity of sites where archaeological evidence is uncovered shall not re-commence until the Engineer gives approval. Delays due to unexpected finds may be a variation at the applicable rates.

2.1.3. The contractor shall implement all mitigation measures approved in any archaeological authority obtained from the Historic Places Trust relating to track works. If this is not practical, they shall advise the Engineer prior to any works covered by such Authority.

2.2. Vegetation

2.2.1. The survey line/design plans marked will identify all vegetation requiring removal. Mature trees will be affected in some areas due to legal access constraints but in general the track alignment should consider options around mature trees and any significant fauna. Endeavor to minimize destruction of native flora and promote growth of native species over non-native species.

2.2.2. Any tree exceeding 300mm diameter, that needs removal will be identified prior to the start of any works; any tree exceeding 300mm diameter must have the approval of the Engineer before it can be removed.

2.2.3. The completed track must have a cleared vegetation line of 2.5m vertical and a horizontal line of 1.0m either side of the track edge. All stumps created in the course of the construction are to be removed from track area unless indicated by the engineer. All slash, branches and removed stumps must be removed from site or chipped or burned (note burning requires a permit from the TA).

2.2.4. If a tree has to be retained details are to be supplied to protects the roots of trees \

2.2.5. Will ensure that disturbance to any trees & roots systems is minimised during construction or done in arboriculturally sensitive manner that is within the tolerances of the tree(s).

2.3. Sediment & Dust Control

2.3.1. Silt fences, traps or bunds should be used around water bodies. and cleared regularly to maintain functionality. Efforts to revegetate battered slopes and cleared land should be made as soon as possible. Where high levels of sediment run off is expected retention ponds may be deemed appropriated.

2.3.2. Dust shall be mitigated during construction and maintenance activities through wetting of bare soil, covering stockpiles or revegetation.

2.4. Health & Safety

2.4.1. The Contractor shall at all times comply with the provisions of the Health and Safety in Employment Act 1992. The Contractor shall take all necessary steps to ensure that the obligations placed on the "Principal" and the "Person who controls the place of work" under the provisions of the Act are complied with at all times and shall immediately advise the Principal of any obligations not being fulfilled.

2.4.2. The Contractor shall prepare a Safety Plan, which shall identify all potential risks and hazards to all personnel on site. The plan shall include safety procedures, requirements for protective clothing and equipment, safety equipment, mitigation procedures, emergency procedures, emergency communications and any other requirements deemed necessary.

2.4.3. The Safety Plan shall be submitted to the Engineer by the Contractor who shall confirm that the Safety Plan has been implemented and is operating on the site.

2.4.4. If at any stage during the course of the works, the Engineer or the delegated representative(s) observe activities or procedures which do not comply with the Safety Plan, a 'Stop Work' notice may be issued to the Contractor.

2.4.5. Extensions of time arising out of 'Stop Work' notices issued to the Contractor due to non-compliance with the Safety Plan will not be considered.

2.4.6. The Contractor shall ensure that during the execution of the Contract there is no risk to the health and safety of other Contractors or employees of DOC, LINZ or Contact Energy, or to members of the public that may be in the vicinity of the site.

2.4.7. The Contractors' Safety Plan shall include particular procedures with respect to maintaining the safety of users of the track during construction including use of appropriate signage, barriers and other protection deemed necessary.

2.4.8. The contractor shall use all practical means to prevent members of the public from using any structures until such time as a Code of Compliance Certificate has been issued for the structure.

2.5. Building Consent

2.5.1. The Contractor shall comply with all conditions of Building Consents relating to structures.

2.5.2. If inspections are required by the Council building inspectors, it shall be the Contractor's responsibility to ensure that the Council is kept informed and given sufficient notice as to when inspections are needed.

2.5.3. The Principal shall obtain all building consents unless otherwise noted.

2.6. Resource Consent

2.6.1. The Contractor shall comply with all conditions of Resource Consents relating to track formation and structures.

2.6.2. If inspections or monitoring is required by either the QLDC or ORC it shall be the Contractor's responsibility to ensure that the Council is kept informed and given sufficient notice as to when inspections are needed.

2.7. Producer Statements

2.7.1. The Contractor shall, on completion of the works, provide the Engineer with a Producer Statement-Construction (PS3) as setout in NZS 3910:2003 Schedule 6. The issuing of a Certificate of Practical Completion is subject to the receipt of the PS3.

2.8. Reinstatement of Area & Grassing

2.8.1. The Contractor and any Sub-constructors employed by the Contractor shall reinstate all land affected by the works, including the re-establishment of working areas, to a condition at least equal to that at the commencement of the works. Grass seed shall be spread on all areas of spoil where appropriate. All fencing disturbed shall be reinstated with new fencing of the same style as what was removed

2.9. Materials brought onto Site

2.9.1. All aggregate brought onto the site for the purpose of track surfacing or any materials brought in as fill, are to be from a weed free source and are to be inspected and approved by the Engineer prior to delivery on site.

2.9.2. Materials are to be stockpiled in approved places and all remnants removed from the site on the completion of the project, except where the Engineer has approved surplus materials that may be left in stockpiles on the site.

2.10. Removal of Waste Material

2.10.1. All timber cut-offs, surplus materials and any waste is to be removed from the site at the completion of the work

2.10.2. Waste is defined as all foreign material on the site. This includes but is not limited to spilt concrete, nails, wood, plastic and metal off-cuts.

2.10.3. Waste or rubbish being held at the site prior to removal is to be stored in such a fashion that it cannot be blown about by the wind. No tyres are permitted.

2.10.4. Major repairs to machines are not permitted on site without approval of the Engineer.

2.11. Helicopter Operations

2.11.1. The Contractor shall obtain prior approval from the Engineer before each and every helicopter operation.

2.11.2. The Contractor is responsible for obtaining all required Civil Aviation and other permits

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necessary for helicopter operations.

2.11.3. The Contractors Safety Plan shall include procedures for such operations and the proposed measures to ensure public safety during the operations.

2.11.4. All materials dropped by a helicopter operator either by accident or on purpose outside of approved sites must be reported to the Engineer as soon as possible and any such materials shall be removed as soon as possible. Site restoration work must be carried out to the satisfaction of the Engineer in the event of any damage from dropped items.

3. TIMBER STRUCTURES

3.1. Relevant Standards

3.1.1. The underlying Standards relevant to this Section are:

NZS 3601	Metric Dimensions of Timber
NZS 3602	Timber & Wood Based Products for use in Buildings
NZS 3603	Timber Structures
NZS 3604	Light Timber Framed Buildings
NZS 3605	Timber Piles & Poles for use in Buildings
NZS 3640	Timber Treatment Specifications
NZS 1328	Glue Laminated Structural Timber
NZS HB 8630	Tracks and Outdoor Visitor Structures

3.2. Scope & General

3.2.1. This section of the contract work shall consist of all carpentry including the associated jointing brackets, cleats, bolts, nails etc. as shown on the drawings or specified herein or otherwise.

3.2.2. This includes, but is not exclusive to the construction of boardwalks, barriers and retaining walls.

3.2.3. **All timber shall be sound, free from knots** and well-seasoned and maintain figured dimensions.

3.2.4. All timber shall be rough sawn sizes unless specifically noted otherwise.

3.2.5. Timber shall comply with Table 1

3.3. Timber Treatment

3.3.1. Treatment shall be as noted in the table below. Treatment shall comply with the current requirements of the Timber Preservation Council. All treated timber shall be branded with the appropriate woodmark. It is preferred that timbers be treated at least 2 months prior to installation.

3.3.2. Cut faces of timber sections greater than 50mm thick shall be treated with Metalex or similar field applied preservative treatment.

Table 1: Timber Specification and Treatment

Structure & Application	Species	Grade	Treatment
Round piles	Pinus Radiata.	NZS 3605	H5
Retaining wall boards, Boardwalk end boards and bearers and other sawn timber in contact with the ground or within 150mm of the ground.	Pinus Radiata	G8 or VSG8	H5
Boardwalk joists, bracing, decking and blocking. Barrier balusters and rails	Pinus Radiata	G8 or VSG8	H3.2
Glulam Beams	Pinus Radiata	GL10	H3.2

3.4. Fixtures & Fittings

3.4.1. Bolts and washers shall be hot dip galvanised engineer's bolts of the diameters and sizes shown on the drawings unless specified otherwise.

3.4.2. Bolts may consist of hot dip galvanised or stainless steel threaded rod cut to length on site.

3.4.3. All hot dip galvanised rod cut ends shall be treated with 'dry galv' corrosion protection.

3.4.4. All galvanised bolts in contact with treated timber shall be protected using general purpose grease in pre-greased holes

3.4.5. Thread protrusion past the nut shall be a minimum of one thread pitch after tightening.

3.4.6. All nails shall be 100mm x 4.0mm FH galvanised steel unless specified otherwise.

3.4.7. The contact faces of washers shall be coated with grease.

3.4.8. Washers shall be fitted to both ends of bolts and shall comply with the following minimum standards:

Bolt Size	Washer (mm)
M12	*50 x 50 x 5.0*
M16	*65 x 65 x 5.0*

3.5. Protection Up to Installation

3.5.1. All materials shall be protected against physical damage.

3.6. Standards of Workmanship

3.6.1. All work shall be in accordance with industry best practice

3.6.2. Details not shown on the drawings shall be formed according to the principles of NZS 3604 or referred to the Engineer.

3.6.3. All work is to be accurately set out.

3.6.4. All structural members are to be fixed true to line.

3.7. Foundations & Concrete Work

3.7.1. All Concrete used for the embedment of posts or headwalls shall have a 20mm maximum aggregate size and be a mix designed to have a minimum 28-day compressive strength of 20MPa.

3.7.2. All concrete shall comply with NZS 3104 or NZS 3108 including specification and techniques setout herein.

3.7.3. The contractor shall be responsible for locating any services on site. Any damage to underground services shall be repaired at the Contractors expense.

3.7.4. Excavations for foundations are to be built to the dimensions and details shown allowing for working room as required.

3.7.5. Where holes are dug or augured for foundations, the Contractor is responsible for ensuring the stability of the hole to ensure the hole maintains its required dimensions before pouring concrete. The costs of any stability work will be deemed to be included in the Contractors tender price.

3.8. Glue Laminated Structural Members

3.8.1. All beams shall comply with NZS 1328 GL10 grade.

3.8.2. Material for the members shall be Radiata Pine with a moisture content not exceeding 18%.

3.8.3. All members shall be made for Category 3: Exterior Exposed. The adhesive used shall be resorcinol glue.

3.8.4. End joints should be randomly spaced throughout the depth of a member to avoid concentration of joints.

3.8.5. Finish shall be 'standard' in accordance with NZS 3606 unless specified otherwise.

4. GABION PROTECTION

4.1. Installation

4.1.1. Gabion baskets unless otherwise specified shall be 2m long by 1m high and 1m wide and made from 2.7mm pvc coated wire.

4.1.2. Gabion baskets shall be installed in accordance with the manufacturers recommendations and industry best practice including appropriate backfill, inter-connections and tying and geotextile separation (filter cloth) to prevent backfill migration.

4.1.3. All areas requiring gabion wall installation shall be marked on site by the Engineer prior to installation and agreed with the contractor.

4.1.4. Where gabions are laid more than 1m in height, subsequent layers shall be offset 300mm.

5. TIMBER RETAINING WALLS

5.1. Installation

5.1.1. Timber retaining walls shall be installed in accordance with the design drawings to achieve minimum embedment depths, maximum heights and angles.

5.1.2. All timber retaining walls shall be fixed together with either galvanized bolts/washers or galvanized purlin screws. Nails shall not be used for fixing timbers.

5.1.3. All timbers shall comply with Section 3.3 Table 1 above.

6. TIMBER CRIB WALLS

6.1. Installation

6.1.1. Crib walls shall be installed in accordance with the design drawings

6.1.2. All timber shall comply with Section 3.3 Table 1 above

6.1.3. Timber shall not be joined with nails. All timbers shall be either plated and bolted or plated and galv purlin screwed together to prevent breakage and splitting of timber.

6.1.4. The end and corners of such walls are to be protected with a minimum 100x50 timber running vertically to prevent end breakage

7. CATTLE STOPS & BOLLARDS

7.1. Design & Installation

7.1.1. Cattle stops shall generally be as per the typical detail plan Sheet R4030_E3_4 The cattle stops shall have a minimum trafficable width as per the required minimum structure width for the trail Grade to enable maintenance access

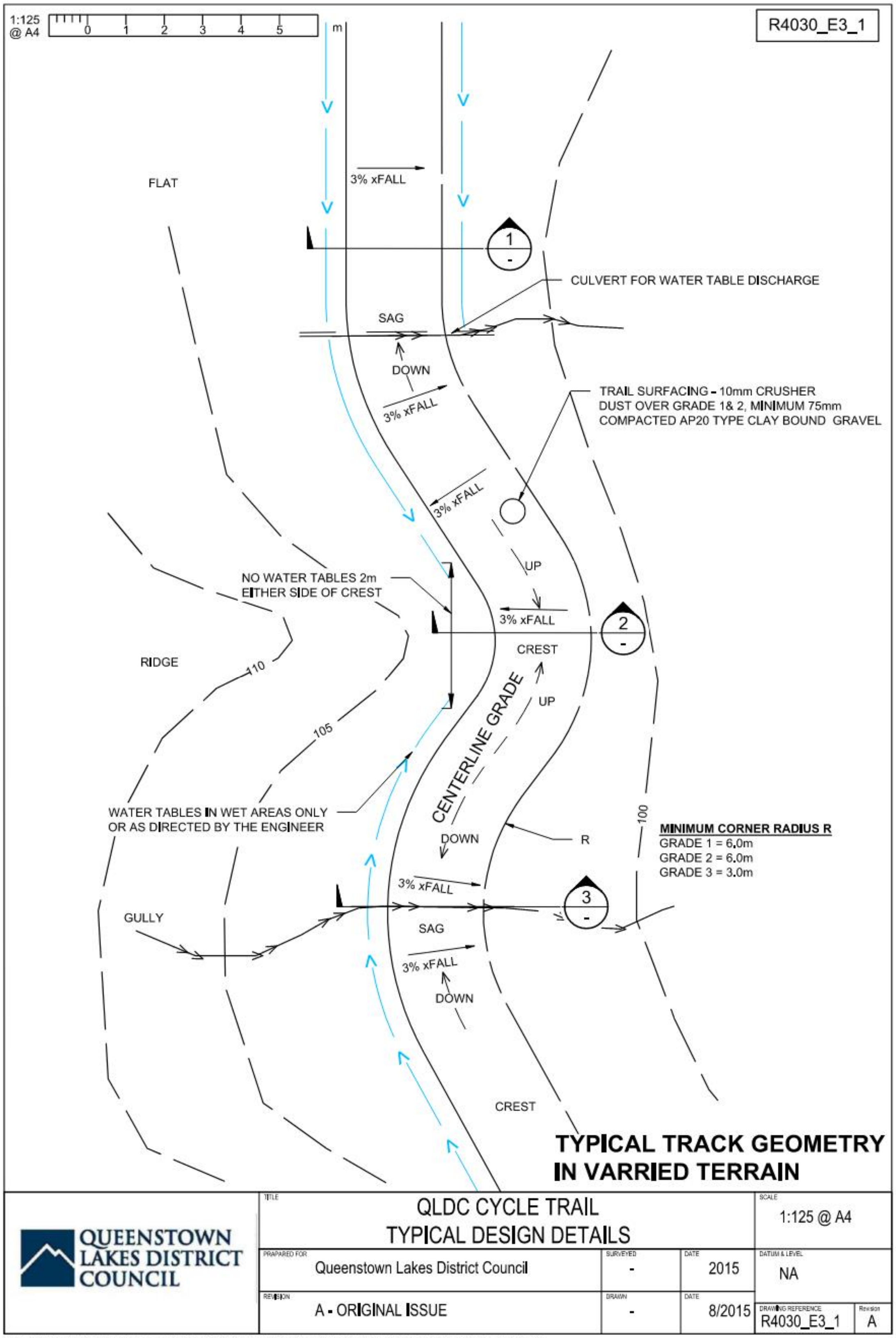
7.1.2. Cattle stops shall have as a minimum a galvanized steel grate consisting of either rounds or flats sharp side up welded to a steel surround. Base and sides may be either timber or metal.

7.1.3. Cattle stops shall be installed at grade with the adjoining cycle trail and in line. Where restricting vehicle access is necessary, a timber bollard shall be installed in the center of one approach and be of the lockable type.

7.1.4. A minimum 100mm flexible pipe shall be installed into the base of the cattle stop to enable hedgehogs to exit from the sump

7.1.5. Bollards for use on QLDC trails shall be as per attached typical detail plan XXXXX and shall be installed in accordance with this plan. Bollards can be Macrocarpa but must be treated at ground level and below, frangible and capped on the top surface.

APPENDIX 2 – TYPICAL DESIGN DETAILS

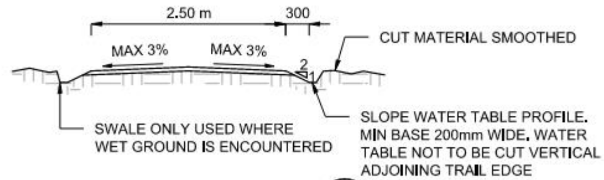


Original Sheet Size A4 [210x297] Plot Date 2018-11-28 at 10:53:05 AM Path \\icsv01\GroupLib\Opus\QLDC Jobs\QLDC Cycle Trail Typical Detail Sheet01.dwg C01

1:75 @ A4 0 1 2 3 m

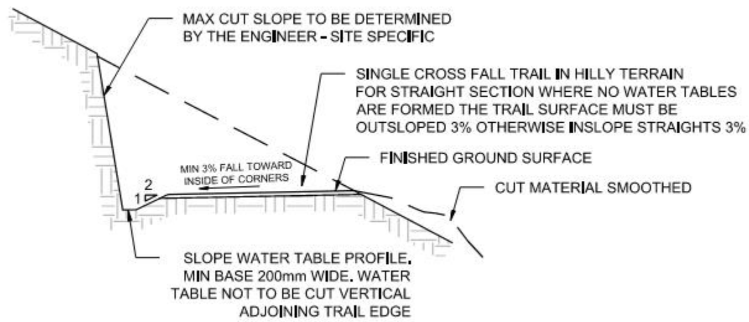
R4030_E3_2

TRAIL DESIGN WIDTH
GRADE 1 = 2.5m
GRADE 2 = 2.0-2.5m
GRADE 3 = 1.2-1.5m

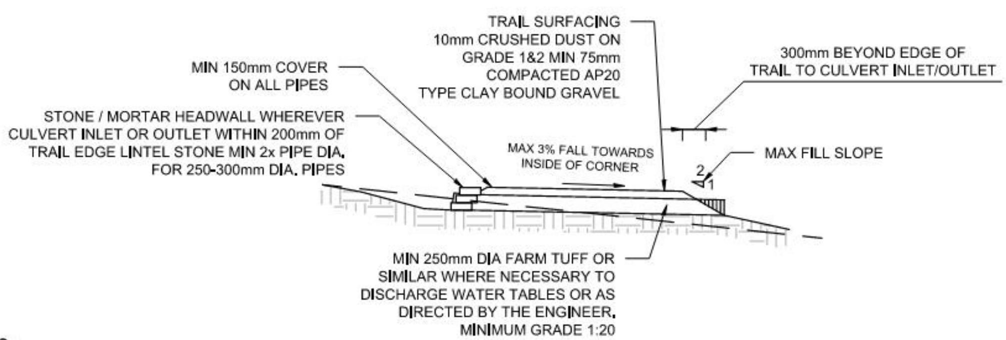


SINGLE CROSSFALL (1 / C02)
USE IN FLAT COUNTRY

ALL CORNERS MUST BE FINISHED WITH SINGLE CROSS FALL SLOPING TO THE INSIDE OF THE CORNER.



FULL CUT BENCH (2 / C02)
USE WHERE CROSS SLOPE > 3:1 (>18°)



USE WHERE CROSS SLOPE < 3:1 (<18°)

CUT & FILL (3 / C02)
USE WHERE CROSS SLOPE < 3:1 (<18°)

NOTES:

1. MINIMUM TRAIN CROSS FALL ON CORNERS = 3%
2. TRAIL SHOULD SAG AT GULLIES AND CREST AT RIDGES TO ASSIST DRAINAGE
3. USE FULL CUT BENCH WHERE SLOPE IS >3:1; USE A COMBINATION OF CUT & FILL WHERE SLOPE <3:1
4. WATER TABLES, WHERE USED, SHALL BE SLOPED AND NOT VERTICALLY CUT AT TRAIL EDGE

QUEENSTOWN LAKES DISTRICT COUNCIL	TITLE: QLDC CYCLE TRAIL TYPICAL DESIGN DETAILS			SCALE: 1:75 @ A4	
	PREPARED FOR: Queenstown Lakes District Council	SURVEYED: -	DATE: 2015	DATUM & LEVEL: NA	
	REVISION: A - ORIGINAL ISSUE	DRAWN: -	DATE: 8/2015	DRAWING REFERENCE: R4030_E3_2	Revision: A

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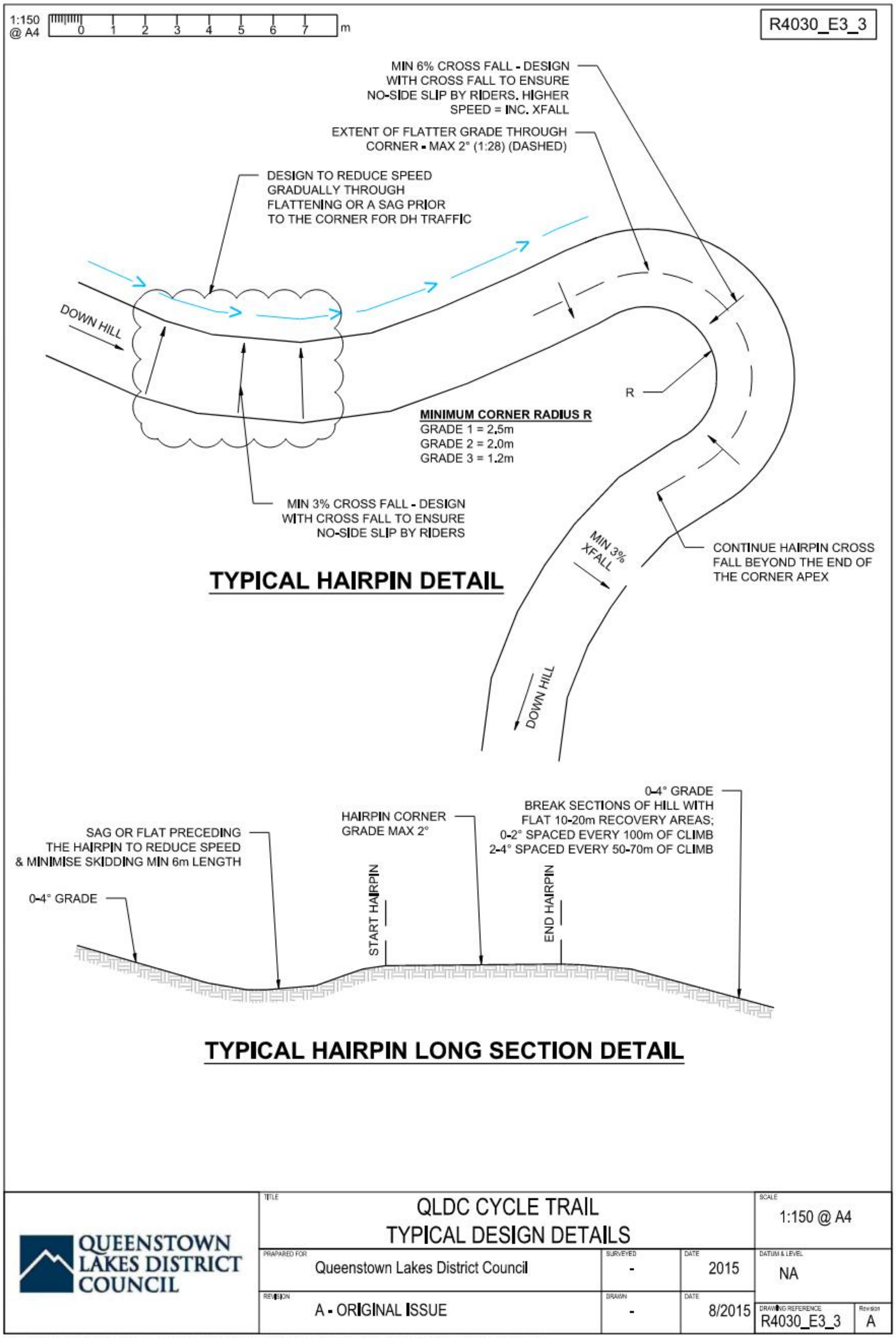
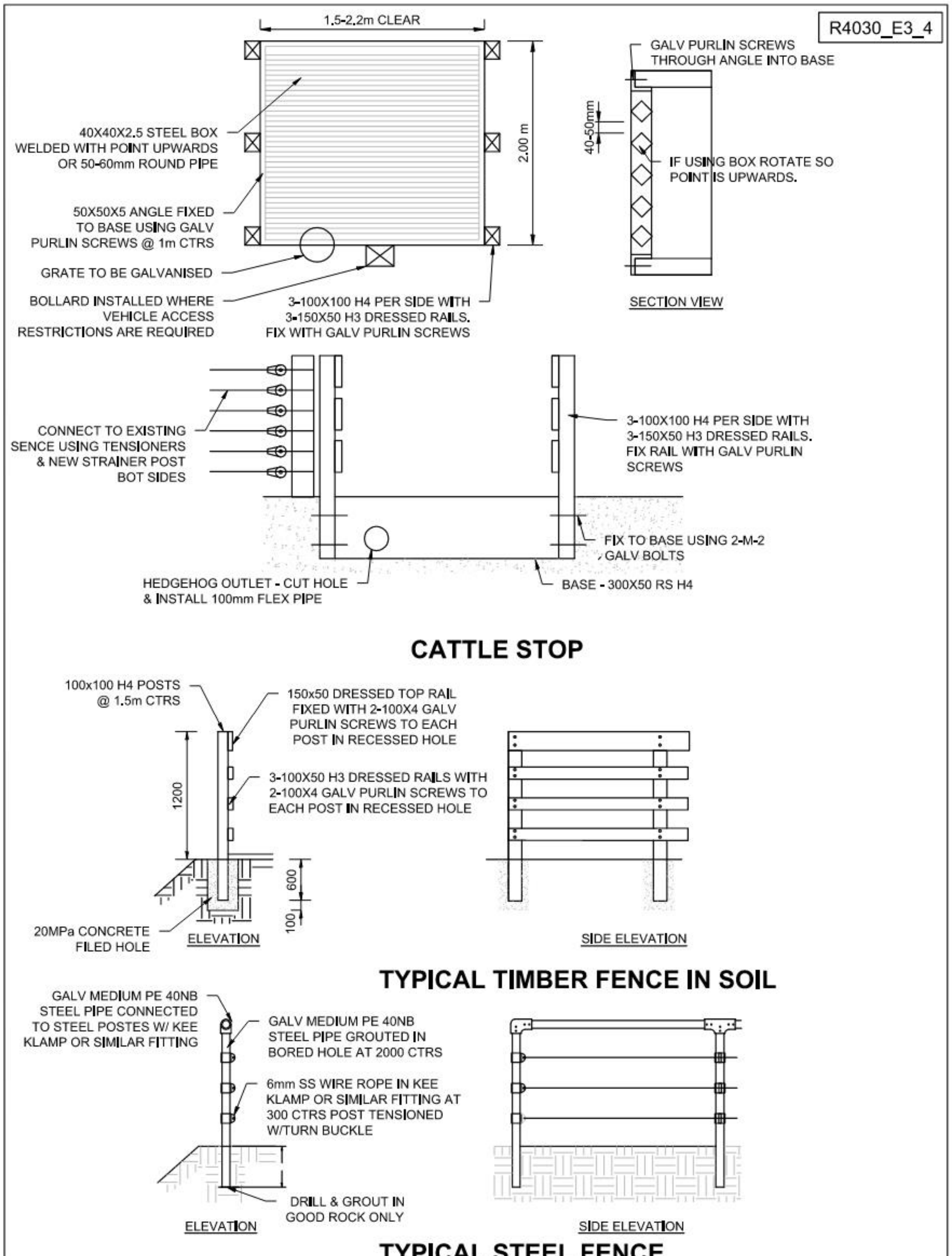

1:150 @ A4
0 1 2 3 4 5 6 7 m
R4030_E3_3
MIN 6% CROSS FALL - DESIGN WITH CROSS FALL TO ENSURE NO-SIDE SLIP BY RIDERS. HIGHER SPEED = INC. XFALL
EXTENT OF FLATTER GRADE THROUGH CORNER - MAX 2° (1:28) (DASHED)
DESIGN TO REDUCE SPEED GRADUALLY THROUGH FLATTENING OR A SAG PRIOR TO THE CORNER FOR DH TRAFFIC
DOWN HILL
R
MINIMUM CORNER RADIUS R
GRADE 1 = 2.5m
GRADE 2 = 2.0m
GRADE 3 = 1.2m
MIN 3% CROSS FALL - DESIGN WITH CROSS FALL TO ENSURE NO-SIDE SLIP BY RIDERS
MIN 3% XFALL
CONTINUE HAIRPIN CROSS FALL BEYOND THE END OF THE CORNER APEX
TYPICAL HAIRPIN DETAIL
DOWN HILL
0-4° GRADE
BREAK SECTIONS OF HILL WITH FLAT 10-20m RECOVERY AREAS;
0-2° SPACED EVERY 100m OF CLIMB
2-4° SPACED EVERY 50-70m OF CLIMB
HAIRPIN CORNER GRADE MAX 2°
SAG OR FLAT PRECEDING THE HAIRPIN TO REDUCE SPEED & MINIMISE SKIDDING MIN 6m LENGTH
0-4° GRADE
START HAIRPIN
END HAIRPIN
TYPICAL HAIRPIN LONG SECTION DETAIL
QUEENSTOWN LAKES DISTRICT COUNCIL
TITLE
QLDC CYCLE TRAIL
TYPICAL DESIGN DETAILS
SCALE
1:150 @ A4
PREPARED FOR
Queenstown Lakes District Council
SURVEYED
-
DATE
2015
DATUM & LEVEL
NA
REVISION
A - ORIGINAL ISSUE
DRAWN
-
DATE
8/2015
DRAWING REFERENCE
R4030_E3_3
Revision
A



QUEENSTOWN LAKES DISTRICT COUNCIL	TITLE: QLDC CYCLE TRAIL TYPICAL DESIGN DETAILS			SCALE: N.T.S
	PREPARED FOR: Queenstown Lakes District Council	SURVEYED: -	DATE: 2015	DATUM & LEVEL: NA
	REVISION: A - ORIGINAL ISSUE	DRAWN: -	DATE: 8/2015	DRAWING REFERENCE: R4030_E3_4 — Revision: A

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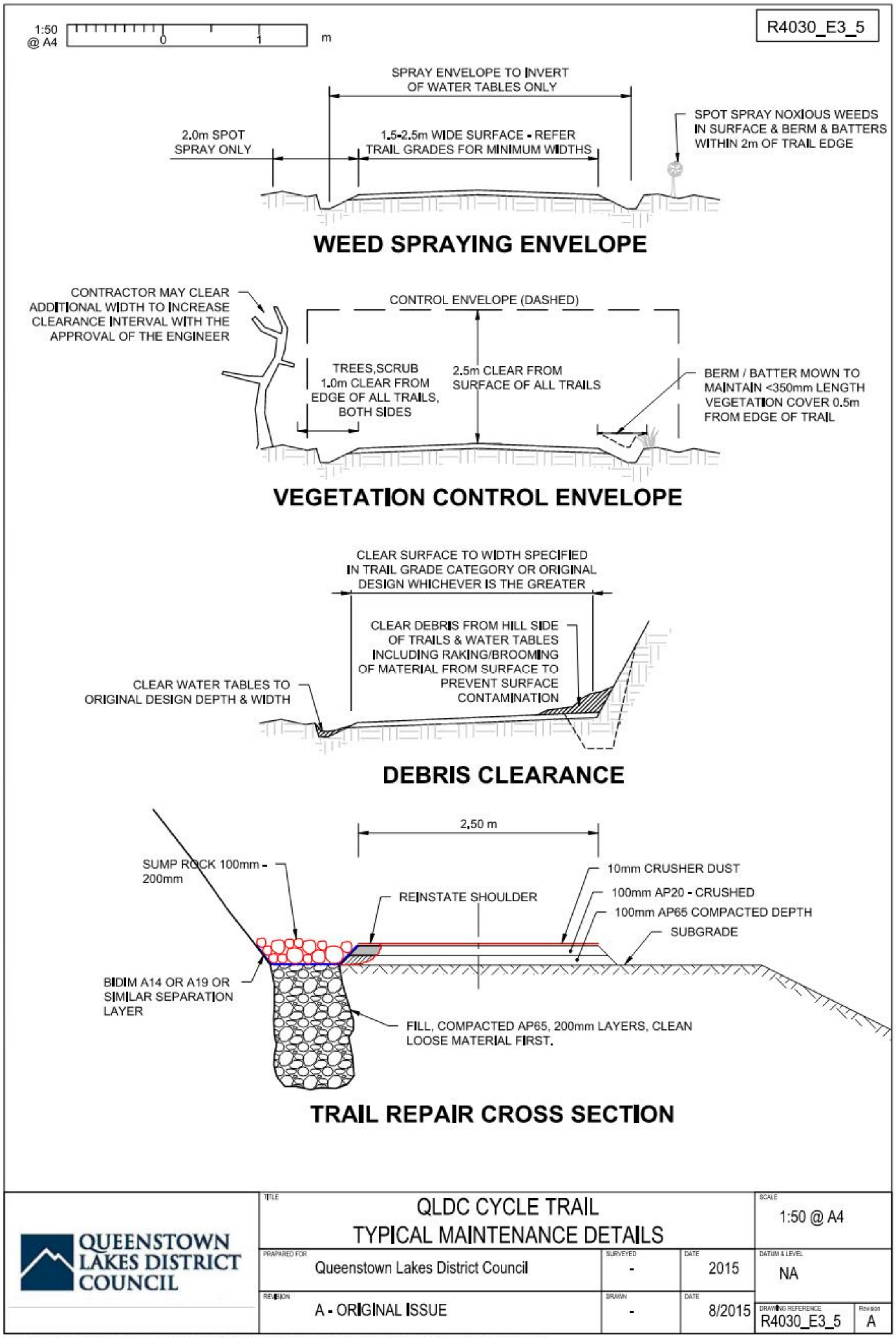
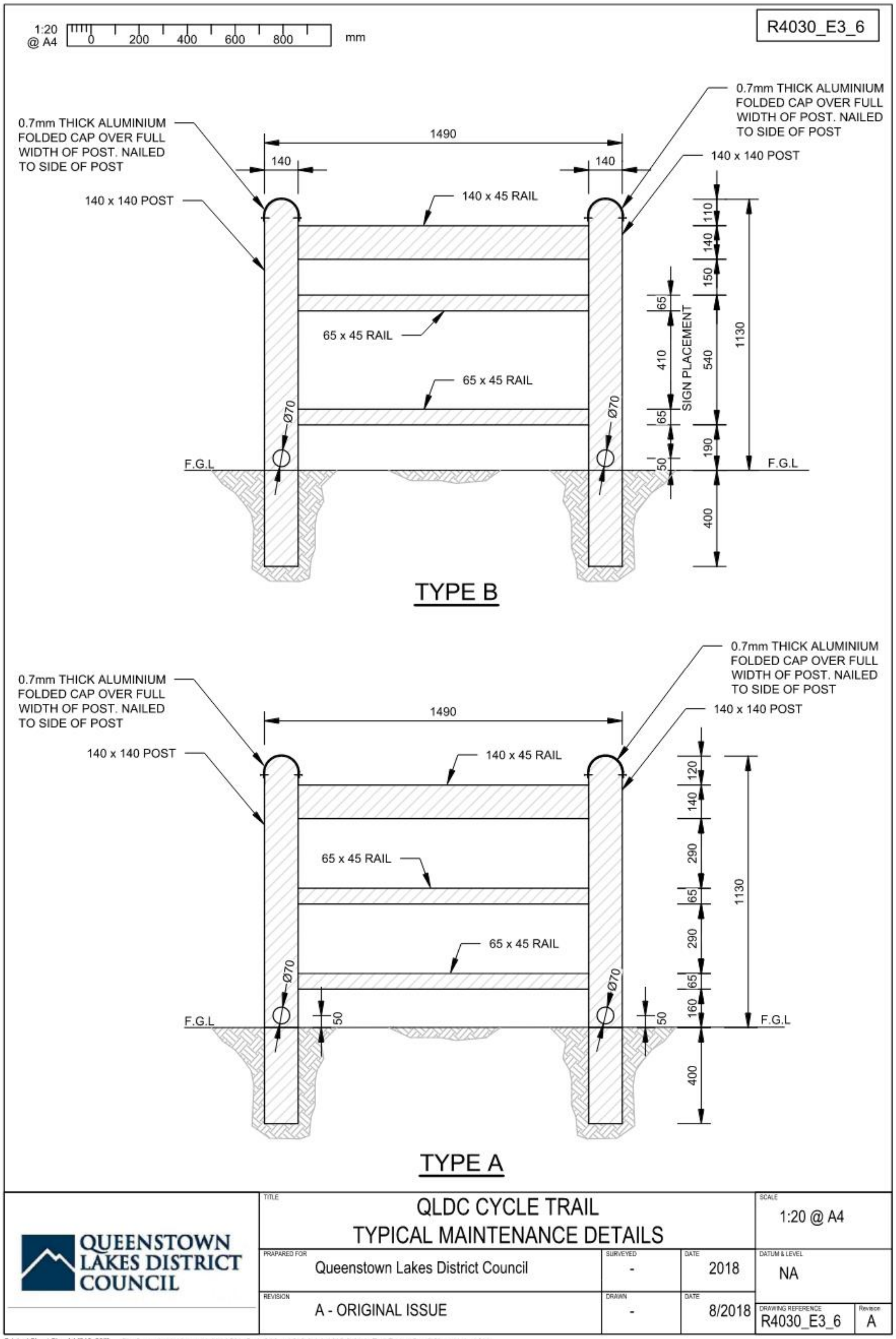

1:50 @ A4
0
1
m
R4030_E3_5
SPRAY ENVELOPE TO INVERT OF WATER TABLES ONLY
2.0m SPOT SPRAY ONLY
1.5-2.5m WIDE SURFACE - REFER TRAIL GRADES FOR MINIMUM WIDTHS
SPOT SPRAY NOXIOUS WEEDS IN SURFACE & BERM & BATTERS WITHIN 2m OF TRAIL EDGE
WEED SPRAYING ENVELOPE
CONTRACTOR MAY CLEAR ADDITIONAL WIDTH TO INCREASE CLEARANCE INTERVAL WITH THE APPROVAL OF THE ENGINEER
CONTROL ENVELOPE (DASHED)
TREES,SCRUB 1.0m CLEAR FROM EDGE OF ALL TRAILS, BOTH SIDES
2.5m CLEAR FROM SURFACE OF ALL TRAILS
BERM / BATTER MOWN TO MAINTAIN <350mm LENGTH VEGETATION COVER 0.5m FROM EDGE OF TRAIL
VEGETATION CONTROL ENVELOPE
CLEAR SURFACE TO WIDTH SPECIFIED IN TRAIL GRADE CATEGORY OR ORIGINAL DESIGN WHICHEVER IS THE GREATER
CLEAR DEBRIS FROM HILL SIDE OF TRAILS & WATER TABLES INCLUDING RAKING/BROOMING OF MATERIAL FROM SURFACE TO PREVENT SURFACE CONTAMINATION
CLEAR WATER TABLES TO ORIGINAL DESIGN DEPTH & WIDTH
DEBRIS CLEARANCE
2.50 m
SUMP ROCK 100mm - 200mm
REINSTATE SHOULDER
10mm CRUSHER DUST
100mm AP20 - CRUSHED
100mm AP65 COMPACTED DEPTH
SUBGRADE
BIDIM A14 OR A19 OR SIMILAR SEPARATION LAYER
FILL, COMPACTED AP65, 200mm LAYERS, CLEAN LOOSE MATERIAL FIRST.
TRAIL REPAIR CROSS SECTION
QUEENSTOWN LAKES DISTRICT COUNCIL
TITLE
QLDC CYCLE TRAIL TYPICAL MAINTENANCE DETAILS
SCALE
1:50 @ A4
PREPARED FOR
Queenstown Lakes District Council
SURVEYED
-
DATE
2015
DATUM & LEVEL
NA
REVISION
A - ORIGINAL ISSUE
DRAWN
-
DATE
8/2015
DRAWING REFERENCE
R4030_E3_5
Revision
A
Original Sheet Size A4 [210x297]   Plot Date 2018-11-28 at 10:53:55 AM   Path \\icsv01\GroupLib\Opus\QLDC Jobs\QLDC Cycle Trail Typical Detail Sheet01.dwg C05


1:20 @ A4
0 200 400 600 800 mm
R4030_E3_6
0.7mm THICK ALUMINIUM FOLDED CAP OVER FULL WIDTH OF POST. NAILED TO SIDE OF POST
140 x 140 POST
1490
140
140 x 45 RAIL
65 x 45 RAIL
Ø70
F.G.L
SIGN PLACEMENT
110
140
150
65
410
540
1130
190
50
400
TYPE B
120
290
160
TYPE A
TITLE
QLDC CYCLE TRAIL
TYPICAL MAINTENANCE DETAILS
SCALE
1:20 @ A4
PREPARED FOR
Queenstown Lakes District Council
SURVEYED
-
DATE
2018
DATUM & LEVEL
NA
REVISION
A - ORIGINAL ISSUE
DRAWN
-
DATE
8/2018
DRAWING REFERENCE
R4030_E3_6
Revision
A
Original Sheet Size A4 [210x297] Plot Date 2018-12-17 at 4:44:04 PM Path G:\Opus\QLDC Jobs\QLDC Cycle Trail Typical Detail\Sheet01.dwg C06

QUEENSTOWN LAKES DISTRICT COUNCIL

CONTENTS

1 APPLICATION

This specification applies to all water facility assets that will be vested in or are currently managed by Queenstown Lakes District Council.

2 PURPOSE

The purpose of this specification is to establish a framework of principles to be applied to the representation of three water facility assets in Queenstown-Lakes District's Asset Management System (AMS) Technology One and operational documents.

A facility is defined as a plant or process that is distinctly separated from the distributed network assets. Facilities include, but are not limited to:

> Wastewater treatment plants
> Wastewater pump stations
> Water Supply treatment plants
> Water supply pump stations

There are currently no stormwater pump stations or treatment facilities within the QLDC network, it is intended that these will be included as and when required. Consideration of including other stormwater assets is underway and may be included in future versions.

It is intended that this specification will ensure that the assets can be accurately valued and effectively managed.

It should be noted that network (distributed) assets are entered into Technology One via GIS as per the QLDC As-Built Standard and are not subject to this specification.

3 RELATED DOCUMENTS

This specification should be read in conjunction with the following documents which are on the QLDC Wedsite under Land Developments and Subdivisions:

> QLDC As-built Standard
> QLDC Land Development and Subdivision Code of Practice

4 ASSET REPRESENTATION IN THE ASSET MANAGEMENT SYSEM

To facilitate the purpose of this document, the following will be required/generated for each asset within a facility:

> **UnitID** – Unique ID generated by the Asset Management System (AMS) when the individual asset is created in the AMS environment.
> **Position ID** – a descriptive ID of the function of the asset within the facility.
> **Asset Register Data** – a list of the required asset specification data prior to its import into the AMS. See section 5.

- **Piping and Instrumentation Diagram (P&ID)** - A diagram which shows the interconnection of process equipment and the instrumentation used to control the process*1*

4.1.1 UnitID

For facility asset types the UnitID is generated by using a combination of the Asset Equipment Codes (see Appendix B) and the unique numeric identifier (compkey) generated in Technology One, e.g.:

VLV		150203
Asset Equipment Type		Unique ID (Compkey)

4.1.2 Position ID

A facility is likely to contain one or more individual process areas depending on the design and sophistication of that plant.

The process ID is it to be generated by the designer or owner (where the asset is to be vested) by concatenating the following four elements separated by hyphens:

- Facility ID
- Process ID
- Asset Equipment Code
- Equipment Number

4.1.2.1 Facility ID

A unique Facility ID is generated by QLDC and is a four character alpha code. This is created from two parts, the first being a two character code describing the facility type, followed by a two character code to identify the specific facility. A longer descriptive name with a 25 charactor limit can follow the 4 character code. The current allocated names are listed in Appendix A, e.g:

ST	SP		Shotover Ponds
Facility Type (Sewer Treatment)	Facility ID (Shotover Ponds)		Facility Descriptive Name

4.1.2.2 Process ID

The appropriate two digit process area code is to be selected from one of the types listed in appendix B. New codes are required to be approved by QLDC prior to their use. E.g. 01 (Intake and Screening)

4.1.2.3 Asset Equipment Code

The appropriate three character alpha asset equipment code is to be selected from one of the types listed in appendix C. New codes are required to be approved by QLDC prior to their use. E.g. SCR (Screen)

4.1.2.4 Equipment Number

A three character sequential numeric ID to uniquely identify multiple occurrences of the same asset type within the facility/process, e.g. 001.

This will result in a Position IDs as per the following examples:

Shotover ponds sewer treatment plant inlet screen one:

STSP	-	01	-	SCR	-	001
Facility ID		Process ID		Equipment Code		Equipment Number

1 As defined by the Institute of Instrumentation and Control

Shotover ponds sewer treatment plant inlet screen two:

STSP	-	01	-	SCR	-	002
Facility ID		Process ID		Equipment Code		Equipment Number

Shotoer ponds sewer treatment plant UV reactor one:

STSP	-	07	-	UVS	-	001
Facility ID		Process ID		Equipment Code		Equipment Number

4.1.3 Asset Register Data

As per the QLDC Land Development & Subdivision Code of Practice an asset register is required to be provided to the adopted format / level of detail. The asset register shall include (but not be limited to) all process units, civil structures and buildings, earth structures, pipes and appurtenances, process tankage, mechanical and electrical equipment.

Individual assets shall be componentised by the expected design life and the physical location of the assets.

Asset costs are to be the actual cost applicable to each item plus any overhead allocation or installation costs that are included in the Contractor's Contract costs.

5 RESPONSIBILITIES

5.1 DESIGNER

The designer or owner (where the asset is to be vested) is responsible for the creation of the Position ID, along with the reference of the Position ID within all appropriate documents including, but not limited to, design drawings, P&IDs, functional documents and asset schedules.

5.2 CONSTRUCTION CONTRACTOR

The construction contractor or owner (where the asset is to be vested) is responsible for the tagging of assets with the Position ID. All items that are assigned a Position ID shall be physically tagged on site using a system that does not suffer degradation due to environmental conditions such as sunlight or gaseous emissions. The tags for each asset shall be connected by use of a plastic cable tie, the tag itself shall be made from stainless steel and the tag number punched into it.

5.3 QLDC

To enable the generation of position IDs, QLDC will provide a facility ID following a request to the Asset Management Team (threewatersdata@qldc.govt.nz.

6 IMPROVEMENT PLAN

> Improve definition and delineation of facility and network assets.

> Incorporate a Piping and Instrumentation Diagram (P&ID) standard.

> Improve the definitions around the level of componentisation.

> Consider inclusion of include Stormwater detention basins and/or soak pits.

7 REVIEW

This specification will be reviewed annually.

TABLE A – FACILITY NAMES The following are currently allocated facility names as at June 2024.

Water - Pump Stations

WPAR-ANDERSON RD BST	WPHI-HIGHVIEW TCE
WPAT-ARROWTOWN	WPHT-HEATON PARK
WPAT-ARROWTOWN 1	WPKH-KELVIN HEIGHTS
WPAT-ARROWTOWN 2	WPKG-KINGSTON
WPB3-ARROWTOWN BOOST	WPL1-LAKE HAYES EST
WPBB-BENBRAE	WPLA-HAYES EST BST
WPBF-BORE ARTHURS PT	WPLC-LOMOND CRES
WPBG-BORE GLENORCHY	WPLG-LUGGATE
WPBL-BALMORAL BOOST	WPLH-LAKE HAYES
WPBP-BEACON POINT	WPLW-QTOWN HILL #1
WPBV-BROADVIEW RISE	WPMA-MTASPIRING RD
WPCD-COREBRIDGE BORE	WPMD-MARINA DRIVE
WPC1-CARDRONA RIVER	WPML-MIDDLETON
WPC2-UPPER TERRACE	WPMR-MIDDLETON ROAD
WPCR-CARDRONA	WPPR-PENINSULA ROAD
WPF1-FERNHILL #1	WPPW-PANNERS WAY
WPF2-FERNHILL #2	WPRB-ROYS BAY
WPFD-FRANKTON RD	WPSC-SHOTOVER BORES
WPFH-FAR HORIZON	WPTM-TWO MILE
WPFR-FRANKTON RD	WPWA-WANAKA AIRPORT
WPGB-GLENDHU BAY	WPWB-THREEPWOOD BST
WPGD-GLENDA DRIVE	WPWW-WESTERN WANAKA
WPGR-GOLDRUSH WAY	
WPHA-HAWEA	
WPHH-HIDDEN HILLS	

Water - Treatment

WTA2- ARROWTOWN
WTAT-ARROWTOWN
WTAP-ARTHURS POINT
WTBP-BEACON POINT
WTCV-CARDRONA VALLEY
WTGB-GLENDHU BAY
WTHA-HAWEA
WTHB - HAWEA
WTHT-HAWEA ALT
WTKH-KELVIN HEIGHTS
WTKG-KINGSTON
WTLE-LAKE HAYES EST
WTLG-LUGGATE
WTLH-LAKE HAYES
WTRB-ROYS BAY
WTTM-TWO MILE
WTWI-WESTERN INTAKE

Water - Intakes

WIC1-PRINGLES CREEK
W1C2-CARDRONA RIVER
WIKG-KINGSTON

Water - Raw Water - Reservoirs

RRCV-CARDRONA VALLEY

Water - Reservoirs

WRAP-ARTHURS POINT	WRKH-KELVIN HEIGHTS
WRAR-ARROWTOWN	WRKG-KINGSTON
WRBB-BENBRAE	WRLC-LOMOND CRESCENT
WRBP-BEACON POINT	WRLE-LAKE HAYES EST
WRCR-CARDRONA	WRLH-LAKE HAYES
WRCV-CARDRONA VALLEY	WRLR-LUGGATE
WRF1-FERNHILL #1	WRMI-MOUNT IRON
WRF2-FERNHILL A	WRMR-MIDDLETON ROAD
WRF2-FERNHILL B	WRMR-MINERS RISE
WRF3-FERNHILL #3	WRNL-NORTHLAKE
WRFH-FAR HORIZON RES	WRPR-PENINSULA ROAD
WRGB-GLENDHU BAY	WRPR-PLANTATION
WRGB-WAITIRI	WRQ1-QTOWN HILL #1
WRGF-GOLDFIELDS	WRQ2-QTOWN HILL #2
WRGR-GLENORCHY	WRQR-QUAIL RISE
WRHR-HAWEA	WRRV-REMARKABLESVIEW
WRJP-JARDINE A	WRSC-SHOTOVER
WRJP-JARDINE B	WR-SE-SICILIAN EST
WRJP-JARDINE C	WRWR-WESTERN
WRJP-JARDINE D	

Water - Irrgation - Reservoirs

IRCV-CARDRONA VALLEY

Water - Irrigation - Treatement

ITCV-CARDRONA VALLEY

TABLE A Continued – FACILITY NAMES The following are currently allocated facility names as at June 2024.

Wastewater - Pump Stations

SPA1-ALISON AVE #2	SPFB-FRANKTON BEACH	SPLP-LANCASTER PLACE	SPT4-ALICEBURNDR #1
SPA2-KINGSTON STREET	SPFF-FASTFLO BLOCK	SPMD-MEADOWSTONE	SPT5-ALICEBURNDR #2
SPA3-ALISON AVE #1	SPFS-FREDERICK ST	SPMP-MARINE PARADE	SPTB-TUCKERS BEACH
SPAP-OXNBRDGE TUN RD	SPGO-GORGE ROAD	SPMR-MCDONNELL RD	SPW1-THREEPWOOD #1
SPAR-AUBREY ROAD	SPGR-GORDON ROAD	SPN2-NORFOLK ST #2	SPW2-THREEPWOOD #2
SPAT-ATLEY ROAD	SPH1-HAWEA ESPLANADE	SPNI-NICHOL STREET	SPW7-THREEPWOOD #7
SPBF-BRIDESDALE	SPH2-SCOTTS BEACH	SPNS-NORFOLK STREET	SPWA-WAN-LUGG HWY #1
SPBM-ARTN-LK HAYS RD	SPHD-HIKUWAI DRIVE	SPOR-OUTLET ROAD	SPWL-WAN-LUGG HWY #2
SPBV-BAYVIEW RD	SPHD-HANLEY DOWNS	SPP1-ALBERTTOWN #1	SPWL-WILLOW PLACE
SPCD-CEDAR DRIVE	SPJA-JONES AVE	SPP2-ALBERTTOWN #2	SPWP-WAIMANA PLACE
SPCD-CARDRONA	SPJV-JACKS POINT VILLAGE	SPP3-RIVERBANK RD	
SPCP-CARDRONA PRINGLE CREEK	SPK1-LAKESIDE RD #1	SPPL-PARK ST LIFT	
SPCR-CEMETERY RD	SPK2-LAKESIDE RD #2	SPPP-STEVENSON RD	
SPCV-CARDRONA VILLAGE	SPKG-KINGSTON	SPPR-129 PENINSULA ROAD	
SPD1-DUNGARVON #1	SPKP-KAWARAU PLACE	SPPS-PARK STREET	
SPD2-DUNGARVON #2	SPL1-LAKE HAYES #1	SPRP-REMARKS PARK #1	
SPDR-DOMAIN ROAD	SPL2-LAKE HAYES #2	SPRS-1A ROBERTSON ST	
SPEA-ESSEX AVENUE	SPL3-LAKE HAYES #3	SPRV-RETIRE VILLAGE	
SPEC-EVENTS CENTRE	SPL4-LAKE HAYES #4	SPSB-SUNSHINE BAY	
SPEP-EELY POINT	SPL5-LAKE HAYES #5	SPSC-STALKER RD	
SPEW-EDGEWATER	SPL6-LAKE HAYES #6	SPT1-CHURCH RD	
SPF2-FRANKTON BEACH	SPLB-LONGBURN AVE	SPT2-HARRIS PLACE	
SPFA-FRANKTON BEACH A	SPLHTB-LAKE HAYES TOILET BLOCK	SPT3-PISA ROAD	

Wastewater - Treatment Plants

STAP-ALBERT TOWN PND
STBB-BENBRAE INNFLO
STBD-BENBRAE DFIELD
STCP-CARDRONA PUB
STCR-PHEONIX 47
STCV-CARDRONA VALLEY
STHP-HAWEA PONDS
STID-INVINCIBLE DR
STKG-KINGSTON
STLP-LANCASTER PLACE
STPP-PROJECT PURE
STSD-SHOTOVER DELTA
STSP-SHOTOVER PONDS
SPSF-SHOTOVER DISPOSAL FIELD
STWP-WANAKA PONDS

TABLE B – PROCESS ID'S

The following are acceptable, as at June 2024, any addition to this list is required to be agreed with the QLDC Strategic Asset Management Team prior to their use.

WW Treatment

01	General and Ancillary
02	Inlet and Screening
03	Biological Treatment
04	Clarifier
05	RAS / Sludge Return Line
06	Sludge Handling / Drying
07	Disinfection

WW Pump Stations

21	General and Ancillary
22	Inlet and Operational Storage
23	Emergency Storage
24	Electrical and Pumps
25	Outlet

WS Intake/Treatment

41	General and Ancillary
42	Bore / Inlet (Including Pumps)
43	Disinfection
44	Contact Tanks

WS Pump Stations (Network)

51	General and Ancillary
52	Bore / Inlet
53	Electrical and Pumps
54	Outlet

WS Storage

61	Inlet
62	Storage
63	Outlet

TABLE C – ASSET EQUIPMENT CODES

The following are acceptable, as at June 2024, any addition to this list is required to be agreed with the QLDC Asset Planning Team prior to their use.

Code	Description	Code	Description	Code	Description	Code	Description
ABL	Air Blower	CAZ	Chlorine Analyser	DVT	Dose/Volume Timer	GBX	Gearbox
ACD	Air Conditioner	CBK	Chain Block	EAV	Electric Actuated Valve	GRS	Grilles
ACT	Actuator	CBL	Cabling	EDD	Electrical Dosing Drive	GRT	Grit Removal
AEL	Analyser Element	CBM	Containment Boom	ELE	Electrical Controls	HAM	Hammer Resister
AET	Aerator	CDB	Chlorine Doser	ELS	Electrical Services	HAR	Harmonic Filter
AIC	Analyser Indicator Controller	CHB	Chamber	EMS	Emergency Shower	HDV	Hand Valve
AIV	Air Bleed Valve	CHL	Chlorine, Chlorinator	FAN	Fan	HER	Heat Exchanger
ALD	Acoustic Door	CLD	Chlorine Leak Detector	FOP	Fibre Optic Panel	HMI	Human Machine Interface
ANT	Antenna/ Arial	CLS	Chlorine Sensor	FIC	Flow Indicator Controller	HND	Handstanding
AOM	Distribution Board	CML	Chamber Lid	FILS	Filter - Storm	HOS	Hose Reel/Hose
ASB	Assembly Kit	CMP	Computer	FIN	Flow Indicating Transmitter	HPR	Hopper
ASM	Alarm System	CDT	Conduit	FIR	Flow Indicating Readout	HST	Hoist
AUT	Autosampler	CNP	Control Panel	FIT	Pipes and Fittings	HTR	Heater
AVR	Automatoc Voltage Regulator	CNT	Centrifuge	FLC	Flowmeter Chamber	HUM	Humidifier
BAS	Basin- Detention, Retention, Sediment	CNV	Conveyor	FLJ	Flexible Joint	HYD	Fire Hydrant
BAC	Battery Charger	COM	Compressor	FLM	Flowmeter	IRR	Irrigation System
BAF	Baffle	CTL	Chlorine Trolley Load	FLS	Flushing Connection	INJ	Injector
BAT	Backup Battery	CWP	Chlorine Weigh Pads	FLT	Cartridge Filter	INS	Instrument
BCN	Beacon	CPN	Cathodic Protection	FNK	Fuel Tank	ITH	IT Hardware
BEL	Bellow (Expansion)	CUL	Culvert	FRE	Fire System	JBX	Junction Box
BIN	Bin/Skip	DAM	Dam	FRT	Filter	KST	Timer/Time Initiated Space
BKP	Backflow Preventor	DCT	Decanter	FSW	Flow Switch	LAB	Laboratory Equipment
BRE	Bore	DIF	Diffuser	FUR	Office Furniture & Equipment	LAD	Ladders
BRG	Bridge	DLG	Data Logger	GCE	Gantry Crane	LAH	High Level Alarm
BLD	Building	DNT	Decant Tank	GCN	Generator Connection	LAL	Low Level Alarm
CAB	Cabinetry	DOM	DO Meter	GEN	Generator	LCU	Level Control
CAM	Camlock Coupling	DRN	Drain - Natural, Manmade.	GNC	Generator Controller	LEI	Level Indicator
CASS	Membrane Cassette	DUC	Ducting	GRC	Grit Classifier		

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TABLE C Continued – ASSET EQUIPMENT CODES

Code	Description	Code	Description	Code	Description	Code	Description
LFB	Lifting Beam	PLC	Programme Logic Controller	SIG	Sign	TOO	Tool
LFS	Lime Hooper & Feeder	PLY	Polymer Tank	SLT	Sludge Storage Tank	TRT	Treatment Device - Wetland, Rain Garden, Tree Pit
LMT	Limit Switch	PMC	Pump Control	SKI	Skimmer (Scum Collector)	TRA	Trap - Pollutant, Silt Trap
LOV	Discharge Louvre	PMP	Pump	SKD	Soakage Device	TRL	Trailer
LPU	Lightening Arrester	PPR	Pump Rails	SOFN	Water Softener	TRN	Transformer
LSH	High Level Switch	POL	Power Pole or Other	SOL	Solenoid Valve	TRR	Telemetry Radio
LSL	Low Level Switch	PON	Pond	SPI	Speed Indicator	TTR	Temperature Transmittor
LSN	Level Sensor	PRG	Pressure Gauge	SPN	Solar Panel	TUM	Turbidity Meter
LTM	Level Transmitter	PRS	Pressure Switch	SPR	Sprinklers	TUB	Turbine
LTR	Level Transducer	PRV	Pressure Reducing/Regulating V	SSR	Scraper	TUR	Telemetry Unit
MAC	Macerator	PSN	Pressure Sensor	STA	Soft Starter	UPS	UPS
MET	Meter	PTR	Prsesure Transmittor	STI	Strainer	UVS	UV System
MHL	Manhole/ Lampholes/ Cleaning E	PSY	Power Supply	SUR	Surge Controller	VDD	Variable Dosing Drive
MIX	Mixer	PTH	Footpath	SUP	Support Structure. Includes Foundation, Anchor Block, Roller, Pad Plinth, Pontoon.	VIB	Vibration Switch
MOC	Moisture Controller	PWS	Pressure Washer	SWY	Spillway	VNT	Ventilation
MOI	Moisture Monitoring Probe	PZM	Piezometer	SWB	Switchboard	VSD	Variable Speed Drive
MPR	Motor Protection Relay	RAI	Rain Gauge	SWF	Screw Feeder	WBR	Water Blaster
MTC	Motor Control	REV	Reservoir	SWW	Screw	WDU	Washdown Unit
MTR	Motor	ROD	Road	SWR	Software	WER	Weir/ Slide Gate
NRV	Non Return Valve	ROT	Rotameter	TAP	Sample tap or similar	WEL	Weigh Element
OFT	Odour Filter	RTR	Router	TAR	Tarriff Metering	WST	Weather Station
PBD	Portable Building (Container/Room)	SAL	Satellite Dish	TEE	TEE	WTR	Weigh Transmitter
PBT	Pressure Break Tank	SAM	Sampler	TEL	Telemetry	WWL	Wet Well Lid
PBU	Polmer Batching Unit	SAT	Surge Anticipating Valve	TEM	Temperature Switch	ZIC	Position Indicating Controller
PCM	Pump Chamber	SBT	SBR Tanks	TIC	Temperature Indicator Controll	ZSO	Position Switch Open
PHA	pH Analyser	SCL	Scales	TNL	Tunnel		
PIC	Pressure Indicating Controller	SCR	Mechanical Screen	TMA	Temperature Alarm		
PIP	Pipework	SIL	Acoustic Silencer	TME	Temperature Element		

CONTENTS

1 PURPOSE

The purpose of this document is to summarise and highlight the requirements for various pavement reinstatements commonly undertaken in Queenstown as a result of excavations for utility services and infrastructure in pavements.

This guide should be read in conjunction with;

> National Code of Practice for Utility Operators' Access to Transport Corridors – 15th July 2020

> QLDC Foam Bitumen Stabilised Pavement – Trench Reinstatement December 2010

> Definitions shall be as per the National Code of Practice for Utility Operators' Access to Transport Corridors – 15th July 2020

2 SCOPE

The scope of this guide is limited to the reinstatement of areas disturbed through the installation or repair of utility services and infrastructure. The guide specifically does not apply to new pavement construction.

3 TRENCH EXCAVATIONS

3.1 PRIOR TO TRENCH EXCAVATION

Prior to the the excavation of the trench:

I. any concrete, asphalt or chip seal surfaces must be cut with a power saw in a clean, straight line through the full thickness of the surface layer;

II. the separation distance (see image below) from the original saw cut must be a minimum of 150mm, except for concrete Carriageways where a minimum of 300mm applies, but more may be required to maintain the integrity of the final trench reinstatement;

III. if necessary, a second saw-cut must be made to ensure that all edges are straight, smooth, parallel to the line of the trench and that minimum trench trimming allowance is achieved; and

IV. all joints must be cut to a depth sufficient to avoid disturbance of adjoining pavement. The depth of cutting must be not less than 30mm, or for concrete carriageways, footpaths, and vehicle crossings the depth must be not less than 80% through the concrete pavement layer. When planning the location of the trenching, ensure that all the requirements of Section 3.5-3.7 (Surface Layer Reinstatement) can be met.

If any break over occurs:

- a further cut must be made to maintain trimming allowances and a clean edge for reinstatement;
- any change in direction of the saw cut must not exceed an angle of 45 degrees to the trenchline;
- the total length of over-break must not exceed 10% of the length of the trench; and
- the length of trim at any one section of over-break must not be less than 1m

Min 150mm **Min 150mm**

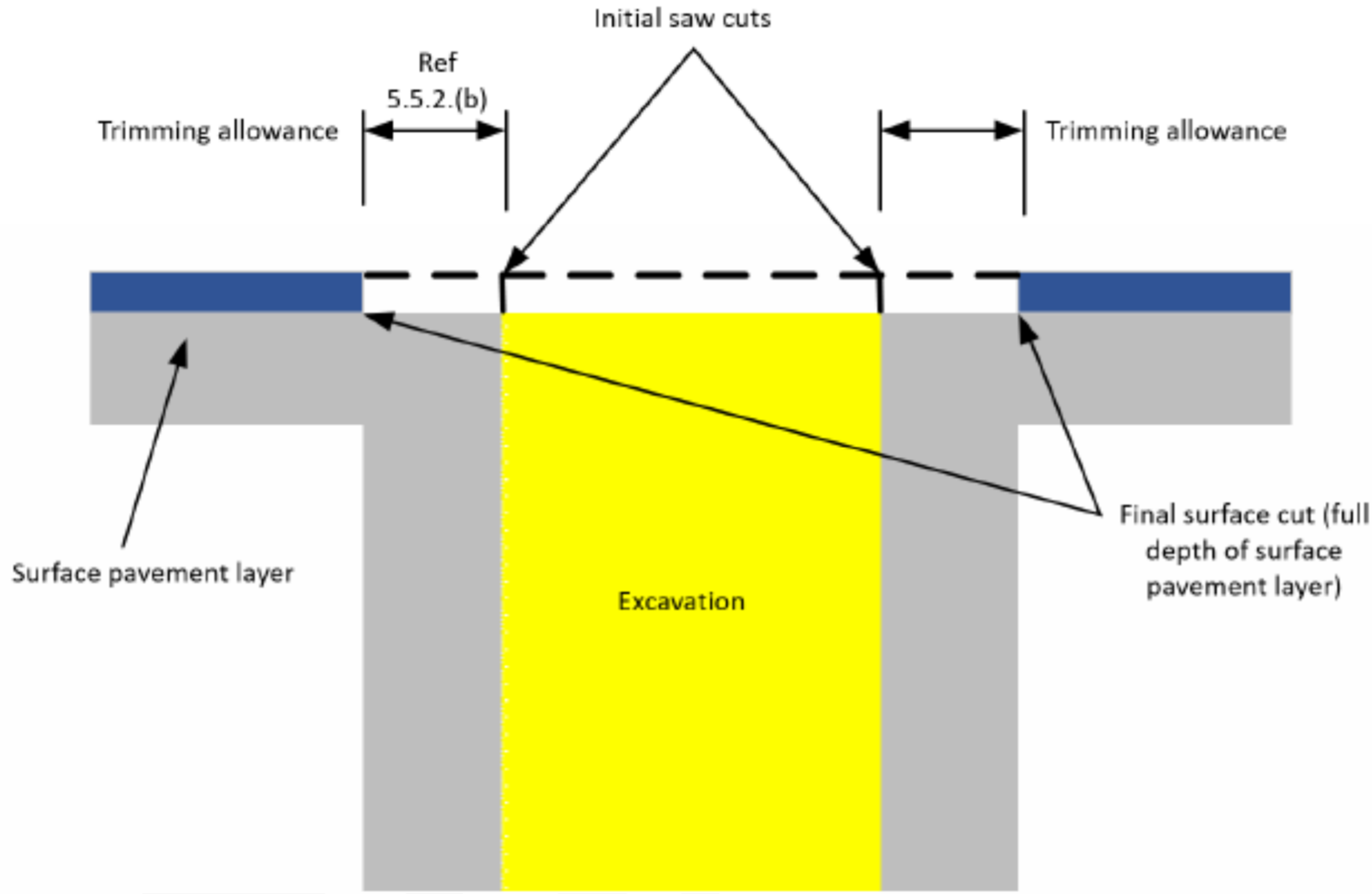


Figure 1 Trench Preparation (Section)

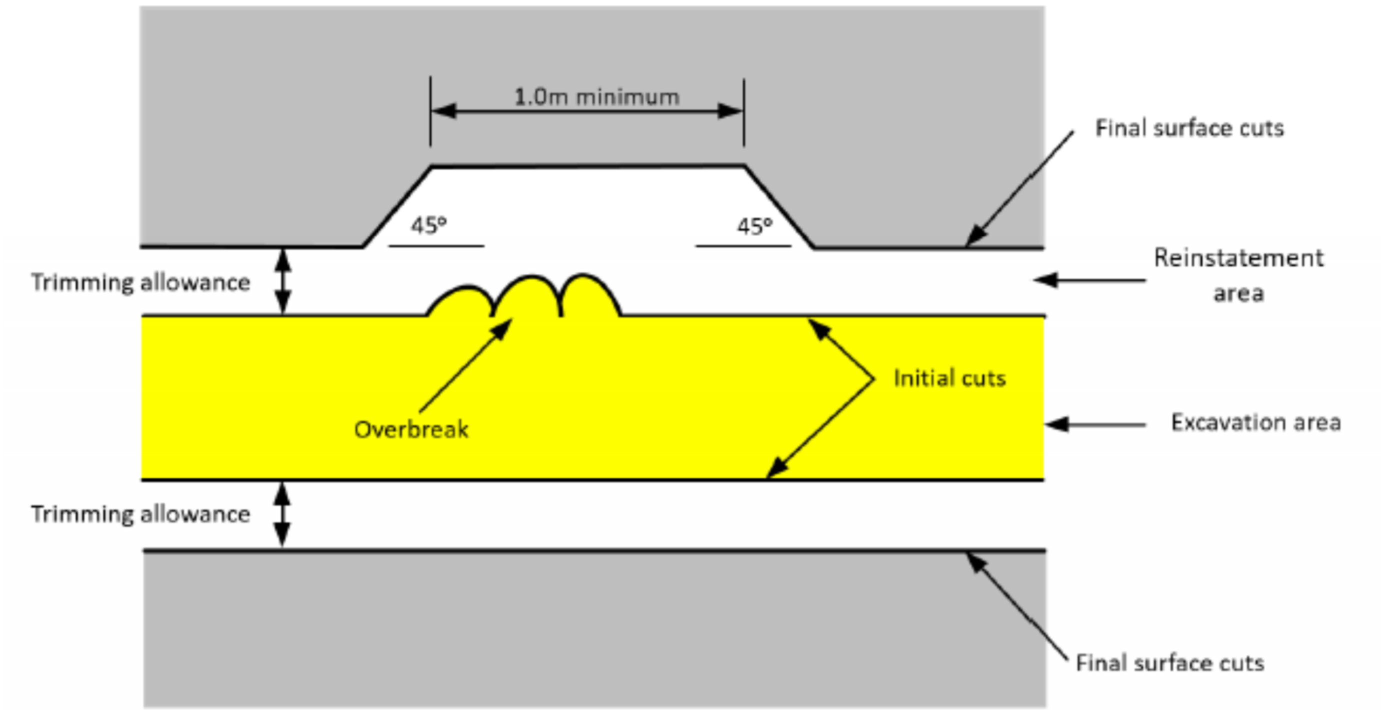


Figure 2 Overbreak Saw Cutting (Plan)

3.2 DURING EXCAVATION

During excavation works:

I. there must be no undercutting of areas adjacent to the excavation;

II. if slumping at the sides of the excavation causes depressed areas adjacent to the excavation, or if the edges of the pavement are lifted during excavation, additional trench cutting outside the original line of the excavation and outside the area of damage must be carried out;

III. excavation to profile/depth must be in accordance with the construction drawings;

IV. the length of open trench must be kept to a minimum and backfilled as soon as practicable;

V. excavated material that is not being used for backfill must be removed from the site;

VI. where groundwater is likely to accumulate as a result of Utility Works, excavations must be permanently drained; and

VII. the Utility Operator must provide temporary support/shoring to all trenches if required to provide lateral support to the excavation and to comply with health and safety Act and codes, including the WorkSafe Good Practice guidelines of July 2016. The Utility Operator must certify this Work in accordance with the requirements of the Building Act 2004. Alternative trench support can include battering, ground stabilisation and sheet piling.

Depending on the depth of reinstatement and width of trench it is best practice to either step the pavement layers into the existing pavement or cut the batter wall at 45 degrees to avoid cracking of the trench on vertical edges.

Effective drainage of the trench is particularly important in rural situations where trenches run through cut areas, fill embankments, or slip prone areas.

3.3 BACKFILL MATERIALS

All Backfill Materials

- must be in accordance with recognised standards and approved by the Corridor Manager;
- must be adequate to ensure that the backfilled area can at least match the pre-trench subsurface integrity;
- must be of sufficient quality and strength to support the imposed loading, including traffic and road construction loading;
- where concrete or other stabilised layers, including geotextile material, exist in the road pavement, the Utility Operator must reinstate the trench with similar material and
- must be neutral or beneficial in effect on any other Utility Structures with which there will be interaction.

The bedding/embedment material must be specified by the Utility Operator and placed as folows:

- in a loose state (sand must be dampened) and tamped to achieve compaction and surround of Utility; or
- in a fluidised state where specifically approved by the Corridor Manager; and
- to a depth of not more than 300 mm above the top of the Utility Structure unless a variance is agreed between the Utility Operator and Corridor Manager.

General Fill

- in Road Carriageway, shoulder and footpath, general fill must be well graded granular material free of deleterious material with maximum stone size 75mm;
- where the Utility Operator uses suitable excavated material in berms, the required compaction standards (Section 3.4 Backfill, Placement and Compaction) must be achieved as per below

3.4 BACKFILL PLACEMENT AND COMPACTION

Placement and compaction of all layers must:

- be in layers not exceeding 200 mm (compacted) thickness;
- allow for appropriate compaction methods around the Utility Structures;
- have mechanical compaction completed for each subsequent layer in turn; and
- ensure lapping of any geotextile material in accordance with the manufacturer's specification.

During backfilling and compaction:

- care must be taken to ensure no damage occurs to Utility Structures during compaction; and
- if over break or other disturbance of the pavement layers occurs, the surface of such areas must be re-cut, excavated and backfilled in compliance with this Section.

Where the strata exposed as side walls of a trench is considered relatively soft, such that there may be risk of settlement arising from ongoing post-construction penetration of the granular fill material into the trench sides, the Utility Operator should discuss backfill options with the Corridor Manager. These may include, for example, the application of a geo-textile liner in the trench, or the use of modified (lime or cement-treated) granular materials in the vicinity of the soft layer/s.

Compaction must:

I. be carried out using suitable plant and equipment to achieve the specifications below. Please refer to the QLDC LDSC2020 COP with examples of trench backfill and compaction dwgs B1-3 and B1-4 from Appendix B Std dwgs and

II. be confirmed by a Clegg hammer, or an agreed alternative, for sub-base and deeper fill; and

III. be recorded on a the contractors own standard form for each job and results of each test shall be made available to the QLDC Corridor Manager on request

The use of a nuclear densometer or similar compaction testing device is required for larger excavations in carriageways (anything exceeding 20m^2, one entire lane, or with a linear length exceeding 10m).

Table 1 Clegg Impact Value (CIV) Value for Reinstatement

Layer	Carriageway	Footpath
Basecourse	98% MDD (IV40*)	IV 25
Sub-base	IV 35	IV 25
Deeper Fill	IV 25	IV 15

* Only applicable to reinstatements undertaken as part of a QLDC maintenance contract

Where a contractor is undertaking regular reinstatements on hbehalf of QLDC i.e. water leak repairs, or trench reinstatements, NDM testing is required once per month to demonstrate that the methodology is working as intended and the Clegg testing carried out is demonstrating the desired density results.

Figure 3 Aggregate wetted down during compaction to achieve 98% of MDD – note no compaction depression lines

QUEENSTOWN LAKES DISTRICT COUNCIL

3.5 SURFACING REINSTATEMENT (GENERAL REQUIREMENTS)

The Utility Operator must, unless otherwise agreed with the Corridor Manager:

I. not open Trenched sites to Traffic until temporary or permanent resurfacing is in place;
II. not use temporary resurfacing unless permanent resurfacing is not practicable; and
III. have permanent resurfacing in place within seven ten working days of completion of backfill or temporary surfacing; and
IV. avoid creating longitudinal surfacing joints in wheel tracks where possible.

The Utility Operator must ensure the reinstated surfacing:

I. is installed in clean, long, straight lines parallel to the kerb or Footpath, or for transverse Trenches, perpendicular to the kerb and channel;
II. uses materials that match the surrounding surface in type, quality, texture, skid resistance and strength (note the use of asphalt for trench reinstatements in non-asphalt roadways is acceptable);
III. matches at least the pre-existing surface in smoothness or ride quality for vehicles (vertical movements);
IV. has a finished surface level and adjoining surface shaped to avoid ponding of surface water, such that the deviation of the surface from a 3m straight edge does not exceed 5mm;
V. does not create a lip greater than 5mm where it joins existing seal on Carriageways;
VI. is continuously graded towards stormwater drainage channels or gully entries;
VII. has no lips greater than 3mm high in pedestrian surfaces; and
VIII. be constructed to have a durable and functional life at least equivalent to the residual life of the existing pavement, as determined in consultation with the asset owner; and
IX. if the edge of the final surface cut, inclusive of the excavation/trench trimming allowance, in a Footpath or Road Carriageway is within 1m of a joint or existing edge of the pavement, then the existing pavement must be replaced to that joint or edge "

3.6 SURFACING REINSTATEMENT (ASPHALT)

Asphaltic concrete surfaces shall be designed and constructed in accordance with NZTA specification M10 2020 and M10 Notes (or latest version) and the following requirements;

- Once compaction is undertaken, the finished Basecourse height to finished surface depth must be checked to ensure the minimum depth of Asphalt is placed. This depth MUST be recorded.
- Patches must have a heavy tack coat prior to placing AC, minimum 0.5l/m2 – see example photo below;

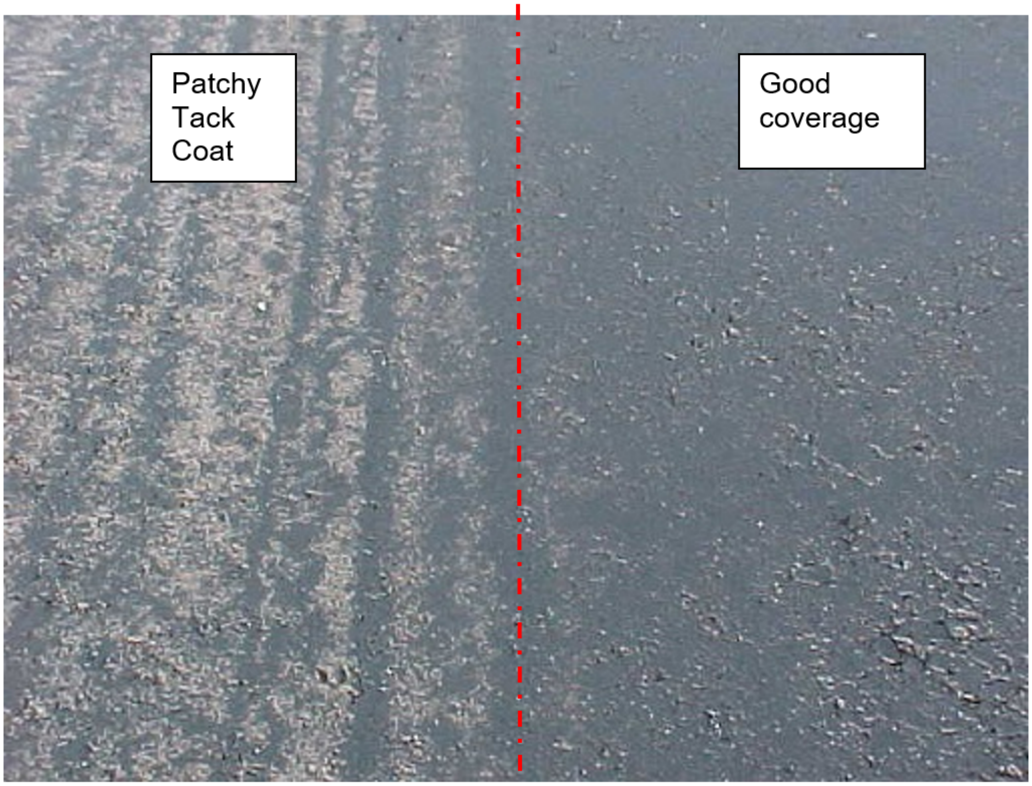


Figure 4 Tack Coat Application Examples

- The temperature of the AC must be recorded prior to placing and during placement to ensure compliance with the minimum temperature requirements.
- The mix design and relevant temperatures are to be recorded on site, preferably on the coontractors own trace sheet or similar that is available on request to the Corridor Manager
- With the exclusion of pothole repairs undertaken under the QLDC Roading Maintenance Contract, all reinstatements are required to be bandage sealed.
- Areas greater than 20m^2, one entire lane, or with a linear length exceeding 10m require a membrane seal underneath the asphalt. The requirements for a membrane seal are per 3.4.4.2 of the COP.

The following temperatures are provided as guidance; however, it is the contractor's responsibility to ensure that they have the appropriate mix temperatures from their suppliers prior to placing the AC;

Table 2 Asphalt Temperature Guidance

Common Reinstatement Mix Types	Mix Temperature	Compaction Temperature	Minimum Layer Thickness
DG7	140-180	165-175	25
DG10	135-160	135-155	35
Mix 10	135-160	135-155	40

Additionally, depending on the ground temperatures at the time of placing, the minimum mix temperature should never be below 95 degrees Celsius or 110 degrees Celsius for polymer modified bitumen asphalts.

3.7 SURFACING RESINSTATEMENT (CHIPSEAL)

Joint sealing/joint bandaging (required as minimum) and tack coats as necessary, should be part of the proposed methodology for approval, and guidance is included in the Chipsealing in New Zealand Handbook;

I. Chip seal shall be reinstated using a two-coat chip seal; the first coat must be a coarse grade chip (e.g. Grade 3) and the second coat a finer grade (e.g. Grade 4 or 5) to visually blend with the existing adjacent surfacing. The second coat must overlap the existing surface by not less than 100mm;

II. be laid in accordance with the NZTA specification TNZ P/3: First Coat Sealing and the Chipsealing in New Zealand Handbook or;

III. be laid in accordance with the NZTA specifications TNZ P/4: Resealing or TNZ P/17: Performance Based Specification for Bituminous Reseals; and

3.8 OTHER RESINSTATEMENTS

Concrete pavement surfaces

- be no less than 1m in any horizontal dimension in order to provide sufficient mass;
- match adjacent concrete paving depth but be no less than 100mm in depth (vehicle crossing depths may vary between RCAs. Check with your Corridor Manager);
- have reinforcing steel/mesh replaced to the same standard as the existing reinforcing;
- have a strength no less than 20MPa at 28 days. Admixtures may be used to attain the required strength earlier;
- match the surface finish of adjacent areas and if not being overlaid should be broom finished; and
- have construction joints formed to match those existing or be installed at minimum 4m centres.
- To re-establish a tight interlocking pattern with specified joint widths for pavers, it may be necessary to remove adjoining blocks and relay them up to a bordering physical feature such as the Road kerb.

Grass berms

- be reinstated level with clean and weed free topsoil to a minimum depth of 50mm (lightly compacted); and
- use approved seed and rake lightly to mix seed into top 20mm.

4 FOAM BITUMEN PAVEMENTS

In recent years Queenstown has seen an increase in the use of Foamed Bitumen Stabilisation throughout its roading projects.

In areas such as Queenstown, Foamed Bitumen Stabilisation provides many benefits to a roading rehabilitation project, for example;

- A strong pavement
- A pavement less susceptible to temperature effects i.e., frost/thaw
- insitu reuse of existing pavement materials

However, the increased use has created a situation whereby service providers are not accustomed to working with this material.

The following section presents a guide/specification for the reinstatement by providers of service trenches that needs to be carried out in pavements that have been Foamed Bitumen Stabilised. It is not usually practical or possible to have "fresh" foamed bitumen stabilised aggregate available for these maintenance works, so a practical alternative is specified in this document.

4.1 BEST PRACTICE

Prior to the physical construction it is best practice for service providers to be notified well in advance of the proposed carriageway rehabilitation. This can allow the operators to identify projects within the area and undertake any works that may be required prior to the stabilisation of the pavement. The best method of ensuring that a pavement remains watertight and uniformly robust after rehabilitation or maintenance works are completed is not undertaking trenching at all.

If a service must be installed via trenching in the pavement after its rehabilitation, an opportune time to carry this out would be prior to the second coat sealing of the site or prior to any planned sealing of the site. This would aid in the appearance of the final surface and maintaining a continuous water proofing layer.

4.2 FBS REINSTATEMENT SPECIFICATION

The ultimate goal of the trench reinstatement is to replace the excavated material with a material that will have a similar strength, stiffness, compaction and surface as the original material, thus avoiding rutting, cracking, differential settlement and moisture ingress.

Prior to starting the excavation

Saw cut a minimum of 100mm into the existing pavement (this is to provide a good surface to match into the stabilised material and protect the remaining stabilised pavement) and to a width 100mm wider on each side than the required trench width. The surfacing should also be cut further to give the profile depicted in figure 1 (chipseal) and figure 2 (thin AC).

Figs 1 & 2 do not refer to surfacing material. Suggest just refer to Fig 1 and Fig 2.

Excavation

The top 200mm of the excavated material i.e., the stabilised material, is to be stockpiled separately to the remaining material excavated. This material when cement is added (detailed below) will form the basecourse layers of the pavement.

Reinstatement

If the original saw cuts have been destroyed during excavation these are to be re cut to form a smooth surface.

Material to be placed in the bottom of the trench above the service bedding shall be the same excavated material or as per the backfill requirement of the service being installed / repaired.

Material to be placed 400mm from the surface shall be the same excavated stabilized and unstabilised material, with the addition of cement. The amount of cement added should be enough to produce a lean mix, in the order of 60kg of cement per m^3 of soil. Water must be uniformly mixed through the material. Alternatively, if foamed basecourse material is available from another local stabilisation project this can be substituted, provided it is carted and placed without delay.

Material is to be placed in 200mm layers and compacted to achieve the required compaction as per the previous sections of this document.

QA documentation

QA records shall be complied for each job and shall be made available to the Corridor Manager on request.

These shall include the following, which are not exclusive:

- Aggregate testing relevant to the aggregate specification eg TNZ M/4
- Aggregate compaction requirements and all test results which shall demonstrate compliance with QLDC requirements. Evidence of layer depths shall be provided
- Modified aggregate design and testing. All test results shall demonstrate compliance with QLDC requirements
- Surfacing design and production/placement QA showing compliance with requirements such as temperatures, compaction
- Photos of construction suitably labelled to provide time and location information

QUEENSTOWN LAKES DISTRICT COUNCIL

CONTENTS

Introduction

The Queenstown Lakes District Council (QLDC) is responsible for all traffic signals installed on Council roads in the Queenstown Lakes District. All QLDC traffic signals are operated by the Wellington Traffic Operations Centre (WTOC) and maintained by QLDC's agreed maintenance contractor.

This document is designed to assist all interested parties to understand the QLDC functions and the standards that have been adopted to ensure a consistent approach is maintained when designing and installing traffic signals and associated equipment.

Glossary of Terms

AS / NZ	Australian Standard / New Zealand Standard
Active Traffic Management System (**ATMS**)	Technology that provides information to road users by means of Variable Message Signage.
AMDS	The Asset Management Data Standard (AMDS) is a data standard that informs activity management decisions for transport https://www.nzta.govt.nz/roads-and-rail/asset-management-data-standard/
Controller	The equipment (including the housing) that switches power to signal lanterns and controls the duration and sequence of signal displays as defined by the controller personality.
Controller Information Sheets (**CIS**)	A hard copy of the information used to make a Controller Personality that is contained within the PROM.
Controller Personality	The unique program stored in the PROM, which configures the controller to the specific operational design of the intersection.
CCTV	Closed Circuit Television.
CoP	Code of Practice
DP Number	Distribution Point for telecommunications.
FSL	From Stop Line, measurement used for distance from start of detector loop.
ICP Number	Installation Connection Point Number (for electricity power meter).
Intelligent Transport Systems (**ITS**)	Refers to various systems like SCATS, CCTV, VMS and ATMS systems that provide and add information and communications technology to transport infrastructure.
JUMA, JUSP	**Joint Use Mast Arm, Joint Use Service Pole**
KJB	Kerbside Junction Box to access services. For example, detector loop feeders.
NZTA	New Zealand Transport Agency (now Waka Kotahi NZ Transport Agency)
NGEN	Software product developed by RMS to produce .SFT and .M68 files.
PCMCIA Card	A computer card containing the controller personality information housed in the TSC / AS 2578 compliant controller.
PROM	A computer chip containing the controller personality information housed in the TSC3 compliant controller. In this document PROM refers to either a PROM, a PCMCIA card or similar software storage device.
Road Asset and Maintenance Management (**RAMM**)	An Internet accessible system that stores the Traffic Signal assets. RAMM also records the activity of the Maintenance Contractors by the logging of faults as Dispatches and the updating by the Contractors following completion of the job. Contractors' claims are generated from the RAMM system each month end.
RCA	Road Controlling Authority.
Roads and Marine Services (**RMS**) of New	The Authority accepted by Queenstown Lakes District Council as the basis for the QLDC standards and for product approval. RMS also develop and own SCATS traffic

South Wales (**NSW**)	signal software and other products related to SCATS and their output files.
SAT	Site Acceptance Test, commissioning checklist.
.SFT / .M68	File formats for traffic signal software (TRAFF)
Sydney Coordinated Adaptive Traffic System (**SCATS**)	A fully adaptive area wide control system for traffic signals that is linked to the traffic signal controllers running TRAFF software via telecommunication lines.
TRAFF	Traffic signal base software inside traffic controllers on site running the signals.
QLDC	Queenstown Lakes District Council
Vehicle Activated Sign (**VAS**)	VAS is a generic term for a type of road traffic sign that displays a message conditional upon the presence or speed of a road vehicle.
Variable Message Sign (**VMS**)	An electronic traffic sign often used to display a message or picture. The sign display is changeable and dynamic.
Wellington Transport Operations Centre (**WTOC**)	Organisation tasked with operating the traffic signals and the ITS systems for local roads and State Highways around the Queenstown Lakes District by monitoring SCATS and CCTV.
Win Traff	A software programme used to check the controller information by testing the software of the controller personality.

1 REQUIREMENTS FOR TRAFFIC SIGNAL DESIGN

Purpose

The purpose of this document is to give an understanding of the QLDC requirements when undertaking the design, installation or maintenance of traffic signal installations in the QLDC regions, and the delivery of the as-built and data submissions

Who Should Use This Document?

All consultants, contractors and project managers (we refer to as "applicant" in this document) involved in the design, installation and maintenance of traffic signals on behalf of Road Controlling Authorities (RCA) in the Queenstown Lakes District should use this document. Where for example, an upgrade is being carried out by an RCA the applicant shall be the assigned. In most situations this would be the traffic signal contractor (who would have most technical experience in providing the relevant information required).

QLDC has prepared this document to assist practitioners when designing traffic signal installations. Although this document has technical and specialist content, the applicant must read it in conjunction with the QLDC Land Development & Subdivision Code of Practice – 2020 (QLDC CoP). The QLDC CoP contains details on document management and describes processes. The intent is to show what is expected in the application.

This guideline has been created to ensure that the designs of all intersections are to the highest standard, with variations being the exception rather than the norm. It is important that the information submitted as part of new or modified traffic signal layouts are standardised as much as possible. This will enable any further changes that may result from changing traffic conditions to be implemented quickly and simply.

The applicant's project team members are expected to have the experience and knowledge required to provide the relevant details, particularly the production of software and, CIS and traffic signal design. QLDC are not responsible for providing training or resources for designers who are new to the industry as there are suitable courses and consultants who can provide training.

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:

- QLDC Land Development & Subdivision Code of Practice – 2022.
- QLDC CoP Appendix L – Traffic Signal Guidelines.
- NZTA P43 Specification for Traffic Signals.
- AUSTROADS Traffic Management Guides.
- Road Traffic Standards (RTS) 14.
- NZTA Pedestrian Planning and Design Guidelines.
- NZS1158 Public Lighting Standards.
- QLDC Southern Light Strategy.
- QLDC RAMM Database Operations Manual
- Asset Management Data Standard

The specification of traffic signals equipment shall comply with the current version of NZTA P43 Specification for Traffic Signals or, a written agreement with QLDC for the use of specific components shall be obtained.

The contractor is responsible for ensuring that all equipment that is installed meets the minimum standards. If there is any doubt, the contractor shall be required to provide evidence that the product meets QLDC requirements.

Reference Material

Detailed below are recommended documents to assist in the processes required.

- NSW Roads & Maritime Services, Traffic Signal Design.

> Australian Road Research Board (ARRB), Traffic Signals: Capacity and Timing Analysis.
> Signals National User Group (SNUG).

1.1 TRAFFIC SIGNAL REPORT DOCUMENTATION

Prior to an applicant submitting a traffic signal report to QLDC, it is expected that the applicant liaise with QLDC and produce a Traffic Signal Feasibility Report prior to the Traffic Signal Detailed Design .

Any deviations from QLDC's Requirements and the reasons for the deviations must be summarised in a separate section in the report.

All documents to be supplied in electronic format. This is to ensure that the plans are clear and concise for reviewers, safety auditors and contractors.

1.1.1 Traffic Signal Feasibility Report

A brief traffic signal report with diagrams and maps that includes the following information:

> Site Location Plan.

> A brief description of the reason for proposing the installation of traffic signals.

> Intersection concept drawing/sketch showing proposed site including poles, lanterns, controller, accesses, bus stops and parking, vehicle and cycle lanes, with widths.

> Proposed and existing site layout detailing:
- Road and Footpath widths dimensioned
- Boundary, driveways, building lines and verandahs
- Traffic signal equipment including phasing
- Existing services, including manhole covers, boundary boxes, bus shelters etc.
- Trees, garden plots, berms etc.

> Risk Identification and assessment of existing services.

> Assessment of Network Operation Plan, road hierarchy, speed and usage including over-dimensioned vehicles.

> Assessment and map showing user desire lines and facilities that generate traffic and pedestrian movements. For example, Hospitals, Schools and associated safe routes, event venues/clubs, elderly housing areas etc. This data is to be included in the modelling, as is information about the expected use of the network surrounding the proposed site.

> List user hierarchy in priority order, time and day. For example:

AM Peak 07:00 – 09:00
1. Cycle
2. Freight
3. Vehicles
4. Pedestrians
5. Buses

> Existing crash data with a brief analysis of causes and commonalities.

> Modelling Report – refer to Section 2 of this Appendix.

> Movements Data. Examples of periods and types to be considered are:
- AM Peak turn counts (07:00 – 09:00) for cars, heavies, cycles and pedestrians.
- Inter Peak turn counts (11:00 – 13:00) for cars, heavies, cycles and pedestrians.
- PM Peak turn counts (15:00 – 18:00) for cars, heavies, cycles and pedestrians.
- School Travel turn counts for cars, heavies, cycles and pedestrians.

- Approach design speeds (posted and 85 percentile).

1.1.2 Traffic Signal Detailed Design

If a Traffic Signal Feasibility Report has been prepared, the detailed design scope can be defined clearly with the majority of risks and modelling assessments already identified. However, some of the requirements have been expanded with an emphasis on more detail.

All drawing plans submitted in electronic format, to show as a minimum:

> Legend corresponding to the symbols and hardware depicted on the drawing.

> North Point.

> Title Block.

> Revisions with comments on changes.

> Drawing type (i.e. construction, information, draft).

Detailed Design requirements in addition to the Traffic Signal Feasibility Report are to include the following drawings and documents:

> Cover Sheet and Site Location Plan.

> Existing Survey and Services.

> Proposed Construction and Set out.

> Proposed Signal and Phasing Layout.

> Proposed Ducting and Cable Diagram.

> Tactile Pavers and Pedestrian Layout.

> Proposed Road Marking and Signage.

> Vehicular Tracking Plan.

> Proposed Street Lighting.

> Standard Details (optional).

> Controller Information Sheet (CIS).

The detailed design should include detailed information for the proposed locations of poles, chambers, signs, lighting columns in relation each other and be drawn to scale.

Particular attention to detailing tactile pavers, pram crossings and pole locations, especially mast arms, should be made.

Further modelling work may be necessary during the detailed design process. The requirements are the same as detailed in the Traffic Signal Feasibility Report section, above.

1.1.3 Cover Sheet and Site Location Plan

This sheet will have the name of the project, a locality plan showing the location of the intersection, a brief and a drawing register.

1.1.4 Existing Survey and Services

This sheet is to show the location of all services plotted from the various service authorities services plans. In addition, the information collected by the topographical survey such as existing kerbs, driveways, trees, berms, local facilities such as manholes, valves, poles, streetlights and road marking and signs, must be shown.

We understand the accuracy of underground services plans can be minimal but it is expected that the designer has taken the steps to allow for inspections and trail holes to be investigated before the detailed design is approved.

1.1.5 Proposed Construction and Set Out

This sheet will show the extent of all new physical works to be undertaken such as kerb relocation, new islands, pole and chamber locations, pram crossings showing top and bottom of let-downs, tactile and directional pavers and, where services are being relocated to if applicable.

1.1.6 Proposed Signal and Phasing Layout

This sheet will show the proposed kerbs and road marking, the location and, the type of all signal hardware.

The plans shall be scaled appropriately to size of paper. Ideally, A1 size and include the following details:

> Lane configuration and assignment (arrows).
> Lane widths / carriageway widths (include cycle ways and advance cycle boxes where applicable).
> Detectors numbered (advance / queue loops to show distance from vehicle stop line).
> Signal Groups diagram, labelled and numbered.
> Signal phasing diagram, phase sequences and default sequence.
> Operation features e.g. 'Rest in A'; 'Z- allows filter'.
> Controller position and door opening.
> Poles with number and type (i.e. 5m outreach mast arm pole, JUMA, JUSP, CCTV).
> External Inputs (include type i.e. Detectors - Infrared, Doppler radar, Video, Thermal.).
> Aspects showing visor and type, and louvers (if used).
> Street Names.
> Property Boundaries.
> Kerb Lines.
> Vehicle Crossings.

1.1.7 Proposed Ducting and Cabling Diagram

A Ducting and Cabling Diagram shall be scaled appropriately to size of paper and include the following details:

> Kerb Lines.
> Access Chambers and Label.
> Kerbside Junction Boxes (KJB) and Tobies.
> Signal controller cabinet.
> Duct Lines, specifying the size and number of ducts.
> Poles and pole numbering.
> Detectors and detector numbering (including external inputs, overhead detection etc.).
> Cable runs.

1.1.7.1 Tactile Pavers and Pedestrian Details

Tactile and directional pavers drawn to show actual proposed location. The design must consider location of services to minimise risk during construction. The relationship between:

> Pole location
> Push button with desired angle shown
> Slip and trip hazards, and
> Pedestrian access ramp and associated slope

is essential detail and the consideration given must be included.

The design should consider accessibility needs of disabled or aged users, such as orientation of the crossing to the target kerb ramp, wayfinding on approach and exit, wheelchair crossings of drains, etc.

The designer must consider relocating services or proposed pedestrian access locations to maintain a practical and operational site. Include additional drawings showing these details. For example:

> Staggered crossing to show fencing positions and method of quick removal for maintenance

> Drainage cross fall details showing within a Median Island, and

> Installation of poles on a staggered arrangement to be located behind the kerb to assist minimising trip hazard, footpath cleaning and drainage.

Specifications for type of tactile paver are defined in the QLDC CoP. Plastic tactile pavers maybe considered after consultation with QLDC. Furthermore, in ground pads are not to be used. Alternatives for call cancelling pedestrians can be considered, such as overhead detection. Refer NZTA P43 Specification for Traffic Signals.

1.1.8 Proposed Road Marking and Signage

This sheet will show the proposed road-marking layout with dimensions including the tie-ins with the existing road marking at the extent of the physical works. Any proposed signage should also be included.

1.1.9 Vehicle Tracking Plan

This sheet will show the tracking of the largest vehicles deemed appropriate for the site. Of particular note should be the left and right turning vehicles with respect to limit line location and kerb lines.

1.1.10 Proposed Street Lighting

The street lighting designer shall provide a design that has assessed the proposed traffic signals design in relation to their industry standard documents and appropriate Road Controlling Authority (RCA) Code of Practice (CoP). QLDC shall comment on fit for purpose in relation to the proposed users and demographic environment. Examples by way of guide are:

> Suitable lighting to be installed for vehicle's, pedestrian access and crossing the road and also as part of the project site, and

> On the approaches to site, assist with crime prevention and CCTV operations.

The lighting design proposed for the intersection shall be peer reviewed by QLDC's nominated consultant.

All overhead traffic signal poles are to have a JUMA spigot fitted to facilitate future street lighting or CCTV equipment if required. A waterproof cap shall be fitted to all spigots not used for lighting or CCTV equipment.

The streetlight is to source its power separate from the traffic signals. This is to be discussed with QLDC prior to construction.

1.1.11 Standard Details

Standard signal sheets will show the details particular to signal installations. NZTA P43 Specification for Traffic Signals shows some standard details however the designer may propose alternatives. For example:

> Staggered crossing to show fencing positions and the method of quick removal for maintenance.

> Drainage cross fall details (showing within a Median Island).

The applicant must ensure that all works meet the relevant RCA Development Codes and Standards. For example; ducting standards and depths, approved tactile pavers, waste management and drainage. Refer to the appropriate road controlling authority for relevant development code.

1.1.12 Controller Information Sheet

Controller Software Specification is to be used to develop the Controller Information Sheet (CIS). The newest CIS sheet must show the revisions from the previous version and highlight each change in yellow.

The Controller Software Specification specifies the generic layout and operation of the site and includes any special requirements or logic in terms of detector or signal group operation.

These requirements are specific to each site / signal design. Refer to sections that follow for further details. At a glance, the requirements may include information such as:

> Train Operation.

- Pedestrian Protection (See Pedestrian Control section).
- Special Signal Group Overlaps.
- Bus, Tram or Cycle Logic.
- Conditional Phasing.
- Pedestrian Reintroduction.
- Special Time Setting Substitutions, and
- Special Detector Calling Functions.

MSS bits to be considered for all non-loop detectors such as push buttons, pedestrian overhead and underground detectors, Video, Infra-Red, Doppler Radar. This is so WTOC can monitor the devices and control functions under SCATS variations.

1.2 TRAFFIC SIGNAL EQUIPMENT

This section is referring to considerations during Feasibility and Design stages in relation to location and practical operations rather than equipment performance and specifications where these are defined in the QLDC CoP and NZTA P43.

1.2.1 Controller

The controller and its associated cable draw pit located within the road reserve with the back of the controller facing the intersection where practicable, with Door opening to be shown on drawing.

The controller should be located where it is:

- Close to the power supply and telecommunications.
- On reasonably level ground.
- Accessible to maintenance vehicles and personnel.
- Preferably near a property boundary and away from the edge of road.

The controller should be located where it:

- Can accommodate temporary external portable power supplies.
- Does not interfere with sight distance.
- Does not interfere with pedestrian and shared path facilities.
- Enables maintenance and operation personnel to have a clear view of traffic signals from the controller, if possible.

Where controllers are at risk of minor collision, e.g. with vehicles manoeuvring / parking on verges, protective bollards are to be installed.

1.2.2 Traffic Signal Post Locations

Traffic signal posts shall generally be located in accordance with AUSTROADS Guide to Traffic Management; however we have detailed the requirements for QLDC below.

In addition, an absolute minimum clearance of 600mm shall be maintained between any portion of the fittings, lanterns or accessories and the kerb face. Clearances must be increased where there is a probability of:

- Conflict with the 'overhang' of vehicles such as buses, or
- The 'cutting in' of the rear end of long vehicles or trailers, or
- Where the road has a significant camber which may cause high vehicles to 'lean in' towards the posts and attachments.

The requirements of clearances for over dimension vehicles (See NZTA website for routes) shall be met where applicable.

Where the lateral position is less than 1metre clear from the kerb face (e.g. on narrow medians) consideration shall be given to modifying the intersection geometry (e.g. widening the medians).

Where there are more than two (2) posts along a kerb (e.g. opposite the stem of a T-junction) they shall be laterally offset sufficiently to provide clear sight lines to all aspects from all relevant approaches; i.e. the lanterns and visors on one post do not restrict sight lines to lanterns on another.

Traffic signal posts shall be longitudinally located such that pedestrian push buttons are easily reached from the top of pedestrian ramps by all pedestrians including the disabled. Where this cannot be readily achieved, relocate traffic signal post or when not practical then separate pedestrian push button posts (stub posts) shall be provided.

Pole location and their relationship to tactile pavers and pedestrian access ramps must be carefully considered ensuring drainage and practical installation of poles can be achieved.

Where the requirements for clearances for over dimension vehicles apply, but the geometric layout and signal post location cannot be arranged to adequately cater for over dimension vehicles, hinged or removable traffic signal posts are to be used and placed near a termination pit so that the post can easily be removed.

1.2.3 Use of Overhead Signal Faces (Mast Arms)

The use of overhead signal faces (mast arms) should be minimised and shall only be included with prior approval from QLDC. Where practicable the geometric layout should be modified to avoid the necessity to use mast-arms. As per AUSTROADS Guide to Traffic Management Part 10, mast arms are warranted where the:

> Stopping sight distance to the post-mounted signal face is inadequate, e.g. because of vertical or horizontal alignment, awnings, poles, trees or similar sight obstructions, and

> Roadway is too wide for kerb mounted signal faces to fall within the driver’s line of sight.

Care must also be taken to ensure signal lanterns do not conflict with airport lights. Alignment and louvres may need to be modified.

1.2.4 Signal Display Location

In general, primary signal posts and signal displays should be located such that they are as close as practicable to the direct line of vision of approaching drivers, ideally at least 1m from the stop line, taking into account the alignment of the approaching lanes.

Secondary and tertiary signals posts and signal displays should be located such that they are as close as practicable to the direct line of vision of drivers when stationary at the stop line and when manoeuvring through the intersection, whilst taking into account the alignment of the individual lanes. For example; a dual secondary signal display may be out of direct line of vision when the driver is stationary at the stop line but may come into direct line of vision when moving forward and waiting to turn.

To assist in the potential conflict of displays the designer may consider use of aspect louvres and/or visors to maintain safe operations.

Multiple signal displays are used to ensure drivers on multilane roads can see at least one signal display for each movement on approach and on departure. This allows for masking of some of the signals by adjacent vehicles and also provides some redundancy in case of lamp failure.

Signal displays shall be arranged generally in accordance with AUSTROADS Guide to Traffic Management Part 10 with the following variations:

> Split tertiary signals shall not be used.

> Signalised left slip lanes shall have a primary and dual primary signal display located between the projection of the stop line and up to a distance of 3m downstream, consider use of arrows on green display to avoid confusion for Giveway / Stop slip lanes.

> Single-lane signalised left slip lanes shall have at least a secondary signal display located on the median of the cross road.

> Multi-lane signalised left slip lanes shall have a secondary and tertiary signal display, both located in the median of the cross road.

> Where parallel walks / no parallel walks are in place at sites without right turn arrows, there is no requirement for a Dual Far Right Secondary Display.

To assist in placing signals as close as practicable to the driver's direct line of vision, where medians are more than 6m wide consideration shall be given to mounting the dual secondary signals on the same post as the dual primary signals of the opposing direction, instead of the far right corner

Where the right hand turn lane approach is aligned towards the right and filtering is prohibited, splitting the 6-aspect secondary signal face and mounting the right turn arrows column on the same post as the dual primary signals of the opposing direction, and maintaining the dual secondary on the far right corner shall be considered.

1.2.5 Chamber Locations and Ducts

A chamber is generally required on each corner of an intersection. An additional chamber is to be installed immediately adjacent to a controller. This allows for easy installation of cables to the controller, provides more space for maintenance contractors to work and keeps cabling within the controller tidier.

Chamber locations should be placed so as not to cause a trip hazard and where practicable outside of any tactile paving. Furthermore, chambers are to be located where minimum traffic management is required. For example, not on the nose of an island.

All ducting should link back to a chamber location at each road crossing. To minimise carriageway work and disruption to traffic, it is best practice to only cross a main road once (i.e. road having the highest volumes). A minimum of two ducts shall be installed on all road crossings. Cables pull throughs to be installed on all ducts.

1.2.6 Detectors

All loop positions are to be determined early in the design.

All controlled lanes must have detector loops installed including for example left turn lanes under Give Way control to count vehicles only, if there are sufficient detector inputs available.

Advance loops may be required in some instances to optimise signal operation and enhance safety in high-speed environments. If controller capacity allows, detector loops are to be included in uncontrolled slip lanes for traffic counting purposes. Loops on bridge decks or approach slabs should be avoided where practical. Refer Section 3 of this Appendix.

Where there are a high number of cyclists the type and style of loops shall be clearly shown. Cycle lane design requires special attention and these shall be considered on a site by site basis.

Special care is required to ensure that the placement of the loop is in the correct position within the lane. Failure to confirm positions prior to sealing can mean that another loop may be required to be saw cut into the new seal. All loop locations to be accurately located and included on as-built drawings.

The ideal or preferred methodology of installing loops is to place them under the bedding of the pavement prior to sealing in order to avoid repeatedly cutting in a short period of time.

Consult with NZTA P43 Specification for Traffic Signals and the QLDC CoP for details on installation methods.

If the controller cabinet is relocated then the site must be renumbered to comply with the standard convention.

Configure virtual red light running loops in the CIS when there is spare capacity to allow, consult with QLDC as required.

1.2.6.1 Vehicle Detectors

Detectors are numbered anticlockwise from the controller assuming that a line is drawn from the controller through the centroid of the intersection.

The first circuit is the stop line loops, departure loops and counting loops are numbered first, with the departure loop being numbered after the stop line loop it is associated with.

The second circuit is the dynamic loops, followed by the advance dynamic loops.

The reason detectors are numbered anticlockwise is so that an approach will read numerically correct left to right when viewed on a SCATS System Monitor display.

Where there is a secondary part to the signals such as at interchanges, the first circuit is around the part of the intersection closest to the controller, then around the second part of the intersection. Then back to the first part of the intersection for the second circuit. A line is drawn from the controller through the centroid of the second part of the intersection to give the starting point for each numbering circuit.

If a controller is relocated then the site must be renumbered to comply with the standard.

1.2.6.2 Detector Card Configurations for AS 2578 VC5/6 Compliant Controllers

When the new AS 2578 and VC5/6 compliant controllers were first introduced each Detector card had 16 Internal Detectors (Vehicles) and 16 External Detectors (Pedestrian). Since then the manufacturers have provided some flexibility to allow combinations to be used. It is important for the designer to understand and number the loops and pedestrian call detectors in the appropriate manner as this impacts directly on the preparation of the software. Furthermore, VC6 controllers have extended the capacity therefore check with the manufacturer on these specifications.

1.2.6.3 Pedestrian Detectors

Pedestrian detectors are numbered depending upon the card in use. First ascertain the number of detectors available at the controller if it is an existing site or determine the requirement if new. TSC3 Controller Detector cards come in groups of four ranging between 4 and 32.

The AS 2578 Compliant controllers come with a 16, 24 or 32 input Detector card. This consists of vehicle inputs and external inputs. Again, this will depend on the type of controller and the configuration applied.

The pedestrian detectors are numbered from the highest number down as follows and may include more than four pedestrian facilities:

PEDESTRIAN / WALK NUMBER	1 PED	2 PEDS	3 PEDS	4 PEDS	5 PEDS
W1	16	16	16	16	16
W2		15	15	15	15
W3			14	14	14
W4				13	13
W5					12

Table 1-1: Pedestrian Detector Slot Numbering (16 Detector)

A similar configuration will apply across the top end for 24 and 32 detector cards.

In ground and above ground pedestrian detection systems will need to be configured as a pedestrian input. Using Table 1-1 as an example, for four pedestrians we use inputs 13-16 and if we were to install above ground pedestrian detection for all the walks the detection would be numbered 11-4 leaving one unused before the pedestrians. MSS bits shall be used and numbered the same as the pedestrian detector number (where possible). Furthermore all non-loop detectors shall have an MSS assigned for each unit for additional SCATS variation options and monitoring options.

1.2.7 Pole Numbering

Poles are numbered in a clockwise direction from the controller assuming that a line in drawn from the controller to the centroid of the intersection.

Where there is a secondary part to the signals such as at interchanges, the intersection closest to the controller shall be numbered first then the additional part can be numbered in the same format assuming that a line is drawn from the controller to the centroid of the secondary part of the intersection. If a controller is relocated then the site must be renumbered to comply with the standard convention.

1.2.8 Signal Groups

With AS 2578 and VC5 compliant controllers, the number of signal groups can range from 4 to 32 in modules of four signal groups. The recent changes to VC6 controllers may change some of the content listed below, therefore discussions with the manufacturer is expected during the design phase.

Pedestrian signal groups in a sixteen group controller will be denoted as: W1=16, W2=15, W3=14, & W4=13. If there are only two Pedestrian groups then W1=16 and W2=15.

1.2.9 Phasing

The phasing diagram must show the following:

> Each phase in a separate box with the phase label inside the box corner A, F, F1, etc.

> Show only the movements that display green in each phase.

> Indicate movements by an arrow pointing in the direction that traffic will travel.

> Signal groups shown in a circle at the point of the movement arrow for vehicles and beside.

> Pedestrian movements.

> Any Special Flags inside the phase box Z, Z+, etc.

> Indicate if filter turn movements are permitted.

> Label phasing to lanterns.

> Default and Alternative phasing to be shown. Alternative phasing must show split phasing for each approach to assist in maintenance and operations.

> An all red phase to be added to all plans for operational requirements, no detector or input to be assigned to call/demand. Shall be operated only by SCATS Dwell.

The phase sequence must be shown on the plan adjacent to the phasing diagram.

In general, all traffic signals shall be consistent with the standard RMS configuration. Standard phasing configurations are detailed below. Where standard phasing configurations are not appropriate due to the site or traffic flow conditions, the phasing should be designed to:

> Minimise the number of phases

> Minimise cycle time

> Run as many compatible movements as possible in each phase

> Restrict each phase to non-conflicting movements

> Allow each movement to run in as many phases as possible (preferably allowing as many as possible to overlap from the previous phase or into the following phase), and

> Comply as closely as possible with the standard RMS configuration. Examples of a range of standard arrangements are found on the following pages of this document.

The phasing design should consider the use of filter right turn movements. The phasing design should provide the most flexible operation that will accommodate changes in traffic conditions without the need to reprogram the controller personality. This may result in a phasing sequence in which not all phases are used initially. An example of this is the inclusion of repeat right turn phases.

The phasing sequence (i.e. the order in which each phase runs) should be designed to provide the optimum coordinated flow along a corridor. This may change at different times of the day.

1.2.9.1 Filtering Right Turn Movements

At most intersections right turning traffic that has opposing movements will be provided for by installing a separate signal display, giving the right turning motorist a protected turn at some time in the phasing sequence. However, under strict criteria filter turn movements may be permitted in order to improve intersection efficiency.

Whilst the provision of filter turns may improve efficiency, it reduces the potential safety as conflicting movements may now occur. The phasing design must consider a balance between safety and efficiency. When considering allowing filtering, safety must be given a higher weighting in the decision process.

The phasing design at adjacent intersections should also be considered to provide consistency along a corridor and preferably throughout the region.

The operation of such movement should be designed and implemented with prior consultations with QLDC.

1.2.9.2 Repeat Right Turn Phases

A repeat right turn is where the right turn movement is introduced for a second time within the same phase cycle. Repeat right turns can be provided at any site with a right turn phase. Generally the controller logic will have two phases with exactly the same movements (i.e. for a T-intersection B and D) with one phase only introduced when a special facility signal is activated (normally B using the Z+ flag).

Repeat right turn phasing can only be used under Masterlink or Flexilink control modes (not in isolated mode) and is generally provided at peak times. It is unusual to have a repeat right turn phase operating 24 hours a day.

Repeat right turn phasing is normally used where the single right turn phase does not provide sufficient capacity within a cycle for specific flow periods, or it is necessary for progression within a coordinated system.

A typical use is where a right turn bay is too short to cope with the number of right turning vehicles that can arrive within the cycle which results in the right turn queue extending into and blocking the through traffic lane. This reduces the capacity for the through movement and increases the risk of nose to tail type crashes occurring. The use of the repeat right turn is particularly important, under these circumstances, where there is only one through lane.

Repeat right turn phasing should only be considered under the above mentioned conditions. Generally, where vehicles may queue outside of the through lane (i.e. on a painted median), it is more efficient to provide a longer single right turn phase than two short phases. Installation of queue detection loops to be considered in the design.

1.2.10 Pedestrian Control

The hierarchy of signalised pedestrian control strategies range from providing full pedestrian protection through to partial protection during the early stages of the crossing movement. They fit broadly into the following range:

i. Exclusive pedestrian phase with full protection and all vehicle traffic stopped. Also known as Barnes Dance. This is only used where pedestrian numbers are high, in CBD.

ii. Full protection for the whole Walk and Clearance using red arrow.

iii. Partial protection for part of the Walk and Clearance using red arrow and individual push button inputs. Red arrow on a minimum of 6 seconds for one direction and the other direction to be calculated to the last crossing lane using 1.5m per second (this can be reduced on site as required).

iv. Full protected staggered or staged pedestrian movements.

The method of control adopted at any specific site is based on location, traffic volumes, pedestrian volumes and type (i.e. age or disability), intersection layout combined with the aim to provide safe, efficient movement for all users. However, when selecting control options, it is important to ensure, whenever possible, that a consistent approach is adopted within any given corridor. This may result in a more conservative approach being adopted at some intersections to maintain uniformity throughout that corridor.

At signalised intersections, near schools, where there is a high pedestrian demand at the same time each day, the signal operation should be adjusted to cater for the reoccurring demand. This will generally be achieved by increasing the Walk' and/or clearance times.

It is preferable to have all pedestrian push button inputs wired and configured in the CIS individually to enhance pedestrian protection.

MSS bits to be used for every push button to enhance the variation options in Scats. (All non-loop detectors shall have an MSS assigned for each unit for additional Scats variation options and monitoring options).

1.2.11 Cyclists

Cycle lanes are being progressively introduced along some of the main corridors. Cyclists are features managed as part of the 'traffic mix' and there are currently limited special facilities for them at signalised intersections. These facilities are generally in the form of advance boxes or hook turn boxes and do not require special traffic signal control. Where cyclists may be on a side road or one that is not reverted to during phase sequence then detectors may be required to demand the phase for the cyclist.

Cycle detector loops are numbered in sequential order as part of the first circuit of vehicle detectors. Cycle call buttons are external inputs and numbered in descending order after the pedestrian inputs, e.g. W1=32, W2=31, C1=30.

Special care and attention to the detector position, type and detector alarm to be used in the cycle lane and / or cycle box.

Where cycle boxes are used they shall always be behind the traffic signal primary pole. Consultation with QLDC is required at an early stage so we can consult the users groups.

1.2.12 Bus Lanes

Bus priority is becoming more common and requires the allocation of a signal group to each approach using the same convention as above for individual sites. If the bus signal group is demanded then the controller puts in a pre-specified delay to the through movement signal group. Where bus loops are installed these are numbered as part of the first circuit of vehicle detectors in sequential order. Where a separate signal group is provided for bus movements, these are numbered last, after all other vehicle signal groups.

1.3 TRAFFIC SIGNAL DATA SUBMISSION

1.3.1 Provision of RAMM Data

The data for all assets installed and specified in the detailed design must be provided and must be compliant with the Asset Management Data Standard. This includes all assets related to the signals, and any additions or amendments to (but not limited by) e.g. drainage kerb and channel, catchpits, footpaths, lighting, lines, signs, surface, pavements.

Submission of data can be via two options:

a) Utising the RAMM sheets found on the QLDC Webite – or available on request from assetmanagement@qldc.govt.nz.

b) Entered directly into the QLDC RAMM database, please contact assetmanagement@qldc.govt.nz to request access.

This includes attaching relevant multimedia into RAMM.

Practical completion will not be issued until data submission is received and approved by QLDC.

2 MODELLING GUIDELINES

Purpose

This guideline is specifically designed to provide guidance without being prescriptive or limiting the modeller building the model. A proportion of the content of the document is designed to make the model scope, building, submission, review and approval as transparent as possible for all parties without inhibiting the practitioner in the technical construction of the model.

Who Should Use This Document?

Modellers, on behalf of consultants and contractors, should use this document and project managers (we refer to as "applicant" in this document) involved in the design, installation and maintenance of traffic signals on behalf of Road Controlling Authorities (RCA) in the Queenstown Lakes District.

QLDC has prepared this document to assist practitioners when designing traffic signal installations. Although this document has technical and specialist content for modellers it must read in conjunction with the QLDC CoP and this Appendix.

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:

> QLDC Land Development & Subdivision Code of Practice – 2022.
> QLDC CoP Appendix L – Traffic Signal Guidelines.
> NZTA P43 Specification for Traffic Signals.
> AUSTROADS Traffic Management Guides.
> NZTA Pedestrian Planning and Design Guidelines.

Reference Material

Recommended documents to assist in the processes required are as follows:

> NSW Roads & Maritime Services, Traffic Modelling Guidelines.
> NSW Roads & Maritime Services, Traffic Signal Design.
> Australian Road Research Board (ARRB), Traffic Signals: Capacity and Timing Analysis.
> Signals National User Group (SNUG).

2.1 MODELLING REPORT

The modelling report must show initiative and educated judgement rather than default parameter settings in modelling (e.g. analysis period profile in terms of peak hour factor, demand arriving at back of queue versus counts at stop-line on oversaturated approaches, adjustments to gap parameters, intergreen times, coordinated arrival types). The modelling report must also contain site observations including calculations.

Whichever traffic signal modelling software is used, the user should consult the SIDRA User Guide or SIDRA software Help menus for any model-specific guidance on reconciling the signal timing input and outputs with average SCATS operation for the peak periods. To facilitate more realistic modelling of existing traffic signal site upgrades, SCATS history files of typical peak hour timings can be provided to modellers upon request to WTOC (including signals in close proximity, refer Table 2-1).

Due to the nature of the models, traffic surveys must be undertaken at all intersections to be modelled. Other critical data collection includes signal operation, queue observation and saturation flow measurement (or estimation). Future traffic flows can be estimated using highway assignment models or by applying growth factors as appropriate. Highway assignment models should only be used to estimate traffic growth as they are generally too coarse to adequately produce detailed turn movements.

2.1.1 Modelling Outputs

The designer shall submit a detailed SIDRA report consisting (as a minimum):

- Introduction.
- Background.
- Traffic volumes including any adjustments made to modelled volumes noting in particular, the forecast years(s).
- Each Option should be modelled in Year 0 and Year 10. The land arrangement and phasing of each Option must be shown.
- Analysis Methodology (including details of calibration).
- Analysis Results Summary, including a table highlighting the following for each movement and the intersection as a whole:
  - Degree of Saturation (DoS) (maximum 0.90).
  - Average Delay (RMS NSW Method).
  - Level of Service (LoS).
  - 50% and 95% Back of Queue distance.
  - Fuel Consumption, Emissions and Cost (total and rate).
  - Flow Scale / Design Life Results based on a 10% increase in traffic volumes.
  - Pedestrian Movements.
- Discussion on all observations of the analysis results and outcomes.
- Conclusions and Recommendations (e.g. length of extensions to turn lanes, etc.).
- A table indicating the proposed cycle length, phase splits and offsets (if coordinated) that the model suggests be adopted by SCATS for the morning peak, and, afternoon peak.
- Best Level of Service whilst fuel consumption and emission are not the highest rate compare to other level of services.
- The applicant must obtain all traffic data deemed necessary to complete the validation.
- For closely spaced signals, a decision needs to be made and justified on isolated versus coordinated system analysis. An initial isolated analysis should inform the design layout and phasing prior to a full coordinated system analysis, serving as a useful cross-check.
-

2.1.2 Modelling Inputs

The designer shall consider listed SIDRA input data when preparing a SIDRA report for traffic signals at grade and if required, as a network. The list below is a minimum requirement for outputs:

> Lane width

> Grade

> Median

> Approach Cruise Speed

> Vehicle Movements

> HV%

> Peak Flow Factor

> Peak Flow Period

> Signal Coordination

> Phasing

2.1.2.1 Signal Analysis Method:

For intersections running under SCATS Coordinated or Master Isolated Control, use the Fixed-Time / Pretimed analysis option. Although SCATS is an adaptive control system, the Fixed-Time / Pretimed analysis method is recommended to emulate the SCATS control algorithms, especially due to the "equal degree of saturation method" used for determining green splits. SCATS green splits and cycle time may change cycle by cycle. The green splits and cycle time determined by SIDRA INTERSECTION should be considered to represent average timings under SCATS control for the analysis period. Use the Actuated analysis method for intersections operating under the traditional actuated control method. This control method uses maximum green and gap settings and does not implement an equal degree of saturation strategy for green splits.

2.1.2.2 Intersection Dialogue

In the SIDRA intersection dialogue:

Area Type Factor parameter for Signals is used as a saturation flow adjustment factor. It applies to all lanes of the approach. HCM recommends 0.9 for CBD area type. This parameter could also be used as a simple saturation flow calibration parameter which can be specified per approach.

Area Type Factor affects the SCATS MF estimates as well.

2.1.2.3 Geometry Dialogue

Geometry should closely resemble actual alignment and orientation of the intersection.

The following is required as a minimum in the Geometry Dialogue:

> Approach and exit lane data are to be as per the existing geometry for constructed intersections and/or for Construction Plans for approved intersections.

> If slip lanes or continuous lanes already exist then the appropriate selection is required.

> Values for extra bunching should be used if there are upstream signals in close proximity. Extra bunching should only be applied to sign-controlled and roundabout intersections.

Maximum values to be used to simulate the effects of extra bunching should be as shown in Table 2-1- .

Distance to upstream signals (m)	<100	100-200	200-400	400-600	600-800	>800
Extra bunching (%)	25	20	15	10	5	0

Table 2-1 - Maximum values for extra bunching

The maximum basic saturation flow should be 1950 tcu /hr (SIDRA Default). Any higher or lower values than default value should be supported by appropriate data. Saturation flow measurements should be undertaken whenever possible on approaches that are heavily congested or forecasted to be heavily congested:

The following method is recommended to calibrate the saturation flow in SIDRA INTERSECTION:

(i) measure the lane saturation flow, s' (veh/h) using the HCM or ARR 123 method; this saturation flow will have effects of all road and traffic factors (heavy vehicles, turning vehicles, lane width, grade, and so on);

(ii) compare the measured lane saturation flow, s' with the lane saturation flow estimated by SIDRA INTERSECTION, s (veh/h) given in the Lane Flow and Capacity Information table in the Detailed Output report; if they are significantly different (given that all road and traffic factors have been specified as input to SIDRA INTERSECTION correctly), calculate a calibration factor s' / s;

(iii) adjust the basic saturation flow (tcu/h) to s'b = (s' / s) sb where sb is the basic saturation flow (tcu/h) specified as input for estimating saturation flow s (veh/h);

(iv) specify the adjusted basic saturation flow in the Lane Data tab of the Lane Geometry dialog and re-process SIDRA INTERSECTION to estimate saturation flow using the new basic saturation flow (s'b); repeat the process if necessary.

The calibration factor (s' / s) can be used for future design options if it is believed that it adjusts the SIDRA INTERSECTION default basic saturation flow for local driver behaviour adequately. This method is not recommended for short lanes, or for lanes with opposed (permitted) turns.

- ***Saturation Speed:***

***Saturation Speed** is the steady speed value associated with queue discharge (saturation) flow rate. This parameter indicates that vehicles do not accelerate to the speed limit during queue discharge.*

*The **Program** option is selected by default and the data field is blocked. The Saturation Speed is estimated by the program in this case. To use an observed value to override the program calculations, select the **Input** option and enter the value in the data field. The program will use the value you specify. Select the **Program** option again for program to estimate the saturation speed (no need to delete the value in the data field).*

The saturation speed can be observed easily while driving a car, e.g. when the car crosses the stop line after accelerating from the queued position at signals, while its position was more than about the fifth car in the queue.

In addition to estimating the driver response time, Saturation Speed is useful for determining parameters such as various SCATS parameters (occupancy and space time at saturation, DS, best loop length, etc), and parameters for microsimulation (average and maximum acceleration rate, acceleration time and distance during queue discharge).

Saturation Speed is determined by SIDRA INTERSECTION for each approach lane using the method described below. This parameter is applicable to all types of intersection. The Saturation Speed is subject to various constraints related to Approach Cruise Speed and the Negotiation Speed.

For through movements at signalised intersections, the saturation speed, vs is estimated from:

vs = 0.75 vac

where 0.75 is the saturation speed factor and vac is the approach cruise speed.

If the queue discharge behaviour is influenced by existence of signals at a nearby downstream location, then the user can specify a lower value than the program estimate (say 10 per cent lower).

For turning movements at signalised intersections, Exit Negotiation Speed estimated by the program or specified by the user is used as the saturation speed.

For all movements at roundabouts and sign-controlled intersections, Exit Negotiation Speed *estimated by the program or specified by the user is used as the saturation speed.*

The following should be noted in relation to the Saturation Speed parameter in SIDRA INTERSECTION:

> *Movement Classes: the Saturation Speed is not adjusted for Movement Classes.*

> *Queue Move-up Speed: The Saturation Speed is used as an upper limit in determining the queue move-up speed. In previous versions, the Approach Cruise Speed was used for this purpose.*

> *Negotiation Speeds:*

- *For Through Movements at signalised intersections, the Approach Cruise Speed is used as the Approach and Exit Negotiation Speed, van = ven = vac for unqueued vehicles. This is relevant for [geometric delay]() calculations.*
- *User-specified Saturation Speed values that exceed the Exit Negotiation Speed are ignored. If a user-specified Saturation Speed is less than the Exit Negotiation Speed, then the Exit Negotiation Speed is reduced to match the Saturation Speed value, ven = vs to ensure that there is no acceleration in the Exit Negotiation section.*

The Driver Characteristics and SCATS Parameters tables in the Detailed Output report include the estimates of saturation speeds and other parameters derived using the Saturation Speed parameter, e.g. driver response times."

Utilisation Ratio, Saturation Speed and Capacity Adjustment Data values should only be changed subject to appropriate intersection data being collected or provided. The Turning Movement Designation should be allocated as per the existing or proposed operation of the intersection.

For wider lane approaches the SIDRA Intersection model should show how the intersection is used rather than how it operates. A wide approach is where width of the lane allows two vehicles to stand next to each other at a Stop line or operate the road as two lane road even though the road is marked as one lane only.

For signalised intersections, the parameters for Buses Stopping, Parking Manoeuvres, Short Lane Green Constraints and free queue should only be inserted if the appropriate intersection data is available.

2.1.2.4 Volumes Dialogue

The following is required as a minimum in volumes dialogue.

> Vehicle volumes are to be based on the most current data collected through an intersection survey/count. Turning Movement Demands are required, which in all cases can be collected by counting arrivals at the back of queue. If a lane or approach is over-saturated (i.e. Cycle failure), then departure counts at the stop-line (presence detectors) only represent capacity, which are likely to be less than the true demand, which the new signal design should accommodate. Thus, stop-line or detector counts are only acceptable if that movement is not over-saturated.

> SIDRA default Peak Flow Factor of 95% is acceptable. Analysis of intersection data collected may impact the Peak Flow Factor used. Supporting documentation is required to justify the factor used other than the default Peak Flow Factor of 95%.

> The appropriate Growth Rate parameter should be used in consultation with QLDC if completing a design life analysis on the intersection.

> Growth rates used for future volume estimation and/or the justification of the methods used to determine future volumes should be included in the final report.

Unit time for volumes and peak flow period should reflect data of the intersection counts where the:

> Maximum unit time for volumes is 60 minutes (unit used is dependent on actual flow data and any variation should be discussed with QLDC and documented).

> Maximum peak flow period is 30 minutes.

> Peak Flow Factor (volume dialogue box) should be carefully assessed to replicate actual Peak Period.

2.1.2.5 Path and Movement Data Dialogue

The Approach Cruise Speed and Exit Cruise Speed for existing intersections should reflect the present intersection conditions. The Approach Travel Distance should be changed to reflect the existing and/or proposed operation of the intersection. The Negotiation Speed and Negotiation Distance can be changed manually to indicate the physical parameters for intersections that have unusual geometry features. Justification should be given for the values used for the intersections of unusual nature. All other items in this dialogue should be the SIDRA default values.

In the Movement Data input dialogue some of the data items may not be available depending on the intersection type and the characteristics of the movement. The default values in the Movement Data Dialogue box should be used unless evidence is provided indicating a different set of values are appropriate. Data in the Pedestrian Effects section can be manually inserted with the appropriate justification provided.

2.1.2.6 Lane Data Dialogue

In the Lane Data input dialogue, you can specify a lane utilisation ratio which is less than 100 per cent in order to allow for lane underutilisation observed in the field. The resulting lane flows estimated by SIDRA INTERSECTION can be compared with the observed lane flows and the lane utilisation ratio can be modified for the estimated lane flows to match the observed values. Where available, SCATS lane flow information is useful for this purpose. The sensitivity analysis facility (the Demand & Sensitivity input dialogue) allows for testing varied values of user-specified lane utilisation ratios.

2.1.2.7 Gap-Acceptance Dialogue

Default values should be adjusted under different geometric arrangements. Therefore, gap-acceptance parameters applicable to particular intersection geometry and flow conditions should be selected by using good judgement and taking into account the local driver characteristics.

Appropriate judgement is required while selecting the critical gap and follow-up headway values to suit the circumstances considering grades, sight distance conditions, opposing movement speeds, number of lanes, and one-way or two-way conditions. Any changes to these values should be justified.

2.1.2.8 Pedestrians Dialogue

The volume of pedestrians and Peak Flow Factor can be altered to suit the intersection counts obtained. The growth rate used under Pedestrian Data should be justified and explained. Data for Crossing Distance, Approach Travel Distance, and Downstream Distance can be changed to reflect the geometry of the existing intersection if this data is available. Default values should be used for all other parameters in this dialogue.

SIDRA default for Pedestrian Walking Speed (Average) in the Pedestrian Data dialogue box is 1.3m/sec. A value of 1.5 m/sec should be used for pedestrian modelling.

Where partial pedestrian protection is proposed the calculation shall be measured ¾ across the full width of crossing.

2.1.2.9 Phasing and Timings Dialogue

The phasing and timing on signalised intersections can be altered to determine the most appropriate solution. However, when modelling the existing intersection, the phasing and timing should be representative of current Phasing and Timing of that intersection. Intersection surveys should be undertaken if the necessary data is not available. Default yellow time of four seconds and red time of two seconds should be used if the measured data is not available.

The maximum cycle time to be used is 120 seconds, consult with WTOC for advice. Cycle time is generally controlled by the SCATS master subsystem. Therefore the cycle time for all intersections linked with the master subsystem should use the same cycle time.

> ***Slip Lanes without detectors:***
>
> *Slip/bypass lane movements should be treated as Undetected under the SCATS control system where turning vehicles using slip/bypass lanes do not cross over stop-line detectors. This is not appropriate in control systems where turning vehicles using slip/bypass lanes cross over advanced detector loops, or with controllers using fixed-time signal plans where the plans are designed to accommodate all turning vehicles.*

> ***Detection Zone length:***
>
> *Effective Detection Zone Length can be specified at all signalised intersections regardless of whether the Analysis Method is specified as; Fixed Time/Pre-timed or Actuated. This is particularly relevant to modelling of intersections running under the SCATS system.*

2.1.3 SCATS Standard Traffic Signal Phasing Diagrams

QLDC has standard phasing arrangements in one of the following forms:

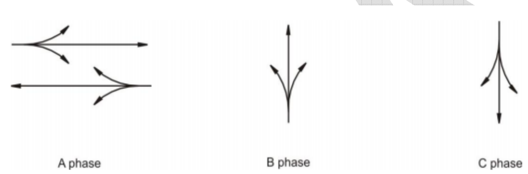
> Conventional phases.

> Conventional phases with turning leading, trailing or repeat right turn phases.

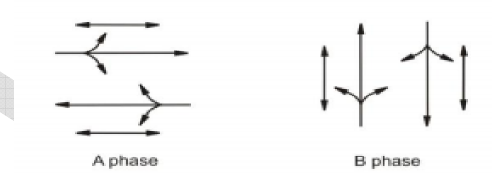
> Diamond phase.

> Split phases.

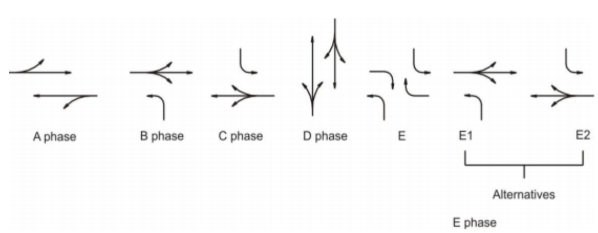
These phase arrangements should be used in intersection modelling. Refer to Table 2-2 for examples of phasing arrangements.



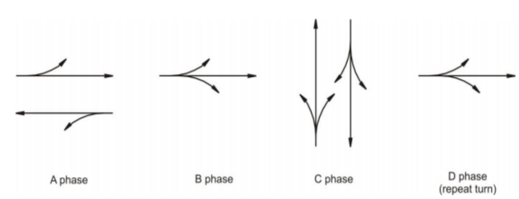
Split approach phasing



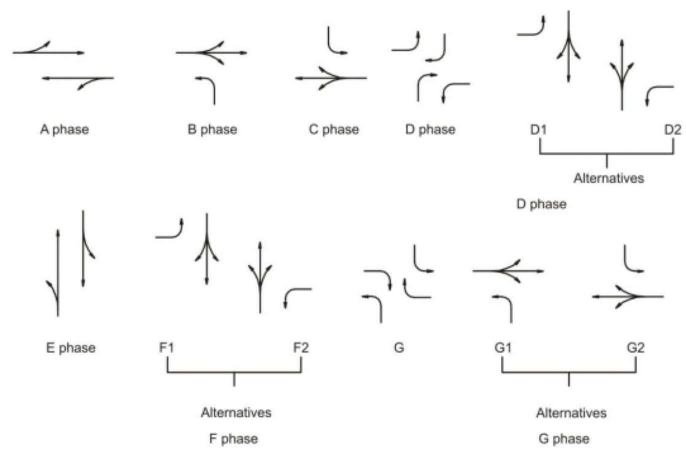
Two phase design



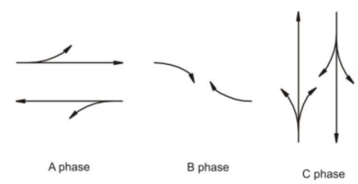
Single diamond overlap phasing



Repeat right turn phasing



Double diamond overlap phasing



Diamond turn phasing

Table 2-2 - Examples of phasing arrangements

2.1.4 Calibration

The calibration process should be based on various traffic surveys and site observations. All changes required in order to calibrate the model should be fully documented with an explanation and justification of the change. SIDRA User Guidelines should be referred to for possible calibration methods.

In order to properly identify the effects of future network and/or demand changes on the existing operation of signalised intersections, the timings obtained from a calibrated model of existing conditions (based on observed signal times) should be compared with those obtained from the SIDRA optimised timings. In this way differences can be compared and an explanation provided as to why they may exist.

This comparison is useful in identifying:

> Incorrect model assumptions in respect of traffic behaviour (saturation flows, delays due to pedestrians, queue storage space etc.).

> Incorrect model assumptions in respect of signal operation assumptions (i.e. alternative phase calls, phase skipping, offset, cycle times, minimum greens, clearance times etc.).

> Incorrect SCATS setup.

In addition to the above, many model software packages have specific SCATS input/import and output/export features. The Help instructions regarding SCATS compatibility should be consulted and guidelines followed, to the extent possible. Specifically, SIDRA has a SCATS Parameters Table available in the Detailed Output report[i]:

It provides the user with estimates of the Maximum Flow (MF) and the associated Headway at maximum Flow (HW), Occupancy Time at maximum Flow (KP) and Space Time parameters reported by the SCATS traffic signal control system.

SCATS parameter estimates can be used together with lane flow rates reported by SCATS for the purpose of calibrating SIDRA INTERSECTION against measured conditions. The basic saturation flow parameter can be adjusted so as to match the measures SCATS MF parameter.

The SCATS on-line feedback system determines the MF parameter using a complex set of filtering rules using traffic data collected cycle by cycle during the day. On the other hand, the SIDRA INTERSECTION estimate of the MF parameter is based on average conditions and derived on the basis of various assumptions regarding the factors that influence this parameter.

Therefore, a one to one correspondence should not be expected between a SCATS-reported MF value and the corresponding SIDRA INTERSECTION estimate. However, a comparison of the SCATS-reported value of MF and *associated parameters and the SIDRA INTERSECTION estimates can be of valuable help when saturation flow rates from field surveys are not available.*

The SIDRA INTERSECTION sensitivity analysis facility (Demand & Sensitivity dialog) can be used to vary the basic saturation flow parameter so as to match the SCATS-reported MF parameters.

2.1.5 Outputs

As outlined in the Introduction, the designer shall submit a detailed SIDRA report consisting (as a minimum) of the following:

- Introduction.
- Background.
- Traffic volumes including any adjustments made to modelled volumes noticing in particular the forecast years(s).
- Each Option should be modeled in Year 0 and Year 10. The land arrangement and phasing of each Option must be shown.
- Analysis Methodology (including details of calibration).
- Analysis Results Summary, including a table highlighting the following for each movement and, the intersection as a whole:
    - Degree of Saturation (DoS) (maximum 0.90).
    - Average Delay (RMS NSW Method).
    - Level of Service (LoS).
    - 50% and 95% Back of Queue distance.
    - Fuel Consumption, Emissions and Cost (total and rate).
    - Flow Scale / Design Life Results based on a 10% increase in traffic volumes.
    - Pedestrian movements.
- Discussion on all observations of the analysis results and outcomes.
- Conclusions and Recommendations (e.g. length of extensions to turn lanes, etc.).
- A table indicating the proposed cycle length, phase splits and offsets (if coordinated) that the model suggests to be adopted by SCATS for the morning peak, and, afternoon peak (include SCATS Parameters Table from Detailed Output report).
- Best Level of Service whilst Fuel Consumption and Emission are not the highest rate compare to other level of services.
- The applicant must report all traffic data deemed necessary to complete the validation in an appendix. An electronic copy of the software input and output files for all options, showing the phasing and time settings used in the evaluation, must also be provided.
- For closely spaced signals, a decision needs to be made and justified on isolated versus coordinated system analysis. An initial isolated analysis should inform the design layout and phasing prior to a full coordinated system analysis, serving as a useful cross-check.

3 GUIDE FOR USE OF ADVANCE DETECTION

	Yes	No	Maybe
Main Road	Runs in Isolated mode and has a combination of: • Approach Speed 60km/hr or greater, or • Multilane approach, or • Sight lines to signal displays restricted due to vertical or horizontal alignment, or • Has a steep approach gradient, or • Significant volume of heavy vehicles.	Controlled by SCATS under continuous Masterlink mode and is the Stretch phase.	Controlled by SCATS but may operate in Master Isolated or Isolated mode during off peak periods and has a combination of: • Approach Speed 60km/hr or greater, or • Multilane approach, or • Sight lines to signal displays restricted due to vertical or horizontal alignment, or • Has a steep approach gradient where slow starting vehicles may cause the approach to terminate early, or • Significant volume of heavy vehicles. • High incidence of Red light running
Minor Road	May operate in Masterlink, Master Isolated or Isolated mode and has a combination of: • Approach Speed 60km/hr or greater, or • Multilane approach, or • Sight lines to signal displays restricted due to vertical or horizontal alignment, or • Has a steep approach gradient where slow starting vehicles may cause the approach to terminate early, or • Significant volume of heavy vehicles.	• Low volumes with easy or flat approach gradient • Low approach speeds • Single lane approaches. • Low volume of heavy vehicles	• Single lane, low speed, low volumes but may have a steep approach gradient where slow starting vehicles may cause the approach to terminate early • High incidence of Red light running • High incidence of Nose to tail type accidents.
Pedestrian Crossing	At all mid-block signalised pedestrian crossings		

The Table above is intended to provide guidance on where the use of advance detection may or may not be considered appropriate. Each site should be assessed based traffic flows and composition, site layout, safety and efficiency considering the above guide and notes below.

It is recognised that costs of installing and maintaining the additional loops for advance detection are not insignificant but we believe that benefits exist to offset the additional costs associated with advance detection. This is especially so at strategic state highway intersections. The following discussion covers these benefits.

These areas have been categorised into ***efficiency***, ***safety*** and ***traffic data***. Often efficiency can result in greater safety by reducing driver frustration.

3.1 EFFICIENCY

3.1.1 Phase Termination

Under isolated or master isolated vehicle actuated operation, signal phases predominantly terminate on gap identification. Typically a gap setting may be in the vicinity of 3-4 seconds. When a gap is identified at a limit line loop, the last vehicle in a 50km/h traffic stream is already some 50-60metres beyond the limit line. By the time the intergreen period (typically 5 seconds) has expired and the opposing flow commences, the last vehicle is 120-140beyond the intersection.

If the gap is located at an advance loop 40-50 metres ahead of the limit line, the intergreen period will introduce as the last vehicle passes through the intersection, thus eliminating 3-4 seconds of waste time at the end of every phase that is terminating on a gap. The last vehicle will still be 50-60 metres beyond the intersection when the opposing flow commences.

Under SCATS control, although the stretch phase length is predetermined, often the side road phases still utilise gap termination thus enjoying some of the benefits above.

The provision of advance loops allows the specifying of special logic within the controller which utilises the limit line loops to get traffic moving during the first 12 seconds or so, and then interrogates the advance loops only, for gap identification. The software in no way affects the SCATS algorithms and purely provides for more efficient phase termination in phases where gap termination is specified.

It is recognised that under low flows (during the first 12 seconds) or under high volumes where phases are terminating on maximum, the benefits above are not realised, but there are significant periods when this is not the case and overall, motorists would experience a far more responsive operation of the signals.

3.1.2 Phase Introduction

Under isolated or master isolated vehicle actuated operation, whenever a vehicle approaches a red display without an advance loop, the phase demand does not occur until the vehicle has almost stopped at the limit line. The vehicle then has to wait for the 5 second intergreen period before receiving a green display. With an advance loop the demand is lodged 40-50 metres before the limit line and if the vehicle begins slowing, the green display should come on as the vehicle reaches the limit line eliminating the unnecessary stop condition.

Advance loops were the universally recognised control system before the advent of SCATS, and still the preferred positioning in regions where SCATS, or other area control systems requiring alternative loop positioning, do not exist. There appears to be no evidence that phase introduction by advance loops is any less safe than the far less efficient phase call at the limit line.

3.1.3 Approach Priority

With advance loops at varying distances from limit lines on different approaches, a measure of priority can be afforded to a particular movement. On some major state highway intersections, we have provided advance loops 70m or more from the limit line on the priority approach whilst the advance loops on a side road of lesser importance may be positioned only 30m from the limit line. This provides priority to the main road approach both in terms of phase calling and extending the main road phase.

3.1.4 Loop Backup

The provision of advance and limit line loops also provides a level of backup in the event of a loop failure. A faulty loop can be switched out and the approach run with a satisfactory level of service utilising either the advance loops only or the limit line loops only until repairs can be effected.

3.2 SAFETY

3.2.1 Non-use of dynamic approach loops

Prior to SCATS, inductance loops were positioned about 40metres in advance of limit lines in 50km/h zones and further back in higher speed areas. This enabled identification of gaps before reaching the limit line and signals tended to change to yellow as the last approaching vehicle in a platoon reached the intersection. The control system was also aware of any vehicle within 40metres of the intersection and unless terminating on maximum, allowed a further increment of green time to progress the approaching vehicle up to the intersection.

Where advance loops are not used the control system is unaware of approaching vehicles and phases terminate regardless of positioning of vehicles approaching the limit line.

On a co-ordinated route under full SCATS control the dynamic approach loops are irrelevant. The termination of such approaches are controlled entirely by the SCATS algorithms designed to maintain the necessary offsets between intersections. If the intersection falls back to isolated or master isolated control, or for side roads under full SCATS control, the dynamic approach loops are far better positioned to safely and efficiently terminate the relevant approaches.

Using SCATS limit line loops, termination following a gap commences when a vehicle is already well clear of the intersection (thus introducing unnecessary waste time), and regardless of whether another vehicle is now approaching the limit line.

Both premature phase termination and inefficient phase termination encourage ***red light running***. We believe that a combination of SCATS and dynamic approach loops can provide a significant improvement in overall safety at an intersection especially where operational speeds of 60km/h or greater are experienced.

At intersections operating under higher speeds, studies have indicated that very significant safety benefits are obtained by protecting areas known as 'Dilemma Zones' with appropriately positioned dynamic approach loops. A 'Dilemma Zone' is a zone of indecision within which, if the yellow signal comes on, the decision of whether to stop or proceed is not clear and varies from driver to driver thus increasing the risk of rear-end collision. Protection of these zones requires advance loops up to 100metres in advance of the limit line on high speed approaches.

4 PROJECT CHECK SHEET FOR TRAFFIC SIGNALS

Purpose

The purpose of this check list is to summarise what is expected when submitting approval to QLDC.

Who Should Use This Document?

This document should be used by all consultants, contractors and project managers (referred to as "applicant" in this document) involved in the design of traffic signals within the Queenstown Lakes District. Where, for example, a traffic signals intersection is proposed the majority of this document will be filled out by the consultant since the design process is specialised.

Each section must be filled out with tick for submitted, any associated notes / comments; when left unticked please comment the reasons why.

4.1 TRAFFIC SIGNAL PROJECT CHECK LIST OF FILES SUBMITTED

Applicant / Consultant			**QLDC**
Traffic Feasibility Report	✓	Notes / Comments	Approved
Site Location Plan			
Brief description			
Concept Drawing			
Services / Risks			
Road / User Assessment			
Crash Data / CAS			
Movement Data / Counts			
Traffic Modelling Report			
Modelling Data Files			

Applicant / Consultant			QLDC
Road Safety Audit	✓	Notes / Comments	Approved
Pre-Construction Audit			
Post-Construction Audit			

Applicant / Consultant			QLDC
Traffic Signal Detail Design	✓	Notes / Comments	Approved
Cover Sheet and Site Location Plan			
Existing Survey and Services.			
Proposed Construction and Set out.			
Proposed Signal and Phasing Layout.			
Proposed Ducting and Cable Diagram.			
Tactile Pavers and Pedestrian Layout.			
Proposed Road Marking and Signage.			
Vehicular Tracking Plan.			
Proposed Street Lighting.			
Standard Details (optional).			
Controller Information Sheet (CIS).			

RAMM AMDS compliant Data Submission (inlcuding attachment to multimedia.			

Applicant / Consultant			QLDC
Software Development	✓	Notes / Comments	Approved
Controller Information Sheet			
.SFT Wintraff Test Report			

5 TRAFFIC SIGNALS SOFTWARE GUIDELINES

Purpose

The purpose of this document is to give an understanding of the QLDC requirements when undertaking the design, installation or maintenance of traffic signal installations in the Queenstown Lakes District.

Who Should Use This Document?

All consultants, contractors, should use this document and project managers (we refer to as "applicant" in this document) involved in the design, installation and maintenance of traffic signals on behalf of Road Controlling Authorities (RCA) in the Queenstown Lakes District. Where for example an upgrade is being carried out by an RCA the applicant shall be the assigned. This would in most situations be the traffic signal contractor who would have most technical experience in providing the relevant information required.

QLDC has prepared this document to assist practitioners when designing traffic signal installations. Although this document has technical and specialist content, the applicant must read in conjunction with this document, the QLDC CoP. The QLDC CoP contains details on document management, flow charts and describes processes. The intent is to show what is expected in the application. The applicants should also refer to NZTA P43 Specification for Traffic Signals.

This guideline has been created to ensure that the designs of all intersections are to the highest standard, with variations being the exception rather than the norm. It is important that the information submitted as part of new or modified traffic signal layouts are standardised as much as possible. This will enable any further changes that may result from changing traffic conditions to be implemented quickly and simply.

This document lists the information that must be shown on the drawing for the traffic signal layout plan. The guideline information covers all the basic data required for a contractor to install the traffic signal equipment. The information will assist QLDC and WTOC to review the Controller Information Sheets (CIS) and the Controller personality as well as allow WTOC to set up the intersection on the SCATS network and provide good operational performance.

This document covers in some detail requirements that must be included in other plans. For example, requirements pertaining to any physical works such as; existing survey and services, proposed construction or road marking. These are essential to provide as complete a picture as possible. The applicant's project team members are expected to have the experience and knowledge required to provide the relevant details, particularly the production of software and, CIS and traffic signal design. QLDC are not responsible for providing training or resources for designers who are new to the industry as there are suitable courses and consultants who can provide training.

5.1 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:

> QLDC Land Development & Subdivision Code of Practice – 2022.

> QLDC CoP Appendix L – Traffic Signal Guidelines.

> NZTA P43 Specification for Traffic Signals.

> AUSTROADS Traffic Management Guides.

> Road Traffic Standards (RTS) 14.

> NZTA Pedestrian Planning and Design Guidelines.

> Other NZTA, TCC, RMS, AS / NZ standards as agreed from time to time.

The specification of traffic signals equipment shall comply with the current version of the QLDC CoP or a written agreement with QLDC for the use of specific components shall be obtained.

The contractor is responsible for ensuring that all equipment that is installed meets the minimum standards. If there is any doubt the contractor shall be required to provide evidence that the product meets the QLDC requirements.

5.1.1 Reference Material

The traffic signal is very specialist and partially in New Zealand where resources and training is minimal. There we have provided some recommended documents listed below to assist in the processes required.

> NSW Roads & Maritime Services, Traffic Modelling Guidelines.

> NSW Roads & Maritime Services, Traffic Signal Design.

> Australian Road Research Board (ARRB), Traffic Signals: Capacity and Timing Analysis.

> Signals National User Group (SNUG)

5.1.2 Detectors

All loop positions are to be determined early in the design.

All controlled lanes must have detector loops installed including for example left turn lanes under Give Way control to count vehicles only, if there are sufficient detector inputs available.

Advance loops may be required in some instances to optimise signal operation and enhance safety in high speed environments. If the controller capacity allows, detector loops are to be included in uncontrolled slip lanes for traffic counting purposes. Loops on bridge decks or approach slabs should be avoided where practical. Refer Section 3 of this Appendix.

Where there are a high number of cyclists the type and style of loops shall be clearly shown. Cycle lane design requires special attention and these shall be considered on a site by site basis.

Special care is required to ensure that the placement of the loop is in the correct position within the lane. Failure to confirm positions prior to sealing can mean that another loop may be required to be saw cut into the new seal. All loop locations to be accurately located and included on as-built drawings.

The ideal or preferred methodology of installing loops is to place them under the bedding of the pavement prior to sealing in order to avoid repeatedly cutting in a short period of time.

The requirements for the detector numbering convention are detailed in 1.2.6.1 of this Appendix. If the controller cabinet is relocated then the site must be renumbered to comply with the standard convention.

Configure virtual red light running loops in the CIS when there is spare capacity to allow, consult with QLDC as required.

5.1.2.1 Vehicle Detectors

Detectors are numbered anticlockwise from the controller assuming that a line is drawn from the controller through the centroid of the intersection.

The first circuit is the stop line loops, departure loops and counting loops are numbered first, with the departure loop being numbered after the stop line loop it is associated with.

The second circuit is the dynamic loops, followed by the advance dynamic loops.

The reason detectors are numbered anticlockwise is so that an approach will read numerically correct left to right when viewed on a SCATS System Monitor display.

Where there is a secondary part to the signals such as at interchanges, the first circuit is around the part of the intersection closest to the controller, then around the second part of the intersection. Then back to the first part of the intersection for the second circuit. A line is drawn from the controller through the centroid of the second part of the intersection to give the starting point for each numbering circuit.

If a controller is relocated then the site must be renumbered to comply with the standard

5.1.2.2 Detector Card Configurations for AS 2578 VC5/6 Compliant Controllers

When the new AS 2578 and VC5/6 compliant controllers were first introduced each Detector card had 16 Internal Detectors (Vehicles) and 16 External Detectors (Pedestrian). Since then the manufacturers have provided some flexibility to allow combinations to be used. It is important for the designer to understand and number the loops and pedestrian call detectors in the appropriate manner as this impacts directly on the preparation of the software. Furthermore, VC6 controllers have extended the capacity therefore check with the manufacturer on these specifications.

5.1.2.3 Pedestrian Detectors

Pedestrian detectors are numbered depending upon the card in use. First ascertain the number of detectors available at the controller if it is an existing site or determine the requirement if new. TSC3 Controller Detector cards come in groups of four ranging between 4 and 32.

The AS 2578 Compliant controllers come with a 16, 24 or 32 input Detector card. This consists of vehicle inputs and external inputs. Again, this will depend on the type of controller and the configuration applied.

The pedestrian detectors are numbered from the highest number down as follows and may include more than four pedestrian facilities:

PEDESTRIAN / WALK NUMBER	1 PED	2 PEDS	3 PEDS	4 PEDS	5 PEDS
W1	16	16	16	16	16
W2		15	15	15	15
W3			14	14	14
W4				13	13
W5					12

Table 5-1: Pedestrian Detector Slot Numbering (16 Detector)

A similar configuration will apply across the top end for 24 and 32 detector cards.

In ground and above ground pedestrian detection systems will need to be configured as a pedestrian input. Using Table 5-1 as an example, for four pedestrians we use inputs 13-16 and if we were to install above ground pedestrian detection for all the walks the detection would be numbered 11-4 leaving one unused before the pedestrians. MSS bits shall be used and numbered the same as the pedestrian detector number (where possible). Furthermore all non-loop detectors shall have an MSS assigned for each unit for additional SCATS variation options and monitoring options.

5.1.3 Pole Numbering

Poles are numbered in a clockwise direction from the controller assuming that a line in drawn from the controller to the centroid of the intersection.

Where there is a secondary part to the signals such as at interchanges, the intersection closest to the controller shall be numbered first then the additional part can be numbered in the same format assuming that a line is drawn from the controller to the centroid of the secondary part of the intersection.

If a controller is relocated then the site must be renumbered to comply with the standard convention.

5.1.4 Signal Groups

With AS 2578 and VC5 compliant controllers, the number of signal groups can range from 4 to 32 in modules of four signal groups. The recent changes to VC6 controllers may change some of the content listed below, therefore discussions with the manufacturer is expected during design.

Pedestrian signal groups in a sixteen group controller will be denoted as: W1=16, W2=15, W3=14, & W4=13). If there are only two Pedestrian groups then W1=16 and W2=15.

5.1.5 Phasing

The phasing diagram must show the following:

> Each phase in a separate box with the phase label inside the box corner A, F, F1, etc.

> Show only the movements that display green in each phase

> Indicate movements by an arrow pointing in the direction that traffic will travel

> Signal groups shown in a circle at the point of the movement arrow for vehicles and beside

> Pedestrian movements

> Any Special Flags inside the phase box Z, Z+, etc.

> Indicate if filter turn movements are permitted

> Label phasing to lanterns

> Default and Alternative phasing to be shown. Alternative phasing must show split phasing for each approach to assist in maintenance and operations.

> An all red phase to be added to all plans for operational requirements, no detector or input to be assigned to call/demand. Shall be operated only by SCATS Dwell.

The phase sequence must be shown on the plan adjacent to the phasing diagram.

In general, all traffic signals shall be consistent with the standard RMS configuration. Standard phasing configurations are detailed below. Where standard phasing configurations are not appropriate due to the site or traffic flow conditions, the phasing should be designed to:

> Minimise the number of phases

> Minimise cycle time

> Run as many compatible movements as possible in each phase

> Restrict each phase to non-conflicting movements

> Allow each movement to run in as many phases as possible (preferably allowing as many as possible to overlap from the previous phase or into the following phase), and

> Comply as closely as possible with the standard RMS configuration. Examples of a range of standard arrangements are found on the following pages of this document.

The phasing design should consider the use of filter right turn movements. The phasing design should provide the most flexible operation that will accommodate changes in traffic conditions without the need to reprogram the controller personality. This may result in a phasing sequence in which not all phases are used initially. An example of this is the inclusion of repeat right turn phases.

The phasing sequence (i.e. the order in which each phase runs) should be designed to provide the optimum coordinated flow along a corridor. This may change at different times of the day.

5.2 STANDARD TYPES

5.2.1 Midblock Pedestrian Crossing

5.2.1.1 Required Signal Groups

5.2.1.1.1 Vehicle

> SG 1 Main road through movement clockwise from the controller

> SG 2 Main road through movement opposite to SG 1.

5.2.1.1.2 Pedestrian

The midblock crossing will normally have one pedestrian and can be catered for with a much smaller controller than would otherwise be required.

Pedestrian Movement 1 – At a right angle to the main vehicle flow (e.g. SG 4, 8, 12 or 16) but typically SG4.

Note:

Staggered / two stage pedestrian crossings require an additional signal group as the walk phases are normally split.

5.2.2 Staggered Pedestrian Crossing

The configuration of a staggered pedestrian crossing should be left to right. Although this may not be practical, this requirement is so pedestrians are walking towards the main traffic flow. Careful consideration for poles and access would be required in the design.

5.2.2.1 Required Signal Groups

5.2.2.1.1 Vehicle

> SG 1 - Main road through movement clockwise from the controller
> SG 2 - Main road through movement opposite to SG1.

5.2.2.1.2 Pedestrian

> Pedestrian Movement 1 – At a right angle with SG1 (e.g. SG 4, 8, 12 or 16) but typically SG4
> Pedestrian Movement 2 – At a right angle with SG2 (e.g. SG 3, 7, 11 or 15) but typically SG3.

5.2.3 T-Intersections

5.2.3.1 Required Signal Groups

5.2.3.1.1 Vehicle

> SG 1 - Main Road through movement adjacent to main road right turn
> SG 2 - Main Road through movement conflicting with main road right turn
> SG 3 – Right turn from main road
> SG 4 – Right turn or right and left turn from side road.

5.2.3.1.2 Pedestrian

> Pedestrian Movement 1 – across side road (i.e. parallel with SG2)
> Pedestrian Movement 2 – across main road and to the left of the side road.

5.2.3.2 Optional Signal Groups

Where provided use next available signal group in order below.

5.2.3.2.1 Vehicle

> Left turn from main road into side road
> Left turn from side road into main road.

5.2.3.2.2 Pedestrian

If an existing controller has eight signal groups and more than four vehicle groups then it may be necessary to renumber the pedestrian signal groups.

> Pedestrian movement across controlled left turn slip lane from main road
> Pedestrian movement across controlled left turn slip lane from side road.

5.2.3.3 Phasing

Normal Phase Sequence = A : C : D

Alternative phase sequence A : B : C : D

<u>A Phase</u> – SG's 1, 2 and Pedestrian Movement 1.

May also include left turn movement into side road from main road if controlled by a separate signal group.

Note : Where considered safe the right turn movement may be permitted to FILTER turn. Filtering will be controlled through the introduction of the Z- flag. Filtering enabled under Flexilink or Masterlink only. If filtering is enabled, the main road left turn signal group (if provided) shall be in the OFF state.

<u>B Phase</u> – SG's 1 and 3.

May also include left turn from side road into main road if controlled by a separate signal group.

Note : B Phase introduction is controlled through introduction of Z+ flag in Flexilink or Masterlink only.

C Phase – SG 4 and Pedestrian Movement 2.

May also include the left turns into and out of the side road, if controlled by separate signal groups.

D Phase – SG's 1 and 3.

May also include left turn from side road into main road if controlled by a separate signal group.

5.2.4 Split Side Road Phases

5.2.4.1 Required Signal Groups

5.2.4.1.1 Vehicle

> SG 1 - Main road through movement clockwise from the controller
> SG 2 - Main road through movement opposite to SG 1.
> SG 3 - Right turn adjacent to SG 1
> SG 4 - Right turn adjacent to SG 2
> SG 5 - Side road movements to the left of SG 1 (clockwise from SG 1)
> SG 6 - Side road movements to the left of SG 2 (clockwise from SG 2).

5.2.4.1.2 Pedestrian

> Pedestrian Movement 1 – parallel to SG 1 (e.g. SG 16)
> Pedestrian Movement 2 – parallel to SG 2 (e.g. SG 15)
> Pedestrian Movement 3 – pedestrian on the left of the C phase side road (e.g. SG 14)
> Pedestrian Movement 4 – pedestrian on the left of the D phase side road (e.g. SG 13).

5.2.4.2 Optional Signal Groups

Where provided use next available signal group in order below.

5.2.4.2.1 Vehicle

> Right turn adjacent to SG 5 (red arrow only for pedestrian protection)
> Right turn adjacent to SG 6 (red arrow only for pedestrian protection)
> Left turn adjacent to SG 1
> Left turn adjacent to SG 2
> Left turn from C phase side road
> Left turn from D phase side road.

5.2.4.2.2 Pedestrian

> Pedestrian across controlled left turn slip lane from main road and parallel to SG 1
> Pedestrian across controlled left turn slip lane from main road and parallel to SG 2
> Pedestrian across controlled left turn slip lane from D phase side road
> Pedestrian across controlled left turn slip lane from E phase side road.

5.2.4.3 Phasing

Normal Phase Sequence = A : D : E : F

A Phase – SG's 1, 2, Pedestrian Movements 1 and 2.

May also include left turn movements into side road from main road if controlled by separate signal groups.

Note: Where considered safe the right turn movements may be permitted to filter turn. Filtering shall be permitted on the AB (SG1) approach under the following conditions:

> The mode of operation is Masterlink or Flexilink AND XSF 1 bit is set and there is Z- flag present
> Filtering shall be permitted on the AC (SG2) approach under the following conditions:
> The mode of operation is Masterlink or Flexilink AND XSF 2 bit is set and there is Z- flag present.

Note: If filtering is enabled, the main road left turn signal groups (if provided) shall be in the "OFF" state.

B Phase – SG's 1, 3, Pedestrian Movement 1.

May also include left turn parallel to SG1 and from D phase side road if controlled by separate signal groups

C Phase – SG5, Pedestrian Movement 3.

May also include left turn parallel to SG2 and from D phase side road if controlled by separate signal groups

D Phase (least busiest side road movement) –SG 6 and Pedestrian Movement 4.

May also include left turn from main road parallel to SG 1 if controlled by a separate signal group.

5.2.5 Single Diamond Overlap with Split Side Road Phases

5.2.5.1 Required Signal Groups

5.2.5.1.1 Vehicle

- SG 1 Main road through movement clockwise from the controller
- SG 2 Main road through movement opposite to SG 1.
- SG 3 – Right turn adjacent to SG 1
- SG 4 – Right turn adjacent to SG 2
- SG 5 – Side road movements to the left of SG 1 (clockwise from SG 1)
- SG 6 – Side road movements to the left of SG 2 (clockwise from SG 2).

5.2.5.1.2 Pedestrian

- Pedestrian Movement 1 – parallel to SG 1 (e.g. SG 16)
- Pedestrian Movement 2 – parallel to SG 2 (e.g. SG 15)
- Pedestrian Movement 3 – pedestrian on the left of the D phase side road (e.g. SG 14)
- Pedestrian Movement 4 – pedestrian on the left of the E phase side road (e.g. SG 13).

5.2.5.2 Optional Signal Groups

Where provided use next available signal group in order below.

5.2.5.2.1 Vehicle

- Left turn adjacent to SG 1
- Left turn adjacent to SG 2
- Left turn adjacent to SG 5 (red arrow only for pedestrian protection)
- Left turn adjacent to SG 6 (red arrow only for pedestrian protection).

5.2.5.2.2 Pedestrian

- Pedestrian across controlled left turn slip lane from main road and parallel to SG 1
- Pedestrian across controlled left turn slip lane from main road and parallel to SG 2
- Pedestrian across controlled left turn slip lane from D phase side road
- Pedestrian across controlled left turn slip lane from E phase side road.

5.2.5.3 Phasing

Normal Phase Sequence = A : D : E : F

A Phase – SG's 1, 2, Pedestrian Movements 1 and 2.

May also include left turn movements into side road from main road if controlled by separate signal groups.

Note: Where considered safe the right turn movements may be permitted to filter turn. Filtering shall be permitted on the AB (SG 1) approach under the following condition:

- The mode of operation is Masterlink or Flexilink AND XSF 1 bit is set and there is no Z+ flag present (i.e. C phase is not permitted to run)

Filtering shall be permitted on the AC (SG 2) approach under the following condition:

> The mode of operation is Masterlink or Flexilink AND XSF 2 bit is set and there is no Z- flag present (i.e. B phase is not permitted to run)

Note: If filtering is enabled, the main road left turn signal groups (if provided) shall be in the OFF state i.e. filtering also.

B Phase – SG's 1, 3, Pedestrian Movement 1.

May also include left turn parallel to SG 1 and from E phase side road if controlled by separate signal groups

Note : Phase introduction controlled through introduction of Z- flag in Flexilink or Masterlink only.

C Phase – SG's 2, 4, Pedestrian Movement 2.

May also include left turn parallel to SG 2 and from D phase side road if controlled by separate signal groups

Note : Phase introduction controlled through introduction of Z+ flag in Flexilink or Masterlink only.

D Phase (least busy side road movement) – SG 5 or SG 6 and Pedestrian Movement 3 or 4.

May also include left turn from main road parallel to SG 1 if controlled by a separate signal group.

E Phase – SG 5 or SG 6 and Pedestrian Movement 3 or 4.

May also include left turn from main road parallel to SG 2 if controlled by a separate signal group.

F Phase – SG's 3 and 4.

May also include left turn movements from side roads, if controlled by separate signal groups.

F1 Phase – SG's 1, 3 and Pedestrian Movement 1.

May also include left turn parallel to SG 1 and from E phase side road if controlled by separate signal groups.

F2 Phase – SG's 2, 4 and Pedestrian Movement 2.

May also include left turn parallel to SG 2 and from D phase side road if controlled by separate signal groups.

5.2.6 Single Diamond Overlap with Combined Side Road Phase

5.2.6.1 Required Signal Groups

5.2.6.1.1 Vehicle

> SG 1 - Main road through movement clockwise from the controller
> SG 2 - Main road through movement opposite to SG 1
> SG 3 - Right turn adjacent to SG 1
> SG 4 - Right turn adjacent to SG 2
> SG 5 - Side road to the left of SG1
> SG 6 - Side road to the left of SG2.

5.2.6.1.2 Pedestrian

> Pedestrian Movement 1 – parallel to SG 1 (e.g. SG 16)
> Pedestrian Movement 2 – parallel to SG 2 (e.g. SG 15)
> Pedestrian Movement 3 – parallel and to the left of SG 5 (e.g. SG 14)
> Pedestrian Movement 4 – parallel and to the left of SG 6 (e.g. SG 13)

5.2.6.2 Optional Signal Groups

Where provided use next available signal group in order below.

5.2.6.2.1 Vehicle

> Right turn adjacent to SG 5 (red arrow only for pedestrian protection)
> Right turn adjacent to SG 6 (red arrow only for pedestrian protection)
> Left turn adjacent to SG 1
> Left turn adjacent to SG 2
> Left turn adjacent to SG 5 (red arrow only for pedestrian protection)
> Left turn adjacent to SG 6 (red arrow only for pedestrian protection).

5.2.6.2.2 Pedestrian

> Pedestrian across controlled left turn slip lane from main road and parallel to SG 1
> Pedestrian across controlled left turn slip lane from main road and parallel to SG .

5.2.6.3 Phasing

Normal Phase Sequence = A : D : E

A Phase – SG's 1, 2, Pedestrian Movements 1 and 2.

May also include left turn movements from main road if controlled by a separate signal group.

Note: Where considered safe the right turn movements may be permitted to filter turn. Filtering shall be permitted on the AB (SG 1) approach under the following condition:

> The mode of operation is Masterlink or Flexilink AND XSF 1 bit is set and there is no Z+ flag present (i.e. C phase is not permitted to run)

Filtering shall be permitted on the AC (SG 2) approach under the following condition:

> The mode of operation is Masterlink or Flexilink AND XSF 2 bit is set and there is no Z- flag present (i.e. B phase is not permitted to run).

Note: If filtering is enabled, the main road left turn signal groups (if provided) shall be in the OFF state.

B Phase – SG's 1, 3, Pedestrian Movement 1.

May also include left turn adjacent to SG 1 if controlled by a separate signal group.

Note : Phase introduction controlled through introduction of Z- flag in Flexilink or Masterlink only.

C Phase – SG's 2, 4, Pedestrian Movement 2.

May also include left turn adjacent to SG 2 if controlled by a separate signal group

Note : Phase introduction controlled through introduction of Z+ flag in Flexilink or Masterlink only.

D Phase – SG 5, 6, Pedestrian Movements 3 and 4.

E Phase – SG's 3 and 4.

E1 Phase – SG's 1, 3 and Pedestrian Movement 1.

May also include left turn adjacent to SG 1 if controlled by a separate signal group.

E2 Phase – SG's 2, 4 and Pedestrian Movement 2.

May also include left turn adjacent to SG 2 if controlled by a separate signal group.

5.2.7 Double Diamond Overlap

5.2.7.1 Required Signal Groups

5.2.7.1.1 Vehicle

> SG 1 Main road through movement with stretched phase, clockwise from the controller
> SG 2 Main road through movement opposite to SG 1
> SG 3 – Right turn adjacent to SG 1
> SG 4 – Right turn adjacent to SG 2
> SG 5 Side road through movement clockwise from SG 1
> SG 6 Side road through movement clockwise from SG 2

> SG 7 – Right turn adjacent to SG 5
> SG 8 – Right turn adjacent to SG 6.

5.2.7.1.2 Pedestrian

> Pedestrian Movement 1 – parallel to SG 1 (e.g. SG 16)
> Pedestrian Movement 2 – parallel to SG 2 (e.g. SG 15)
> Pedestrian Movement 3 – parallel to SG 5 (e.g. SG 14)
> Pedestrian Movement 4 – parallel to SG 6 (e.g. SG 13).

5.2.7.2 Optional Signal Groups

Where provided use next available Signal Group in order below.

5.2.7.2.1 Vehicle

> Left turn adjacent to SG 1
> Left turn adjacent to SG 2
> Left turn adjacent to SG 5
> Left turn adjacent to SG 6.

5.2.7.2.2 Pedestrian

> Pedestrian across controlled left turn slip lane from main road and adjacent to SG 1
> Pedestrian across controlled left turn slip lane from main road and adjacent to SG 2
> Pedestrian across controlled left turn slip lane from main road and adjacent to SG 5
> Pedestrian across controlled left turn slip lane from main road and adjacent to SG 6.

5.2.7.3 Phasing

Normal Phase Sequence = A : D : E : G.

A Phase – SG's 1, 2, Pedestrian Movements 1 and 2.

May also include left turn movements from main road if controlled by separate signal groups.

Note : Where considered safe the right turn movements may be permitted to FILTER turn. Filtering shall be permitted on the A-B (SG 1) approach under the following condition:

> The mode of operation is Masterlink or Flexilink AND XSF 1 bit is set and there is no Z+ flag present (i.e. C phase is not permitted to run)

Filtering shall be permitted on the AC (SG 2) approach under the following condition:

> The mode of operation is Masterlink or Flexilink AND XSF 2 bit is set and there is no Z- flag present (i.e. B phase is not permitted to run)

Note: If filtering is enabled, the main road left turn signal groups (if provided) shall be in the OFF state.

B Phase – SG's 1, 3, Pedestrian Movement 1.

May also include left turn parallel to SG 1 and left turn parallel to SG 6 if controlled by separate signal groups

Note : Phase introduction controlled through introduction of Z- flag in Flexilink or Masterlink only.

C Phase – SG's 2, 4, Pedestrian Movement 2.

May also include left turn parallel to SG 2 and left turn parallel to SG 5 if controlled by separate signal groups.

Note : Phase introduction controlled through introduction of Z+ flag in Flexilink or Masterlink only.

D Phase – SG's 7 and 8.

May also include left turn movements from main road, if controlled by separate signal groups.

D1 Phase – SG's 5, 7 and Pedestrian Movement 3.

May also include left turn parallel to SG 1 and left turn parallel to SG 5 if controlled by separate signal groups.

D2 Phase – SG's 6, 8 and Pedestrian Movement 4.

May also include left turn parallel to SG 2 and left turn parallel to SG 6 if controlled by separate signal groups.

E Phase – SG's 5, 6, Pedestrian Movements 3 and 4.

May also include left turn movements from side road to main road if controlled by separate signal groups.

Note: Where considered safe the right turn movements may be permitted to FILTER turn. Filtering shall be permitted on the D1-E-F1 (SG 5) approach under the following condition:

> The mode of operation is Masterlink or Flexilink AND XSF 3 bit is set and there is no XSF 6 bit present (i.e. F2 phase is not permitted to run)

Filtering shall be permitted on the D2-E-F2 (SG 6) approach under the following condition:

> The mode of operation is Masterlink or Flexilink AND XSF 3 bit is set and there is no XSF 5 bit present (i.e. F1 phase is not permitted to run).

Note: If filtering is enabled, the main road left turn signal groups (if provided) shall be in the OFF state.

F1 Phase – SG's 5, 7 and Pedestrian Movement 3.

May also include left turn parallel to SG 6 if controlled by a separate signal group.

Note: Phase introduction controlled through introduction of XSF 5 Bit in Flexilink or Masterlink only.

F2 Phase – SG's 6, 8 and Pedestrian Movement 4.

May also include left turn parallel to SG 5 if controlled by a separate signal group.

Note: Phase introduction controlled through introduction of XSF 6 Bit in Flexilink or Masterlink only.

G Phase – SG's 3 and 4.

May also include left turn movements from side roads, if controlled by a separate signal group.

G1 Phase – SG's 1, 3 and Pedestrian Movement 1.

May also include left turn parallel to SG 1 and left turn parallel to SG 6 if controlled by a separate signal groups.

G2 Phase – SG's 2, 4 and Pedestrian Movement 2.

May also include left turn parallel to SG 2 and left turn parallel to SG 5 if controlled by a separate signal groups

5.2.8 Filtering Right Turn Movements

At most intersections right turning traffic that has opposing movements will be provided for by installing a separate signal display, giving the right turning motorist a protected turn at some time in the phasing sequence. However, under strict criteria filter turn movements may be permitted in order to improve intersection efficiency.

Whilst the provision of filter turns may improve efficiency, it reduces the potential safety as conflicting movements may now occur. The phasing design must consider a balance between safety and efficiency. When considering allowing filtering, safety must be given a higher weighting in the decision process.

The phasing design at adjacent intersections should also be considered to provide consistency along a corridor and preferably throughout the region.

The operation of such movement should be designed and implemented with prior consultations with QLDC.

5.2.9 Repeat Right Turn Phases

A repeat right turn is where the right turn movement is introduced for a second time within the same phase cycle.

Repeat right turns can be provided at any site with a right turn phase. Generally the controller logic will have two phases with exactly the same movements (i.e. for a T-intersection B and D) with one phase only introduced when a special facility signal is activated (normally B using the Z+ flag).

Repeat right turn phasing can only be used under Masterlink or Flexilink control modes (not in isolated mode) and is generally provided at peak times. It is unusual to have a repeat right turn phase operating 24 hours a day.

Repeat right turn phasing is normally used where the single right turn phase does not provide sufficient capacity within a cycle for specific flow periods, or it is necessary for progression within a coordinated system.

A typical use is where a right turn bay is too short to cope with the number of right turning vehicles that can arrive within the cycle which results in the right turn queue extending into and blocking the through traffic lane. This reduces the capacity for the through movement and increases the risk of nose to tail type crashes occurring. The use of the repeat right turn is particularly important, under these circumstances, where there is only one through lane.

Repeat right turn phasing should only be considered under the above mentioned conditions. Generally, where vehicles may queue outside of the through lane (i.e. on a painted median), it is more efficient to provide a longer single right turn phase than two short phases. Installation of queue detection loops to be considered in the design.

5.2.10 Pedestrian Control

The hierarchy of signalised pedestrian control strategies range from providing full pedestrian protection through to partial protection during the early stages of the crossing movement. They fit broadly into the following range:

i. Exclusive pedestrian phase with full protection and all vehicle traffic stopped. Also known as Barnes Dance. This is only used where pedestrian numbers are high, in CBD.

ii. Full protection for the whole Walk and Clearance using red arrow.

iii. Partial protection for part of the Walk and Clearance using red arrow and individual push button inputs. Red arrow on a minimum of 6 seconds for one direction and the other direction to be calculated to the last crossing lane using 1.5m per second (this can be reduced on site as required)

iv. Full protected staggered or staged pedestrian movements.

The method of control adopted at any specific site is based on location, traffic volumes, pedestrian volumes and type (i.e. age or disability), intersection layout combined with the aim to provide safe, efficient movement for all users. However, when selecting control options, it is important to ensure, whenever possible, that a consistent approach is adopted within any given corridor. This may result in a more conservative approach being adopted at some intersections to maintain uniformity throughout that corridor.

At signalised intersections, near schools, where there is a high pedestrian demand at the same time each day, the signal operation should be adjusted to cater for the reoccurring demand. This will generally be achieved by increasing the Walk’ and/or clearance times.

It is preferable to have all pedestrian push button inputs wired and configured in the CIS individually to enhance pedestrian protection.

MSS bits to be used for every push button to enhance the variation options in Scats. (All non-loop detectors shall have an MSS assigned for each unit for additional Scats variation options and monitoring options).

5.2.11 Cyclists

Cycle lanes are being progressively introduced along some of the main corridors. Cyclists are features managed as part of the ‘traffic mix’ and there are currently limited special facilities for them at signalised intersections. These facilities are generally in the form of advance boxes or hook turn boxes and do not require special traffic signal control. Where cyclists may be on a side road or one that is not reverted to during phase sequence then detectors may be required to demand the phase for the cyclist.

Cycle detector loops are numbered in sequential order as part of the first circuit of vehicle detectors. Cycle call buttons are external inputs and numbered in descending order after the pedestrian inputs, e.g. W1=32, W2=31, C1=30.

Special care and attention to the detector position, type and detector alarm to be used in the cycle lane and / or cycle box.

Where cycle boxes are used they shall always be behind the traffic signal primary pole.

Consultation with QLDC is required at an early stage so we can consult the users groups.

5.2.12 Bus Lanes

Bus priority is becoming more common and requires the allocation of a signal group to each approach using the same convention as above for individual sites. If the bus signal group is demanded then the controller puts in a pre-specified delay to the through movement signal group. Where bus loops are installed these are numbered as part of the first circuit of vehicle detectors in sequential order. Where a separate signal group is provided for bus movements, these are numbered last, after all other vehicle signal groups.

Appendix N- Pipe Decommissioning Specification (Informative)

Basic specification for decommissioning pipes, subject to alteration should the onsite situation require and approval given by monitoring engineer and QLDC:

- Existing AC pipes exposed during works must be removed to the extents exposed and disposed of responsibly, irrespective of the parameters listed below. If remaining operational, the existing pipe must be replaced with a suitable alternative to the extents exposed.
- Valves, hydrants, fittings and associated street furniture must be removed from all pipe work being decommissioned. These items must be disposed of responsibly; recycling must be prioritised over landfill where practicable.
- Decommissioned existing pipes with **<600 mm** cover must be removed. Pipe must be disposed of responsibly; recycling should be prioritised, if possible, over landfill.
- Existing pipes with between **600 mm and 1000 mm** cover must be assessed against the following hierarchy of treatment:
    1. If reuse as a future utilities duct is possible, cap pipe and ensure its alternate use is captured on as-built information. Where long lengths of reusable pipes are exposed, these pipes must have marker tape, applicable to their future use, installed during backfilling. Assessment for reuse must consider the condition (based on CCTV inspection data where possible) and location of the pipe and the associated structural integrity of the pipe subject to the existing or future possibility of vehicle loading along its alignment. Separation of services in accordance with the QLDC LDSCoP must be achievable.
    2. If reuse is not feasible/practical, the following hierarchy of treatment must be followed, subject to feasibility:
        1. Remove and recycle
        2. Remove and landfill
        3. Internally grout full extent of pipe*
- Existing pipes with **>1000 mm** cover must be assessed against the following hierarchy of treatment:
    1. If reuse as a future utilities duct is possible, cap and mark pipe (marker tape appropriate for its future use). Where long lengths of reusable pipes are exposed, these pipes must have marker tape, applicable to their future use, installed during backfill. Assessment for reuse must consider the condition (based on CCTV inspection data where possible) and location of the pipe and the associated structural integrity of the pipe subject to the existing or future possibility of vehicle loading along its alignment. Separation of services in accordance with the QLDC LDSCoP must be achievable.
    2. If reuse is not feasible/practical, the following hierarchy of treatment must be followed, subject to feasibility:
        1. Internally grout full extent of pipe*
        2. Remove and recycle
        3. Remove and landfill

Notes

- *As-built information must be updated appropriately for the future presence/function of the decommissioned pipework. Information must be provided to QLDC for update of their GIS.*
- *Cover requirements noted are to finished surface level.*
- **Grouting of a pipe is dependent on the diameter of the pipe and the volume of grout required for filling. Where a pipe identified for grouting is >400mm ID, approval for grouting must be sought from the monitoring Engineer and QLDC.*

Disclaimer

PRESSURE SEWER SYSTEM DESIGN STANDARDS

QUEENSTOWN LAKES DISTRICT COUNCIL

1 INTRODUCTION

This document is a supplement to the QLDC Subdivision and Land Development Code of Practice (CoP). It documents the technical standards for the design of Pressure Sewer Systems (PSS) in Queenstown Lakes District and must be read in conjunction with the CoP. Together with the CoP this document details all the information required as well as design and construction standards to be met by developers when seeking engineering acceptance for land development serviced by a PSS.

This document does not cover private pumping facilities to the gravity network (known as pump ups). These are addressed in the Appendix G – Sewer Pump Stations section of the CoP.

2 INTERPRETATION

The definition of a Pressure Sewer System and On-Property Pressure Sewer Equipment will be in accordance with the Queenstown Lakes District Council (QLDC) Pressure Sewer Systems Policy (PSS Policy).

3 STANDARDS AND GUIDANCE DOCUMENTS

Further to Section 4.3 of the CoP and the standard PSS drawings included in the CoP, the other relevant standards and guidance documents are:

- Queenstown Lakes District Council Pressure Sewer Systems Policy;
- New Zealand Building Code (Clause G9 Electricity and Clause G13 Foul Water);
- AS/NZS 1546.1 - On-site domestic wastewater treatment units - Septic tanks;
- AS/NZS 1547 - On-site domestic wastewater management;
- AS/NZS 3000 – Electrical installations (known as the Australian/New Zealand Wiring Rules);
- AS/NZS 3500.2 – Plumbing and Drainage – Sanitary Plumbing and Drainage;
- Queenstown Lakes District Council Water Supply Mains Pressure Testing Code of Practice;
- Pressure Sewer Manufacturer Guidelines
- QLDC Drawing No.: PSS-1 - QLDC Pressure Sewer System Standard Detail
- QLDC Drawing No.: PSS-2 - QLDC Pressure Sewer - Typical On-Property Layout
- QLDC Drawing No.: PSS-3 - PRESSURE SEWER DISCHARGE INTO MANHOLES FOR DN90 - DN180 PIPES
- QLDC Drawing No.: PSS-4 - PRESSURE SEWER DISCHARGE INTO MANHOLESFOR UP TO DN63 PIPES
- QLDC PSS Installer Declaration Form
- Connection to Council Services (CCS) Application Form

This information is correct at date of issue. Always check in the relevant QLDC policy manual that this copy is the most recent version

4 APPLICATION AND USE OF PSS

The selection of the primary wastewater collection system for a proposed catchment must be agreed with QLDC prior to proceeding with preliminary design. PSS must be used in the pressure sewer areas as defined in the District Plan. The use of pressure sewer systems outside of the mandatory pressure sewer areas is at the discretion of QLDC.

Where a PSS is proposed outside of the mandatory pressure sewer area a detailed technical submission justifying the use of a PSS must be provided in accordance with the PSS Policy.

As per the PSS policy, the on-property pressure sewer equipment, including the gully trap and piping, a pump or grinder pump, collection tank, electrical and control system, and individual discharge pipe up to the private property boundary will installed and owned by the private property owner (refer to the PSS Policy).

Regardless of the eventual ownership of the on-property pressure sewer equipment all requirements as set out in this standard shall apply.

5 APPROVED SUPPLIERS AND CONTRACTORS

Specific pressure sewer system components must only be sourced from an approved supplier, and that same supplier must grant approval of the design and construction of the PSS. Contact QLDC for the current list of approved PSS suppliers. Evidence of the input from an approved supplier shall be provided with the concept plans.

The approved supplier must provide as a minimum the following services:

- Hydraulic design, including modelling if required;
- Input into concept plans including system layout;
- Engagement in a safety in design process;
- Input into engineering drawings, specifications and reports;
- Training of approved system installers and initial oversight of construction;
- Commissioning;
- Troubleshooting/technical support through the Defects Liability Period (DLP); and
- Guarantees / Warranties for the equipment that they have supplied.
- Development and Delivery of the Home-Owner's Manual

The following on-property equipment must be supplied by the approved supplier who provided input into the concept design:

At development stage:

- Boundary kits

At building consent stage:

- Gully trap and piping to the collection tank
- Collection tank and grinder pump;

- Chambers and lids (both trafficable and non-trafficable);
- Electrical and control system, cabinetry and components.
- Piping and connection to the boundary kit

All parts of a PSS must be constructed and commissioned by a Council approved supplier who has been approved for the construction of PSS.

6 SYSTEM DESIGN

The Developers Technical Representative must have oversight of the PSS system design with input from an approved supplier.

Where a development is to be served by pressure sewer, concept plans must be provided and the following must be provided with the concept plans (concept design):

- The operational philosophy of the overall system to show that the design and control requirements have been adhered to (including those for peak smoothing and flushing);
- Evidence of design including future flow rates so demand on downstream infrastructure can be determined by Council;
- For industrial / commercial areas, process data such as estimated daily discharge volumes and peak flow rates as well as sewer discharge characteristics.

6.1 DESIGN METHODOLOGY

The design methodology must be relevant to the operation of the system. Where flow control of any kind, such as peak suppression or flushing, is to be utilised, the system must be modelled by the approved supplier.

If no flow control mechanism is to be utilised, system must be designed by the approved supplier using the Probability Method as outlined in WSA-07. When applying the Probability Method to size pipes, the designer must perform a sensitivity analysis on input parameters such as flow per capita, pipe characteristics and pump units connected and in operation to ensure the selected pipe size meets the design criteria listed in Section 6.2.

6.2 DESIGN CRITERIA

The PSS must be designed to meet the following criteria:

- One PSS chamber, boundary kit and control panel per dwelling (refer also PSS Policy);
- Utilisation of the on-property storage chamber as part of the normal operation of the system in combination with minimised pipe sizes;
- Maximum total dynamic head of 55m;
- Minimum velocity of 0.7m/s;
- Minimum of one flush to be achieved at least once every 24 hours;
- Maximum velocity of 3.5m/s, with exception for at the discharge point as specified in section 7.7.

- Maximum in-network retention time of 6 hours, i.e. the total sewage retention time between upstream entry point at boundary kit and downstream pressure main discharge point. This is to be based on the weighted average of the accumulated retention time in each zone against the total number of connections;
- With the minimum the number of connection points to the existing gravity system.

6.3 STAGING AND SEPTICITY

If the development is to be staged the staging methodology shall be proposed and approval for it sought at concept plan stage. For a staged development the design of the system must ensure that self-cleansing of the system occurs during each phase of development to ensure the risk of septicity is kept to a minimum. Evidence of this, including details of design residence times and velocities at each stage must be supplied with the concept design.

Automated flushing within each part of the network may be used to address the risk of septicity. Automated flushing may also be required in accordance with section 9.2 of this document. Details of any automated flushing must be included in the concept design. This must function during all stages of the development.

If flushing cannot be feasibly achieved by flow control, due to large pipe diameters, staged installation of smaller diameter twin trunk mains may be considered by QLDC. Provision for future twin trunk mains must be installed as part of the first stage of the development and details provided with the concept plans.

Manual flushing as a solution must be authorised by QLDC and may only be utilised in exceptional circumstances. The cost of manual flushing must be met by the developer. Additional infrastructure to facilitate the flushing of mains (such as flushing tanks) will not be permitted.

6.4 DESIGN FLOWS

If a PSS system is expected to service a wet industry or other high-water user, approval must be sought from QLDC at concept design stage that a PSS is an appropriate method of servicing the development. Conversely for an existing PSS, approval must be sought from QLDC at the investigation phase for the building consent if the system is intended to service a wet industry or other high-water user.

Design flows for dry weather must be in accordance with Section 5.3.5 Waste Water Design Criteria of the CoP. For wet weather flow design a peaking factor of 1.2 shall be applied for pressure sewer systems.

6.4.1 HIGH FLOW CONNECTIONS

For connections with the potential to create high peak flows, a suitable means of mitigating the high peak flows must be designed and installed at the time of building consent. Examples of circumstances when high peak flows may be generated include:

- Swimming pool discharges (can be up to 2 l/s for 4 minutes);
- Facilities able to host large events;
- High flow trade premise connections for which a PSS may be an appropriate method of servicing.

The typical mitigation measure is expected to comprise a buffer storage tank to allow for a modulated discharge of wastewater to the pressure sewer system.

In the case of a residential property with a swimming pool the following should be considered:

- reducing pool pump flows;
- an electrical feed from the control panel to the pool backwash pump. This relay should cut power to the backwash pump whenever the alarm is activated.

An appropriate solution to mitigate high peak flows must be confirmed with the PSS supplier and evidence of its feasibility supplied with the building consent application.

6.5 CHAMBER VOLUME

Standard chamber sizes from approved suppliers must be utilised. Details of the standard chamber sizes can be obtained from the approved suppliers. If an installation requires a non-standard chamber approval must be sought from QLDC at building consent stage.

For residential installations the chamber must be sized to provide storage in the chamber above the pump start level equivalent to 24 hours at Average Dry Weather Flow. For trade premise installations the size of the chamber must be selected based on the specific flows for that installation but shall provide a minimum of 24 hours storage. In all cases details of the chamber volume selection are to be supplied with the building consent application.

6.6 MATERIALS

All pipelines for PSS must be constructed from black with cream stripe (colour coded) PE100 PN16 (SDR11) sewer/wastewater compliant pipes that comply with the COP. PSS mains and lateral joints and connections to the boundary kit must be electrofusion or butt fusion jointed. Pipework from the boundary kit to the chamber may be electrofusion or butt fusion or compression jointed.

All pressure Sewer pipework, valves and fittings must use appropriate pressure sewer color coding suitable only for sewer/wastewater applications. Black PE pipe with cream stripe and red surface boxes are required for pressure sewer systems. Use of any pipe and materials intended for other services is strictly prohibited (i.e.: must not use black with blue stripes.)

Chambers must be made of polyethylene or fibre reinforced plastic (FRP). Chamber lids must be made of polyethylene, be child safe and be capable of being locked.

Pumps shall be fully submersible and specifically designed for use in pressure sewer systems.

7 NETWORK REQUIREMENTS

7.1 NETWORK LAYOUT

The network layout must be designed in accordance with the COP and to meet the following criteria:

- PSS mains must have a minimum cover in accordance with the COP and a maximum cover of 1.5m;
- Pressure sewer laterals on private property must have a minimum cover of 600mm where likely to be crossed by vehicles and 450mm elsewhere;
- Bending radii must be greater than 100 x OD of the pipe where the pipe may be tapped on the bend or minimum 75 x OD otherwise;
- Vertical deflections in the alignment must be no greater than 1m in 10m (10%), to reduce the risk of air build-up in the system.
- Network Post construction as-built drawings in accordance with QLDC Asbuilt Specifications and ArcGIS Pro User Guide (3W, OS);

The minimum pipe size for pressure sewer pipes including laterals, is DN40.

7.2 ISLOLATION VALVES

Isolation valves must be positioned:

- On both upstream legs of any three-way branch;
- On the pressure main within 1m downstream of the last house serviced by the pressure sewer system;
- So that there are sufficient valves to allow the isolation of the network into blocks serving no more than fifty properties.

7.3 AIR RELEASE VALVES

PSS pipelines shall be designed in accordance with Section 7.1 to minimise the need for air valves. If a significant high point is unavoidable then an air valve must be installed.

Air valves must be designed to meet the minimum head required to seal the air valve and so eliminate the requirement for drainage. Air valves may be offset no more than four metres from the main. Some minor realignment of the pressure main to minimise this offset may be considered. The pipe connection from the main to the air valve must be the same diameter as the main.

Air valves must be specifically designed for wastewater applications and must meet the following minimum requirements:

- Be rated to PN16;
- Have an epoxy coated cast iron body;
- Be of a double acting anti slam type;
- Be mounted inside a dedicated pit with a Class B vented cover;
- Have an isolation valve to allow maintenance without disruption to PSS main.

Provision of odour treatment at air valve installations may be required. The odour treatment device must be designed to manage intermittent discharges over a range of air flows, be low-profile, damage resistant and effective.

7.4 FLUSHING POINTS

Flushing points must be installed:

- On each branch or sub-zone where the number of connections on a branch line exceeds five (5);
- Downstream of isolating valves, except where there is a downstream flushing point within 100m;
- At 500m intervals along straight sections of main.

In accordance with the wastewater system layout requirements of the COP, flushing points must be installed in a location that is easily accessible for operation and maintenance, being a location where a tanker truck (or equivalent) can be safely parked and operated, given the traffic conditions and access arrangements.

7.5 FLOW METERING

A flow meter must be installed at each of the points of discharge to the gravity network. Meters must be in-line electromagnetic flow meters with a pressure sensor, capable of being connected to Council's telemetry system or another communication method as approved by Council.

7.6 BOUNDARY KIT

A property boundary kit must be installed for all properties served by a pressure sewer system. The concept plans must detail the proposed location of all boundary kits.

The boundary kits must be installed at a uniform distance (150mm min offset) from the property boundary. The following considerations, in descending order of priority, must guide the location of the boundary kit:

1. For a single dwelling the boundary kit should be located as near as practical to the property boundary (150mm min offset), in the road reserve. Where a grassed strip exists between the back of the footpath and the boundary, the boundary kit is to be located in that strip.
2. The boundary kit should be located so as to avoid obstructions of the service line both on the public and private property side.
3. The boundary kit is to be located in a 'non- trafficable' location.
4. If the boundary kit cannot be located in accordance with (1) above, the boundary kit is to be located in compliance with (2) & (3) above.
5. Failing (1) above, the boundary kit can be located in the road reserve so that it can be easily found by operations staff.
6. Failing (1) and (5) above, the boundary kit is to be located within the private property but in a location easily locatable by operations staff using the main access to the property, i.e. near the driveway or front path.
7. Locate in carriageway with trafficable property boundary kit.
8. Boudnary kits shall be have red surface lids colour coded for pressure sewer.
9. Boundary kits shalk have a minimum depth of 400mm.

The location of boundary kits serving properties in a private right-of-way must be approved by QLDC, but will generally be in accordance with the typical common land connection position detail.

7.7 CONNECTION TO EXISTING SEWER SYSTEM

The number of discharge connections between the PSS and the existing gravity system must be minimised. All proposed points of connection must be approved by QLDC. For the minimum requirements in construction for pressure sewer network discharges to gravity networks, refer to Installation Standard Drawings No.: PSS-3 DN90-DN180 pipe sizes entering gravity network manholes, and PSS-4 for pipes up to DN63.

Flow velocities shall not exceed 1.5 m/s at the discharge point. A minimum 4m length of gravity discharge pipe shall be provided prior to the discharge entering the existing gravity sewer system to control turbulence.

Odour treatmentshall be installed at the receiving manhole if the age of the incoming flow is likely to be over four hours. The odour treatment device must be designed to manage intermittent discharges over a range of air flows, be low-profile, damage resistant and effective.

8 ON-PROPERTY EQUIPMENT

8.1 PRESSURE SEWER CHAMBER

The pressure sewer chamber on the property must be located:

- As close as possible to the point in the gravity pipework from the dwelling where all flows join to minimise the length of gravity pipework;
- To meet the minimum clearance distances to structures as specified in the QLDC Wastewater Bylaw (the chamber is considered a service opening in terms of the Bylaw) and to underground services as specified in the COP;
- To provide access at all times for maintenance (e.g. not under a deck or in a carport, garage or shed). The minimum requirement is safe pedestrian access. Access through buildings or dwellings is not acceptable;
- In a non-trafficable location. Acceptance of any alternative is at the discretion of QLDC and any such application must be accompanied by evidence that a non-trafficable location is not viable. A non-standard chamber design and trafficable lids to be rated to minimum Class C loading (AS3996) will be required in these cases;
- Clear of any low spots prone to ponding;
- A suitable distance from any property boundaries to avoid impacts on adjacent properties;
- In a position that minimises the amenity impact of equipment on the use of the property and allows for possible future development (e.g. to the side of lawn areas rather than centrally).

To avoid floatation and settling, installation and backfill requirements must be appropriate for the local ground conditions. If the weight of the tank is not sufficient to prevent floatation, additional anchoring to hold the tank in place must be provided.

Chambers will generally be vented through the cover. If a pump chamber is in a flood prone area, a watertight lid with an external vent is required.

Where there is insufficient space on-property, placement of the storage chamber within the road reserve may be considered. The location of an off-property storage chamber must be approved by QLDC. In all cases power is to be provided from the private dwelling's electrical switchboard.

For existing properties, the position of the pressure sewer chamber on site must be agreed with QLDC and the property owner prior to proceeding.

8.2 CONNECTION TO THE PSS NETWORK

The connection of the pressure sewer lateral to the pressure sewer network must be by means of a EF saddle tee or integral PE tee piece, cut and EF socket welded into the pressure main. Self-tapping EF saddle tees are permitted on all pipe sizes down to and including DN50 pressure main pipes, provided that the tapping does not reduce the internal diameter (i.e. greater than 30 mm for a typical single pump connection).

When installing EF saddle tees, the pressure main pipe must be peeled with a rotary pipe peeler and cleaned according to the manufacturer of the EF saddle tee. All EF saddle tees must be pressure tested in accordance with the QLDC Water Supply Mains Pressure Testing Code of Practice.

8.3 FREEZE/FROST PROTECTION

Any components installed above ground or near the ground surface are to have sufficient frost insulation measures applied.

Below ground equipment shall be designed with sufficient depth for frost protection, and valve boxes shall provide sufficient frost protection.

Where freezing is likely not to be mitigated by passive design and insulation, electric freeze protection is required.

8.4 POWER AND CONTROL BOX

Power to the pump must be provided from the electrical switchboard of the private dwelling that is serviced by the pump. This must be a dedicated circuit not shared with any other connections.

The control box must be mounted on the side of the house with a minimum clearance of 1.2m from the bottom of the box to ground level. The control box should be located within line of sight of the chamber. The distance between the control box and the chamber should be typically be 10m, but must be less than 30m. The location of the control box should be as visually unobtrusive as possible.

The cable conduit must not to be connected to the controller. An air gap of a least 100mm must be provided, with individual glands used for cable entries.

Detailed specification, installation and wiring drawings for the control boxes must be provided at concept plan stage.

A redundant 40mm PVC-U conduit for future cabling between the chamber and the control box must be installed. The duct must be brought through the wall of the chamber at one end and plugged with a rubber plug. The other end must also be plugged and terminate underground directly below the control box.

A label clearly identifying the telephone number to call in case of an issue with the PSS must be installed on the exterior of the control box.

8.5 RELOCATION OF ON-PROPERTY EQUIPMENT

If the property owner wants to relocate any part of the PSS (e.g. pump, control panel, pipeline) written approval must be obtained from QLDC. Detailed designs must be provided to QLDC showing the relocation complies with all the requirements of this document.

A building consent or building consent exemption will be required as part of the QLDC approval process for the relocation. Where written approval is granted the full costs of the relocation shall be borne by the applicant/property owner.

9 CONTROL AND OPERATIONAL SYSTEMS

9.1 STANDARD CONTROL AND ALARM BOXES

The following minimum features must be provided as standard on all alarm and control panels:

- Audible alarm with manual and auto reset, with the manual reset mounted outside of control panel (audible alarm with resident activated off switch, visual alarm that can only be switched off by maintenance authority);
- Visual red light, with the flashing light sequence that gives an indication of the specific fault;
- Manual and timer reset capacity;
- High and low voltage protection;
- Over pressure protection;
- Visual hours run display;
- Ability to record and store a downloadable history of events;
- Adjustable start delay after power failure;
- Back up battery to power control box during power loss;
- Provision of space and ability for future retrofitting of a SIM card for texting of alarms and/or integration with the QLDC telemetry system;
- Insulated lockable cover with corrosion resistant hinges;

- Rated to IP65 or greater;
- A generator plug.

9.2 CONTROL REQUIREMENTS

In all PSS systems the local pump station controls must provide for the following outcomes:

- Pump stop/start levels which prevent wastewater in the chamber going septic;
- Maximum pump starts per hour which meet pump manufacturer recommendations;
- Delayed diurnal starts to minimise pressure sewer network pipe sizing.

In developments where the ultimate number of lots will exceed 100 or where specifically required by QLDC then the following additional control requirements will apply:

- Provision for reducing peak discharge flows from the development by smoothing the diurnal flow peaks;
- Provision of automated flushing within each part of the network such that the minimum scouring velocity is achieved at least one time per day;
- Controlled recovery from a prolonged power outage which limits peak flows and avoids repeated over-pressure pump stop/start cycling.

The programming necessary to achieve the outcomes and requirements must be developed at the concept design stage. Each of the control solutions must be developed in such a way that it can accommodate and perform effectively during all stages of the development with no requirement for re-programming.

It is expected that the above control outcomes will be achieved by programming the individual PSS controllers in blocks or groups using timing delays or triggers. If the developer wishes to provide for a more sophisticated networked control system to achieve the outcomes this must be discussed with QLDC at concept design stage.

The installation of a more sophisticated control system does not necessarily require QLDC ownership of the on-property equipment.

10 TESTING AND COMMISSIONING

10.1 NETWORK

PSS pipe work must be pressure tested in accordance with the COP and the QLDC Appendix C – Field Testing of Pipelines in the Subdivision and Land Development Code of Practice.

After testing all valves must be opened and flushing must be carried out. Flushing must be done from the extreme ends of the system throughout the entirety of the system, including all branches. The network must be divided up for the flushing.

Note that a consent notice will be applied to all lots in the subdivision requiring that all requirements of the concept design is adhered to at building consent stage.

10.2 ON-PROPERTY EQUIPMENT

On-property PSS pipe work must be pressure tested in accordance with the COP and the QLDC Appendix C – Field Testing of Pipelines in the Subdivision and Land Development Code of Practice.

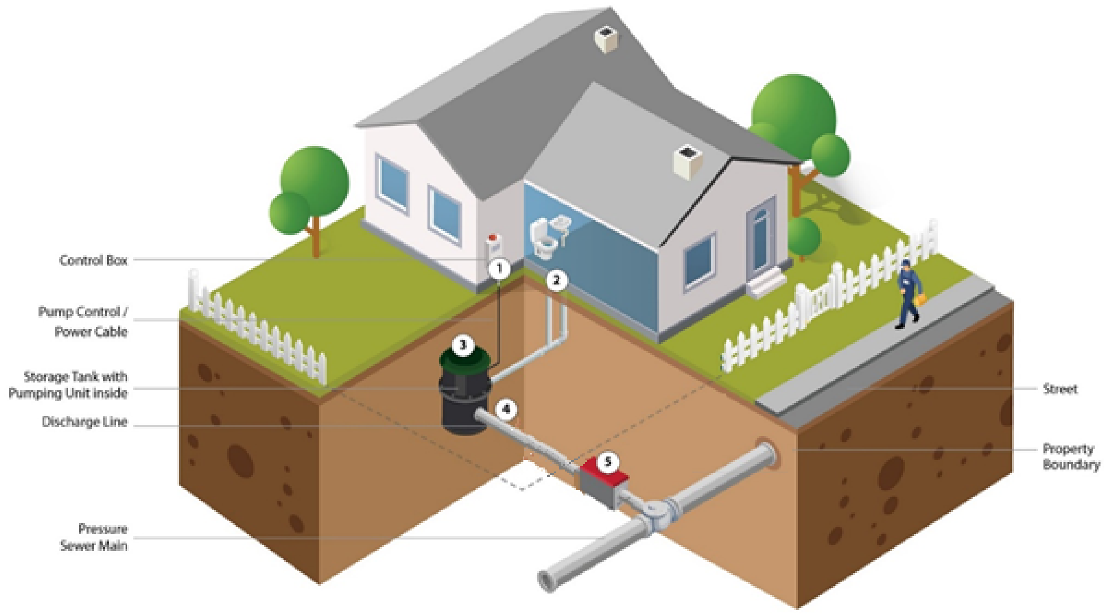
The supplier’s recommended start-up and commissioning procedure must be followed and all supplier checklist and/or QA forms completed. The relevant serial numbers must be recorded on the checklist. The commissioning process shall be completed by a Council approved contractor who has been approved for the construction of PSS under the supervisions of the appropriate Council staff.

Prior to the issuing of the Code Compliance Certificate the following must be provided to Council:

- A signed declaration from an approved installer that the equipment has been installed as per manufacturer's specification;
- A signed declaration from the approved supplier who provided input into the concept design that the equipment, including the controls, has been installed as per the concept design;
- A signed declaration from the approved supplier who provided input into the concept design that the equipment, including the controls, has been installed as per the concept design;
- A signed construction producer statement (PS3);
- For individual connections, post construction as-built drawings are to provided by the installation contractor through building conset process.
- A copy of the completed supplier commissioning checklist and an any other supplier QA forms;
- Inclusion on the electrical records to include the pressure sewer;
- For all trade waste installations and for private installations where the on-property equipment is to be privately owned, evidence that a service agreement is in place.

Note this section also applies when on-property equipment is relocated in accordance with section 8.5 of this document.

APPENDIX A. PARTS OF A PRESSURE SEWER SYSTEM



1. The electrical power controls and alarm
2. The household plumbing and wastewater line
3. Storage Tank with Pumping Unit inside
4. A discharge line from the storage tank to boundary kit
5. A boundary valve assembly inside a buried box with a plastic lid located just outside your property

ON PROPERTY LPSS SPECIFICATION

INTRODUCTION

This document is a supplement to the Queenstown Lake's District Council's (QLDC) *'Land Development and Subdivision Code of Practice'* (CoP). It documents the technical standards for the supply and installation of on property pressure sewer equipment in the Queenstown Lakes District and must be read in conjunction with the CoP. These pressure sewer systems are known as and referred to throughout this document as 'Low Pressure Sewer Systems' (LPSS).

This document is not intended to cover private pumping facilities to the gravity network (known as pump ups); however it's use as a proxy for those designs is recognised. These pump ups are specifically addressed in the *'Appendix G – Sewer Pump Stations'* section of the CoP.

This document does not cover, and QLDC do not currently permit, vacuum pressure sewer systems.

This specification is based on the objectives outlined in QLDC's *'Pressure Sewer Policy'* and gives technical information to suppliers to achieve these.

This information is correct at date of issue. Always check in the relevant QLDC policy manual that this copy is the most recent version

1 CONTENTS

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1 DEFINITIONS

1.1 GENERAL

ALARM
A visual and/or audible signalling device used for indication of alarm conditions.

AVERAGE DRY WEATHER FLOW (ADWF)
The combined average daily sanitary flow into a sewer from domestic, commercial, and industrial sources.

BOUNDARY
Survey line separating adjoining properties for the purposes of defining ownership/title.

COLLECTION/PUMP UNIT
A package of sewer components installed on a property, including a collection tank, grinder pump, level switches, pipework, valves and other appurtenances within the unit.

COLLECTION TANK
That part of a collection/pump unit which collects and stores flows from the customer sanitary drain(s).

COMMISSIONING
The running of the plant and equipment to ensure flow through the collection and pumping system, carrying out any necessary testing and adjustments until it is ready and suitable for normal starting and running under service conditions.

CONNECTION POINT
Point of connection between the collection tank and the inlet pipework. Also called property connection point. See also connection point inspection shaft.

CONNECTION POINT INSPECTION SHAFT
A shaft at the connection point to allow inspection and maintenance of the sanitary drain.

CONTROL/ALARM PANEL
The power and control panel that controls operation of the grinder pump and which contains audible and visual alarm components. The panel also contains a dedicated circuit breaker for power disconnection.

CONTROL VOLUME STORAGE
The storage volume within the collection tank above the pump-off level (BWL) and below the pump on level (TWL).

CORROSION
Deterioration of a material and alteration of its properties due to chemical or electrochemical reaction between the material and its environment.

DEAD STORAGE
The volume within the collection tank below the pump-off level i.e., the volume that remains in the tank after a normal pumping cycle is complete. Also known as collection sump.

DISCHARGE PIPEWORK
Any pipework within the collection tank (i.e., from the grinder pump to the outlet pipework).

ELECTRICAL CABLE
A cable that delivers power from the building electrical distribution box to the control/alarm panel.

ELECTRICAL DISTRIBUTION BOX
A board that disseminates the main power supply to the property and is the primary source for metering.

EMERGENCY STORAGE
The volume within a collection tank between pump on level and overflow level i.e., the volume of sewage that can be accumulated once the pump has been activated and prior to overflow.

GRINDER/CUTTER PUMP

A mechanical device designed to pump liquid and, in the process, reduce the size of solids contained in the sewage.

HEAD
Pressure expressed in terms of the height of a column of water (in metres).

INFILTRATION
Ingress of groundwater into a sewer system.

INFLOW
Ingress of stormwater into a sewer system.

INLET PIPEWORK
A pipeline installed by a licensed plumber within the property boundary and operated by a property owner to convey sewage from buildings to the connection point; constructed to plumbing code standards. Also called house drain, house service line, house sewer, sanitary connection, property drain, sanitary drain, customer sanitary drain.

LEVEL SENSOR
A device used to activate a grinder/cutter pump when a predetermined level of sewage has been reached in the collection tank.

LEVEL SWITCHES
Control devices operating at single point levels to effect control of pump operation.

OPERATING STORAGE
The storage volume within the collection tank above the pump-off level and below the high water/alarm level. Comprises control volume storage and reserve (buffer storage).

OUTLET PIPEWORK
A pressure sewer line located on private property that connects the collection/pump unit to the property boundary assembly/kit, referred to as property discharge line in other publications.

OVERFLOW LEVEL
The level at which the collection tank will begin to overflow. This will be the lower of either the overflow gully level or top of tank.

OVERLOAD PROTECTION DEVICE
A device which protects electrical components from current overload.

PEAK DRY WEATHER FLOW
The most likely peak sanitary flow in the sewer during a normal day. Exhibits a regular pattern of usage with morning and evening peaks related to water usage for toilets, shower, baths, washing, and other household activities.

PRESSURE RETICULATION SEWER
A common main which transfers sewage from a number of properties to a downstream point in a pressure sewer system i.e., a component of pressure sewer reticulation.

PRESSURE SEWER LATERAL
A main that connects a pressure reticulation sewer to a property boundary assembly.

PRESSURE SEWER RETICULATION
A network of mains including pressure sewer laterals and property boundary assemblies which transports sewage from properties to a sewage treatment facility or another sewerage system.

PRESSURE SEWER SYSTEM
A complete system wherein macerated sewage is conveyed under pressure generated by pumping units located on each property to a sewage treatment facility or another sewerage system.

PROPERTY BOUNDARY ASSEMBLY/KIT
A fitting assembly that:

a) Connects a pressure sewer lateral to a property discharge line; and

b) Provides a means of isolating pressure sewer reticulation from a property discharge line and associated collection/pump unit/

It consists of, as a minimum, a reflux valve, inspection tee, and isolation valve and is generally located within a pit at the boundary of the property being served by the system.

PROPERTY CONNECTION SEWER

A short sewer, owned and operated by QLDC, which connects the main sewer and the boundary kit; it includes a junction on the main sewer, a property connection fitting, in some cases a vertical riser, and sufficient straight pipes to ensure the property connection fitting is within the lot to be serviced.

PUMP CONNECTION POINT

The point where the discharge pipework of the pump passes through the wall of the collection tank.

PUMP CONTROL/POWER CABLE

A cable which delivers power from the control/alarm panel to the grinder pump located within the collection tank and transmits control signals between the panel and the pump.

PUMP LEVEL CONTROLLERS

A device that detects sewage levels in the collection tank and initiates pump start/stop sequences.

RESERVE (BUFFER) STORAGE

The volume within the collection tank above the pump-on level and below the high water/alarm level i.e., the volume of sewage that can be accumulated beyond the normal operating volume prior to alarm activation.

SEWAGE

Water polluted by use and discharged to a sewer system.

SEWER

Pipeline or other construction, usually buried, designed to carry sewage from more than one source.

SEWER SYSTEM

Network of pipelines and ancillary works that conveys sewage to a treatment works or other place of disposal; see also *pressure sewer system.*

SURCHARGE

Condition in which sewage is held within a collection tank and sanitary drainage system but does not overflow.

SURFACE BOX

A purpose designed and manufactured pit and cover to provide access to appurtenances for operations and maintenance.

UNUSABLE STORAGE

The volume within a collection tank above the overflow level i.e., the volume of the tank that is unusable.

24 HOUR STORAGE REQUIREMENTS

The volume of wastewater in Litres expected to be produced per day, based on the guidelines outlined in the Queenstown Lakes District Council's Land Development and Subdivision Code of Practice.

2 GENERAL REQUIREMENTS

Low Pressure Sewer System (LPSS) units offered shall be complete systems including specifically designed collection tanks, grinder pumps, control/alarm panels, level sensors, pipework, and valves. They shall be designed and supplied as an integral unit.

The supplier/manufacturer of the LPSS shall be Aquatec or Ecoflow (or approved equivalent – refer to QLDC approved materials list).

To be considered for addition to the QLDC approved materials list, the supplier/manufacturer must demonstrate proven track record supplying pressure sewer systems in Australia/New Zealand over a period of at least 15 years. The supplier/manufacturer shall provide proof that their products have been designed and built specifically for use in low pressure sewer systems (LPSS). Suppliers/manufacturers shall submit detailed installation and user instructions; and submit evidence of an established service and spare parts backup program, with spare parts and pumps available locally.

2.1 STANDARDS AND GUIDANCE DOCUMENTS

All components included within the LPSS shall comply with the following standards and codes:

- WSA 07-2007 - Pressure Sewerage Code of Australia
- AS/NZS 1546.1:2008 - Septic Tanks
- AS/NZS 3000:2018 - Electrical Installations
- AS/NZS 3500.2:2021 - Plumbing and Drainage
- AS/NZS 2566.1:1998 – Buried Flexible Pipelines – Part 1: Structural Design
- AS/NZS 5065:2005 – Polyethylene and polypropylene pipes and fittings for drainage and sewerage applications
- Water New Zealand Pressure Sewer National Guidelines
- NSW Health Certification
- SA Health Certification
- ISO9001:2008 – Quality management systems
- ASTM A351
- ANSI/NSF 46:2020 – Evaluation of Components and Devices Used in Wastewater Treatment Systems

2.2 QUALITY ASSURANCE

All collection tanks, pump units, boundary kits, and control panels shall be identified with a unique serial number. These serial numbers shall be:

- Permanently inscribed onto the component at the time of manufacture; or
- attached by means of a 316 stainless steel embossed/engraved plate with stainless steel drive screws; and
- not be painted or stickered; and
- located in a position that can be easily read after installation; and
- sufficiently detailed such that the quality assurance system provides traceability of the manufacturer from the serial number.

All LPSS installed shall comply with the quality assurance specifications outlined in Sections 8 through 11 of this document.

3 COLLECTION TANKS

3.1 GENERAL

Collection tank design and manufacture shall be for complete fabricated units and shall meet and adhere to all applicable standards. For residential units high-grade virgin polyethylene or glass reinforced fibre plastic (GRP) is preferred. Concrete is not an accepted material for any LPSS collection tanks.

Bases of collection tanks shall be domed, with a minimal flat section underneath the pump to minimise solids build up on the floor of the well/tank. LPSS tank depths shall be adapted for specific site conditions, volume requirements, and OH&S purposes when installing.

Collection tanks shall be able to be installed using small lifting equipment in areas with minimal access. The wells shall be of leak-proof design using proven materials and manufacturing techniques. They shall be designed for a service life of not less than 50 years.

The wells, including lids, shall be constructed from materials that are not subject to corrosion from sewage or galvanic action. All parts exposed to sunlight shall be resistant to UV degradation both in strength and colour. The wells, including lids, shall be designed and installed in accordance with AS3996 as below:

- Non-trafficable locations shall be rated to Class A loading.
- Standard chamber design in trafficable locations on-property (i.e., driveway) shall be rated to Class B loading;
- Non-standard chamber design or locations outside the property boundary shall be rated to Class C or D loading.

All metalwork within collection tanks shall be stainless steel Grade 316. Council may approve other corrosion resistant material where adequate corrosion performance can be demonstrated through previous applications.

Collection tanks shall be designed to resist structural failure under all service conditions. Selection of the appropriate pipe class, tank strength/stiffness and embedment, combined with correct manufacturers installation practice, shall be undertaken to achieve this.

Commercial applications of this standard shall comply with all requirements outlined within this technical specification and have specifically engineered designs for each application. Load ratings for commercial installations shall be from Class C to Class E based on AS3996. Examples of tank materials for commercial applications are fibreglass filament wound reinforced fibre plastic (RFP) units in a designed and constructed one-piece construction; or HDPE100 material (Borealis HE-3490-LS) which is commonly used for large underground pipework up to 3 m in diameter.

3.2 TANK SIZING AND VOLUME

All collection tanks shall be designed and sized sufficiently to meet daily flow and 24-hour storage requirements (refer to QLDC CoP), having considered static/dynamic loading and water table requirements in design. Pipe sizes may be based on septicity requirements and confirmed with QLDC prior to construction.

The various storage volume components which make up the total storage requirement for an LPSS collection tank are shown in Figures 1 and 2 and described below.

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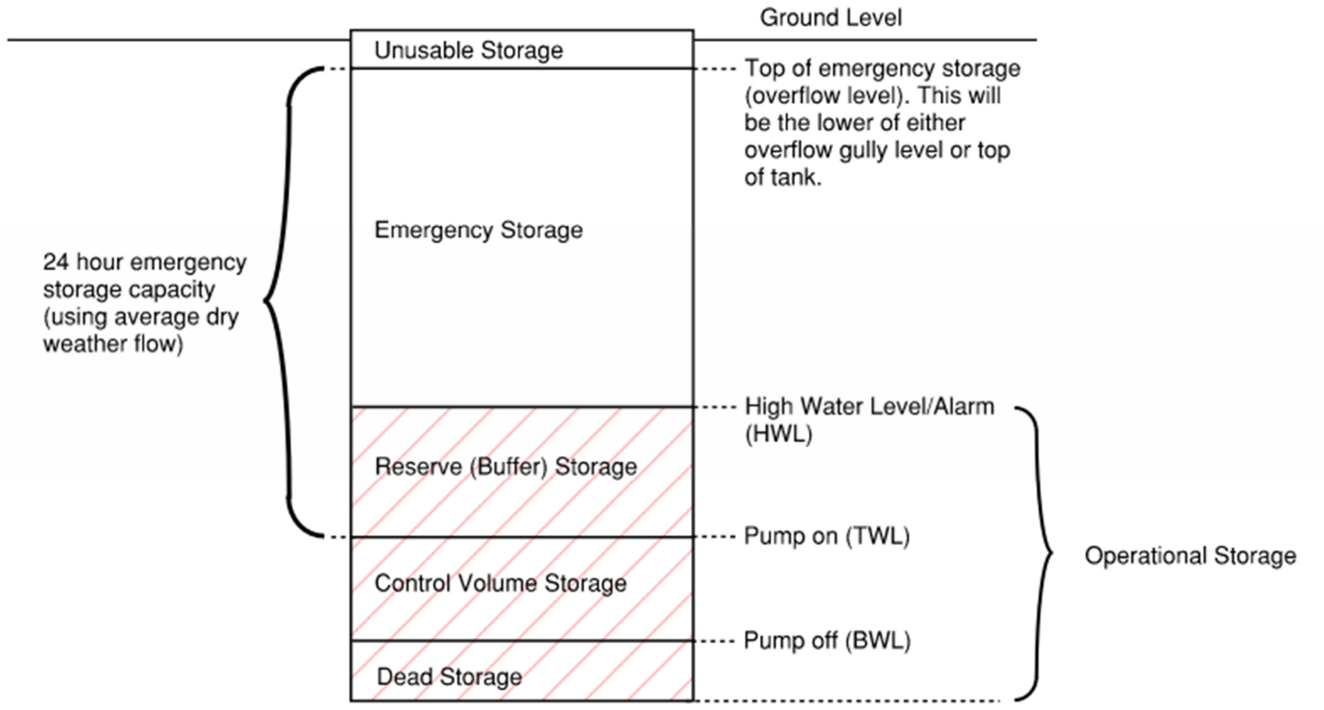

Figure 1. Storage components of collection tanks without network buffering

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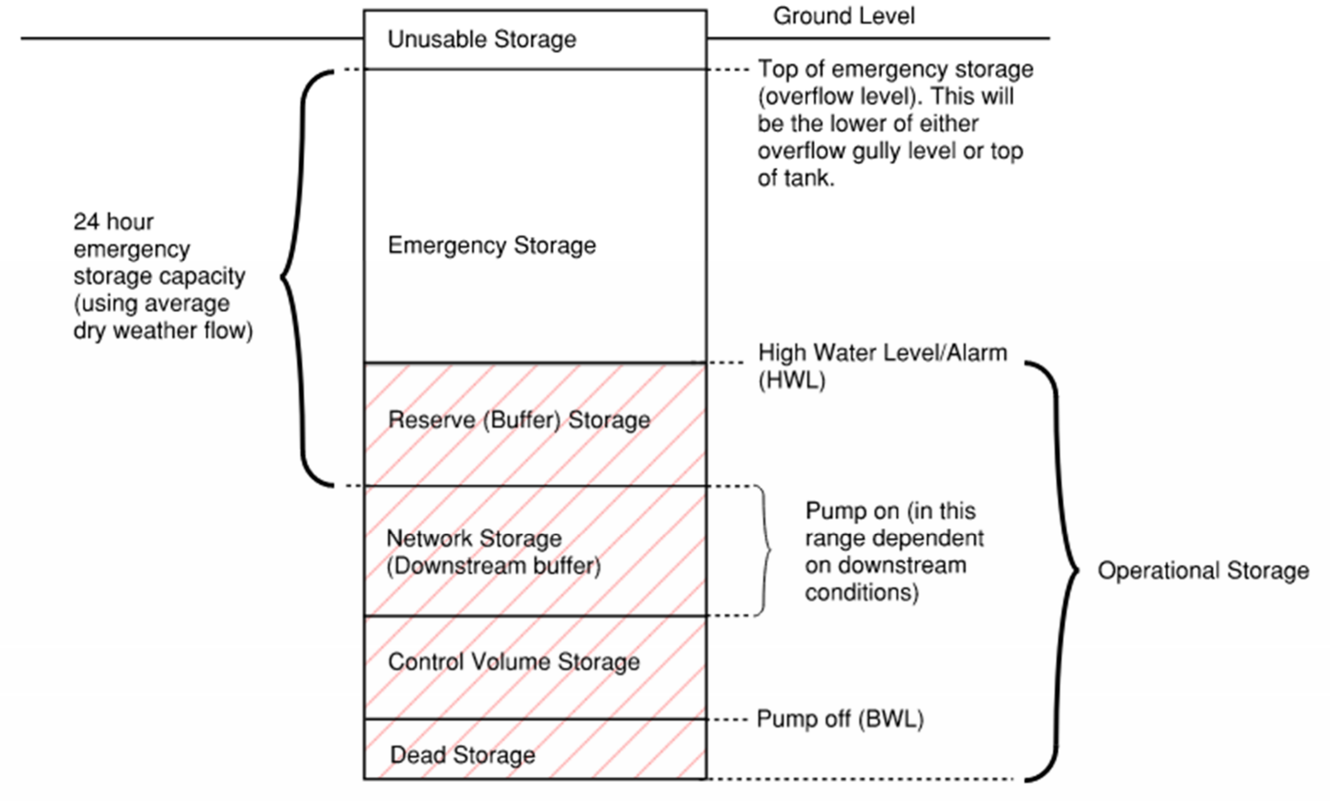

Figure 2. Storage components of collection tanks with network buffering

Residential collection tanks shall have a minimum storage as below:

- For collection tanks that have no requirement for network buffering (i.e., no additional network storage to reduce diurnal peaks entering the wastewater treatment plant):
    - Total Storage Volume of the collection tank (tank size) of at least 900 litres.
    - Emergency storage volume component (above pump on and below overflow) of minimum 24 hours emergency storage capacity (using average dry weather flow e.g., 750L for standard household assuming 3 inhabitants). *
- For collection tanks that are in areas that have a requirement for network buffering (i.e., diurnal peak and/or wet-weather attenuation prerequisites due to downstream capacity constraints):
    - Total Storage Volume of the collection tank (tank size) of at least 1100 litres.
    - Emergency storage volume component (above pump on and below overflow) of minimum 24 hours emergency storage capacity (using average dry weather flow e.g., 750L for standard household assuming 3 inhabitants).
    - Any sizing of these tanks shall be pre-agreed with QLDC, approved by the Infrastructure Delivery and Engineering Manager, and clearly include all design considerations required into their sizing.

*Where the above cannot be met due to standardised manufacturing constraints, compliance with the above shall be considered for any tank that is within 10% of the requirements outlined.

Commercial collection tanks shall have a minimum storage as below:

- Total Storage Volume of the collection tank (tank size) of at least 1500 litres.

- Emergency storage volume component (above pump on and below overflow) of minimum 24 hours emergency storage capacity (using average dry weather flow).

Other tank sizing's or customisations where available in polyethylene or fiberglass require QLDC approval from the Infrastructure Delivery and Engineering Manager. Commercial collection tanks shall be designed on a case-by-case basis to suit the development. In some cases, subject to Council's detailed review and approval, a separate emergency storage vessel may be provided.

Collection tanks shall be selected to allow the most economic installation that meets the network design criteria. The well depth shall be sufficient to allow drainage pipes to be connected without backup in the pipe during normal operation. For normal installations it shall be assumed that the cover to the incoming pipe will be at least 1 m in trafficable areas; and 600 mm in non-trafficable areas as per the Code of Practice.

SPECIFIC REQUIREMENTS FOR COMMERCIAL UNITS AND PUBLIC AMENITIES

The number of pumps installed shall relate to flow output per day and serviceability (i.e., maintaining a minimum time between normal servicing of the pumps over a five year period). Where a two (or more) pump configuration must be installed into the collection tank, pumps shall be: industrial grade 2-stage centrifugal units; 2-Stage centrifugal vortex style grinder pumps; positive displacement/progressive cavity pumps; or semi positive displacement pumps specifically designed for commercial use in LPSS.

Flow and storage may differ from each site due to downstream capacity constraints. The ability to control the number of concurrent pumps operating at any one time shall be considered in order to manage flow conditions and optimise storage requirements across each catchment. Further specifications regarding this capability are included in section 7.2 'Controls'. Each design shall be submitted to QLDC for approval prior to construction.

3.3 LIDS

Collection tank lids shall be manufactured from UV resistant polyethylene and shall blend in with the environment. Lids shall be low profile, no more than 50 mm above ground level, installed to avoid surface water ingress and ponding, and suitable for pedestrian or trafficable areas as outlined in Section 3.1. Any lids in flood prone areas shall be able to be sealed. Lids shall be child safe and capable of being locked. A padlock or approved security bolt with unlocking tool supplied is acceptable. The lid to the tank shall be secured to the well body in such a way that it cannot be removed without special tools.

The lids shall be lightweight, so that one person can open them. Removal of the lid from the collection tank shall give easy access to the pumps and associated equipment. When the lid is removed it shall be possible to see the entire surface of the sewage collected and to use a 100 mm diameter eduction truck hose to empty the tank. It shall also be possible to clean any fats and oils that are sticking to the wall of the tank.

3.4 INLET AND OUTLET CONNECTIONS

All penetrations through the collection tank wall (other than the household drainage line/inlet connection point) shall be factory sealed to ensure no ingress of groundwater.

The collection tank shall incorporate a connection point via an approved 100 mm flexible rubber coupling. This rubber coupling shall be able to be cut short onsite to provide a clear opening for the 100 mm PVC inlet pipework. The inlet connection point shall be installed on the opposing side of the tank as the outlet pipework. All accessories required to install this connection point with a watertight seal shall be provided. The seals shall ensure that there is no ingress of groundwater into the collection tank. Each inlet connection point shall include a connection point inspection shaft consisting of a shaft and threaded cap opening at ground level, which shall be located below the overflow level of the tank.

A 316 stainless steel isolation valve and tank outlet shall be pre-installed into the chamber to connect the discharge pipework to the outlet pipework. Connection points shall not be cored onsite and uniseal connections are not acceptable unless they are an approved repeatable part of the installation system; installed by an approved manufacturer's representative in accordance with manufacturers installation procedures; and each methodology is approved by QLDC in advance; and QA records of these installations are kept and clearly marked.

Commercial units may have larger diameter inlet connections. These sizes shall be confirmed with QLDC in advance and be based on peak inlet flow.

The electrical conduit connections for pump and level controls need to have dedicated bulkhead fittings incorporating an electrical gland inside the chamber which can be tightened and sealed around the cables to eliminate the risk groundwater entering via cracked conduit and into the tank.

3.5 BALLAST

Collection tanks shall be installed with a suitable solution to prevent flotation and resist uplift either through tank design or installation method. Ballast calculations shall be provided for each proposed installation. The design shall prevent the units from floating when the water level is at the top of the unit. This may be achieved by the use of concrete if applicable. The units shall be shaped to adequately bond with any concrete or other backfill material. A factor of safety against flotation of at least 1.5 shall be provided.

3.6 PUMP CONNECTION POINT

Each system shall have a quick disconnection point within the collection tank to allow for efficient removal and disconnection of the pump for maintenance. This quick disconnection point shall be secure and reliable during operations. A 316 stainless steel camlock within the chamber is preferred, however suitable substitutes may be accepted by Council (such as a Goose Neck Mac Union coupler to Valve with pressure relief on outlet pipe).

Except for the pump connection point, the pump shall be able to be removed and reinstalled without the need to dismantle, or risk damage to, any other equipment. It shall be possible to properly reinstall the pumps while the well is near full (below the level of the pump connection point) of sewage. The pump connection points shall be located as high as possible, and in easily accessible locations. The pump connection point shall be accessible from the top of the lid without the need to lean into the tank. Multiple risers are not acceptable due to the health and safety risks they may create.

3.7 VENTILATION

Ventilation shall be provided so that sewage can fill to the top of the tank and empty without causing pressure build-up or suction. This ventilation may be provided through the lid. For flood prone areas, the ventilation system shall ensure that floodwater does not enter the tank and an external vent may be required along the wall of a nearby building.

Trafficable installations shall include a separate vent that is not subject to blocking or damage from vehicle movements.

4 PIPEWORK

4.1 GENERAL

All pipework shall be designed, manufactured, and constructed in accordance with QLDC's Land Development and Subdivision Code of Practice and standards outlined in Section 2.1 of this document. This includes but is not limited to minimum pipe sizes; gradient; gully traps; air vents; cleaning or rodding eyes.

All buried pipework shall be of polyethylene (PE) material and have a minimum pressure class of PN16. Pipework within collection tanks may be PE, PVC, or other suitable pressure piping system. Products, materials, and jointing methods shall be selected and specified for each location to ensure structural adequacy; corrosion resistance; suitability for geological conditions; appropriate construction methods.

4.2 INLET PIPEWORK

All inlet pipe work (customer sanitary drains) within the private property boundary between the serviceable or rated unit and the collection tank shall be minimised so as to limit unnecessary distances of private gravity infrastructure, and corresponding depths required to achieve appropriate gravity profiles.

4.3 DISCHARGE/OUTLET PIPEWORK

The discharge pipework shall have a pressure relief that may be manually actuated to mitigate the risk of splash back contamination to the operator upon disconnection of the pump.

Where possible, the outlet pipework shall be located parallel to lot boundaries.

5 BOUNDARY KITS

5.1 GENERAL

Each property shall have a boundary kit containing at a minimum:

- Isolation Valve (full bore or gate)
- Check Valve with top access
- Flushing Point

All boundary kit fittings shall be bronze (max zinc component 7%) or grade 316 Stainless Steel with a pressure rating of minimum PN16. The above shall be of integral one piece construction and included within a boundary kit pit.

5.2 BOUNDARY KIT PIT

The boundary kit pit shall have the following characteristics:

- Be large enough to contain valves and flushing points, with a minimum depth of 400 mm.
- Be installed with the cover flush with ground level.
- Be constructed from materials that are not subject to corrosion due to contact with sewage or galvanic action.
- Any parts exposed to sunlight shall be resistant to UV degradation in both strength and colour and shall be of an unobtrusive colour.
- Some pits and covers may be subject to vehicle loads. This is to be confirmed per site, with load ratings the same as for collection tank lids.

6 GRINDER PUMP UNITS

6.1 PUMP GENERAL

A pump with an integral grinder unit shall be supplied with each collection tank. The pump shall be supplied with all necessary pipework, valves, and pressure sensing equipment. The pumps shall be submersible to IP68, specifically designed for the pressure sewer market, and may be one of the following:

- Regenerative Turbine Grinder Pump.

- 2-Stage centrifugal vortex style grinder pump.
- positive displacement/progressive cavity pump; or
- semi positive displacement pump.

All pumps, including the check valves that are part of the grinder pump package shall be tested to NSF/ANSI 46-2007. Pumps shall have a minimum design life of 25 years and include no materials that may degrade significantly while the product is on the shelf.

The pump identification nameplate shall include:

- manufacturer's name;
- address;
- pump type;
- Horsepower
- Hz
- Voltage
- Ampage
- Manufactured date
- Patent
- Serial number
- Head
- capacity;
- size;
- motor kW;
- serial number;
- order/contract number;
- speed;
- year of manufacture;
- and pump casing test head.

The pumps shall:

- Be self-priming;
- Be current models which have proven successful operation under similar conditions;
- Be fit for purpose (i.e. their duty point must be adequate for the area with the highest head requirement, considering implications of the entire catchment and wider area);
- Have easily replaceable parts that protect the integrity of the pump motor by acting as a sacrificial layer;
- Be suitable for domestic, commercial and industrial sewage;
- Be suitable for intermittent operation with up to 20 starts per hour;
- Have a maximum speed of 3000 rpm;
- Have shaft and rotors of stainless steel.

PUMP MOTORS

Pump motors shall be specifically designed for New Zealand (Queenstown Lakes District) conditions, and domestic units shall be at minimum 0.75KW, 240v 50Hz, single phase with IP68 submergence rating. Residential pump units may be air cooled or oil coiled.

Commercial units may be either single phase, or three phase 415v 50Hz, depending on the flows per day, storage requirements, and service intervals. Industrial units shall be three phase 415v 50Hz. Commercial units shall be oil cooled and capable of continuous running for an extended period without deterioration of pump performance.

Each pump shall have an inbuilt anti-siphon valve and a non-return valve located on the discharge standpipe of the pump, removable by a flanged arrangement.

The supplier shall carry spart parts (overnight and complete pump availability) and offer 24-hour support in the case of any faults.

Any industrial units/applications shall be agreed with QLDC prior to construction. Residential units are not considered adequate for industrial applications and will not be accepted.

6.2 PUMP OPERATIONS

Residential pumps shall have a predictable and constant flow rate across the required pressure head ranges, and shall comply with the following head and flow capabilities:

- Maximum flow rate of less than 1.25 L/s at zero head;
- Minimum flow rate of greater than 0.4 L/s at 55 m head;
- Rated for continuous operation at 55 m head;
- Ability to run continuously at no head and maximum flow;
- Ability to operate intermittently at between 55 m and 80 m head
    - 'Intermittent' running is expected to be on rare or unplanned occasions (i.e. after prolonged power outages); and
- Either have the ability to run against a closed discharge head for unintentional long periods of time with no impact on the performance or damage to the pump (for the avoidance of doubt the system shall be designed so that these events are avoided or mitigated) or; otherwise have protections in place to trip the pump so these do not occur.

The maximum designed continuous operating head for any pump in a system shall be 55 m. The pumps shall also have integral built-in protection to mitigate situations where overheating or excessive head is encountered, guarding the integrity of the pump and achieving the longest possible asset life.

The pumps shall also comply with the following requirements:

- Be able to handle sand and abrasive material, with proven results on wearing parts;
- Have a standard cord length of minimum 15 metres (for connection to the control panel), with longer options available from the manufacturer.
- Have all wearing parts of the regenerative pump turbine coated with an approved abrasive coating that has proven performance for pressure sewer applications.
- For progressive cavity style pumps the material of the stator shall be EPDM

6.3 GRINDER/CUTTER PUMPS

Grinding mechanisms shall be designed to minimise the inlet velocity such that solids have sufficient opportunity to be processed. Grinding mechanisms shall be manufactured from materials with proven performance in wastewater environments and with high wear or abrasion resistance. Grinder pump grinding performance shall comply and be tested to ANSI/NSF 46:2007. Suppliers shall provide evidence of a grinder pumps certification and test results from the Household Items Loading Test (section 9.4 table 1 in ANSI/NSF 46:2007). Grinder mechanism shall include features to promote stirring to keep solids in suspension.

Grinders shall comply with the following requirements:

- The grinder shall be positioned in such a way that solids are fed in an upward flow direction.
- The impeller mechanism shall rotate at a nominal speed of no greater than 3000 rpm.
- The grinder shall be placed immediately below the pumping elements and shall be direct driven by a single, one-piece, Stainless Steel motor shaft.
- Should an item come to rest lying inside the cutting or shearing face, the grinder pump should have sufficient torque to restart when debris is lodged inside the grinding mechanism.

The pumps shall be able to handle sewage debris which includes but is not limited to:

- Fibrous items such as sanitary pads, tampons, nylon stockings, underwear, baby wipes etc.
- Flexible items such as condoms, plastic bags
- Solid items such as bottle tops, hypodermic needles, cotton buds
- Coagulating liquids such as fats and oils

6.4 ELECTRIC MOTORS

Electric motors shall be squirrel cage induction type with a low starting current (does not exceed 30 amperes or allowable circuit protection startup currents). Inherent protection against running overloads or locked rotor conditions shall be provided by the use of an automatic-reset, integral thermal overload protector incorporated into the motor. For submersible pumps, the electric motor shall be IP68 for submergence to a depth of 6 metres. The pump units shall be capable of being operated on a single phase power supply typical of a residential household without the need to augment the power supply.

Semi positive displacement pump motors shall be 0.75kW, 1425 RPM, 240 Volt 50 Hertz, single phase, capacitor start, ball bearing, air-cooled induction type with Class F installation, low starting current (does not exceed 30 amperes, or allowable circuit protection startup currents), and high starting/locked torque of 11.4/15.6 Nm.

6.5 PUMP PROTECTION

Grinder pump motors shall be fitted with inbuilt no-flow and thermal overload protection as standard. Current sensors for over pressure protection are also acceptable.

Pump motors shall be suitably sized for the pump type. The grinder pump shall include features to protect the pump from operating under unideal conditions. These features include thermal overload protection, over pressure protection. Pump motors shall be oil-cooled or air-cooled and the supplier shall provide evidence that the motor is capable of operating across the entire performance range and a variety of duty cycles without overheating. For oil-cooled motors, suppliers shall provide proper guidance and training for periodic replacement of dielectric oil and instruction on disposal so oil does not pose an environmental or health and safety risk.

6.6 PUMP ACCESS

The pump shall be able to be lifted by a means other than the discharge pipework or cabling. The pump shall therefore be fitted with a permanently fixed and suitable lifting chain, marine grade polypropylene rope (suitable for sewer conditions) or equivalent for lifting and manoeuvring the pump into position inside the tank.

Pumps shall be installed such that removal from the well can be achieved without entering the collection tank. The internal outlet quick connector and plug for the pump shall be reachable from ground level without the need to lean into the pump chamber.

Commercial Duplex and Triplex grinder pump units shall be installed on 316 stainless steel C-channels for chambers greater than 3 metres in depth. When installed with C-channels the discharge pipework within the well shall also be 316 stainless steel.

Service technicians shall follow local and national health and safety guidelines when handling grinder pumps and other components of the grinder pump system. Lifting trolleys shall be used when installing or removing grinder pumps from tanks.

7 ELECTRICS & CONTROLS

7.1 GENERAL

An alarm/control panel shall be supplied for each collection tank, installed by the unit installer. The control panel shall contain the operational controls and alarms needed to operate the pump, including at minimum:

- Pump/panel Circuit Breaker
- A switch with On/Off/Auto Positions
- Alarm and Control Components
- Battery backup for alarms for at least 48 hours without power.

The pump controller/alarm panel provided shall be a complete control system incorporating all equipment pre-assembled, wired and tested prior to delivery. The panels shall comply with the requirements of AS/NZS3000:2018 Wiring Rules, shall be wired to a dedicated separate circuit breaker at the property's existing meter box, and shall be wall or pedestal mounted.

The control panel identification nameplate shall be visible on the outside of the control box and include at minumum:

- Telephone number to call in case of issue with the LPSS
- Manufacturer's name

A further identification nameplate may be included on the inside or outside of the control box and shall include:

- Pump Type
- Pump Capacity
- Pump Size
- Pump Motor KW
- Serial number
- Order/contract number
- Pump speed
- Year of manufacture
- Pump casing test head.

7.2 CONTROL PANEL

An electrical alarm/control panel shall be supplied for each collection tank. The panel shall be suitable both for wall mounting and pole mounting. The panel shall be constructed to comply with AS/NZS 3000.2018 Electrical Installations. All controls shall be contained within the control cubicle preventing the necessity to remove the pump unit to attend to electrical faults.

The control panel shall be manufactured from polycarbonate or GR 316 stainless steel to ensure robustness and have suitable protection against vandalism and UV rays seen in Australian / New Zealand conditions and be of weatherproof construction to a minimum IP65 rating. It shall utilise high quality componentry. All penetrations shall be on the underside of the panel only and an appropriately sized gland is to be provided to prevent any water ingress. The panel shall be fitted with corrosion proof hinges. QLDC may accept other corrosion resistant material where adequate corrosion performance can be demonstrated.

Internally, the panel shall have a safety barrier (An internal escutcheon panel which covers the entire area of the panel and which only allows access to the operator controls for protection against unauthorised entry) compliant with AS/NZS 3000:2018.

The control panel shall incorporate the following features:

- Key lockable with the lock uniform across all installations
- Audible alarm 90Db with mute button
- Low voltage visual alarm light
- Automatic mute for audible alarms after 5 minutes with 12 hour restart
- Pump/Panel Circuit Breaker (must be double pole)
- Selector switch with Auto/Off/Manual positions
- Compatible with level switches, or 4-20mA, 0-5v and 0-10v pressure transducers
- Under and over voltage protection
- Hours run display
- Number of starts display
- High level and low level (run dry) indication
- Over pressure protection
- LED status indication for pump run fault, pump stop and common faults
- Backlit LCD screen for all status and alarm displays
- Ability to record, view, or store a downloadable history of events
- Inbuilt event history for minimum 4000 events
- Adjustable random restart delay after power failure
- Ground Lug for incoming connections
- Battery backup for alarms
- Generator plug in point (for emergency power outages)
-

The control panel shall be able to be upgraded simply and without enclosure modification to natively support the following:

1) Sim card for cellular based communication or alternative communications module (e.g. fibre optics);
2) Fully integrated SCADA to suit QLDC's existing telemetry system which may include the following features:
    - Adjust start periods or pause pump operation,
    - Full remote visibility of all operational information,
    - 2-way control of all stations,

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- Ability to remotely communicate Firmware updates.
- Real time clock
- USB port access or web based portal for history and real time view faults

Battery backup to allow communications and alarms

Control circuitry and/or level sensors operating in the collection tank shall be low voltage and suitably designed and installed for use in areas that may contain explosive gases.

Cable entries from the collection tank to the control panel shall be designed and sealed appropriately to ensure no fumes/gases are able to enter the control panel. Design shall be rugged, durable, and preventative of gas build up, fire, or explosion. Design shall also be tolerant to operators, maintenance contractor, or owner error.

The control panel shall ensure that the maximum pump starts per hour (recommended by manufacturers) are not exceeded.

SPECIFIC REQUIREMENTS FOR SMART SYSTEMS WHERE WASTEWATER FLOW CONTROL IS REQUIRED

Where Wastewater flow control is required, such as for network buffering to minimise downstream storage requirements, the controller installed at each property must include the following features:

- IP65 minimum rating;
- 240V controlled output to pump;
- Local Pump control on cut in / out levels with remote setting option;
- Telemetry connection for monitoring and control to back end server;
- Fault alarms direct to operators via email and/SMS to include as a minimum the following:
    - High level alarm above cut in level;
    - Power outage alarm (Black out or Brown Out);
    - Communication fault alarm;
    - Pump over current alarm;
    - Pump long run alarm;
    - Level sensor fault alarm.
- Online portal for operator access to include as a minimum the following:
    - Map showing individual connection locations;
    - List showing individual connection status;
    - Filters to select all active alarms;
    - Individual connection graphs of continuous liquid levels monitoring;
    - Options for operator selection of pump controls;
    - Options to add new sites or update controller reference data.
- Operator pump control of individual or multiple selected connections via online portal to include as a minimum the following:
    - Control mode to reduce diurnal peak flows based on network based concurrent pump control;
    - Control mode to generate self-cleansing flushing velocity in network;
    - Control mode to inhibit pumps in an emergency.
- Automated control mode for post emergency recovery to prioritise connections with highest levels and control peak flows;
- Connection hard wire to tablet with App for controller diagnosis to include as a minimum the following:
    - Alarm status;
    - Pump Status;
    - Amps draw during pumping;
    - Pump Voltage ;

This information is correct at date of issue. Always check in the relevant QLDC policy manual that this copy is the most recent version.

  - Level reading;
  - Comms status with communication network;
  - Comms signal strength;
  - Comms status with back end server;
- Backup audible buzzer and light alarm on the controller;
- Float switch pump activation trigger and remote alarm in high level situation.
- Spare IO to facilitate connectivity of potable and recycled water pulse meters to achieve daily flow data reporting

7.3 LEVEL CONTROLS

Level Controls shall be installed as per manufacturers recommendations and shall be pre-set at the factory. Level controls shall also have a back-up system to provide an alarm should the main level system fail.

Level sensors for measuring the level of sewage in the pump well shall be supplied. The primary sensors may be integral to the pump unit, or separate from the pump. A separate level sensor shall be used to detect high level in the pump well and to provide a high-level alarm signal. This shall be a back-up system to provide an alarm should the main level system fail. Level sensors may be pre-installed at the factory. If not factory installed, the installer shall be adequately trained to install the sensors and correctly set their levels.

Any pressure sewer system with more than one pump must not utilise level switches integrated to the pump. Separate level controls shall be installed independently of the pump and be connected to the control panel to allow full coordination of pump operation and adjustability to suit each application.

The pumps shall be controlled by probes or pressure sensors installed in the pump well. The probes or pressure sensors shall indicate the following levels:

- Low Level (BWL) – the pump stops;
- High Level (TWL) – the pump starts;
- Above High Level (HWL) – the alarm is activated.

A *'below low level'* sensor may also be supplied which shuts down the pump and activates the alarm. The '*low level'* shall be set as low as possible, while maintaining adequate submergence of the pump. The *'high level'* shall be set as low as possible to minimise storage, while not exceeding allowable pump start frequency at any flow rate. The *'above high level'* shall be set so that in normal operation it is not reached. Adequate volume between *'high level'* and *'above high level'* shall be installed to balance instantaneous inflows. If the operating levels can be adjusted they shall be readily adjustable by a worker remaining outside the well and complying with all OH&S requirements for safe working.

Control circuitry for the level sensors shall be contained in the alarm/control panel. The panel shall also have an OFF/Auto/ON switch or equivalent button configuration for the pumps. The ON setting shall bypass all pump controls except the thermal overload. The pumps shall be protected from overload and over pressure operation.

In situations of recovery after a blackout, pumps shall be programmed to come online through a deliberate strategy that staggers individual pump restarts so they are not all at once (i.e. time delay starts whether locally or from SCADA).

7.4 ALARMS

The pump controller shall be fitted with an audible alarm (buzzer) and a flashing red light that activates if the level of sewage in the collection tank reaches a high level. The audible alarm shall comply with the lower of: EPA rules; or noise restrictions outlined in QLDC's Operative District Plan ODP (PDP) where applicable. The audible alarm shall run for a maximum of ten (10) minutes and may only be restarted on activation of a new fault after the mute button has been pressed and the initial fault has been rectified.

The control panel shall include a mute button for the audible alarm to silence it on acknowledgement. The mute button shall be accessible externally to the pump control cubicle and shall be located in a protected position (generally underside of cubicle).

The operation of alarms shall be as follows:

- Above High Level: visual and audible alarm activates but pump does not stop. Alarm resets when the high level condition is rectified.
- For all other faults including over temperature, no flow, over pressure, overload, and *'below low level'*: the pump shall stop and operation re-commence when the fault is rectified.

The control panel shall have a reset procedure, which may only be carried out when the panel is opened. The procedure may use either the OFF/Auto/ON switch or a separate "Reset" button. The audible alarm shall be capable of field disconnection without interference to any other electrical functions.

7.5 ELECTRICAL INSTALLATION

All Electrical work shall be performed by a Licensed Electrician and shall be installed to comply with AS/NZS 3000.2018 Electrical Installations. The alarm/control panel shall be suitable for connection to a standard residential meter panel.

8 FACTORY TESTING AND COMMISSIONING

8.1 FACTORY TYPE TESTING

Before any units are installed, the following tests shall be carried out at the suppliers workshop.

Alternatives may be considered by QLDC if the supplier can provide details of a proven, standardised testing regime already adopted by the factory that addresses the intent of the following clauses.

If the unit supplier has already carried out type testing, type test certificates which cover the required tests may be accepted in lieu of factory testing.

Certificates giving records of tests carried out shall be supplied.

A copy of the completed supplier testing certificates and results for all components (tank, boundary kit, pump, electrical and control boxes). Factory Test shall be carried out and serialised for traceability and certificates provided with supply and delivery.

8.2 GRINDER PUMPS

Pump tests shall be carried out in accordance with AS 2417-2001 Annex A, or where not relevant, applicable international standard.

The pump casings shall withstand a hydrostatic test pressure scheduled for a period of 15 minutes without any leakage or permanent distortion.

8.3 COLLECTION TANKS

The collection tank shall be hydrostatically tested prior to installation to ensure that all penetrations are watertight.

The collection tank shall be prepared by installing a short section of test pipe (using the method for installation of inlet pipework) and sealing off all openings and vents. The unit shall then be tested via a hydrostatic test to a pressure of 3 m above the top of the well. The test shall be considered acceptable if there are no drips or weeps.

8.4 BOUNDARY KITS

The boundary kit shall be individually pressure tested at the factory and serialized for traceability of the pressure test. Testing regime shall include closed ball valve test, open ball valve test, and check valve test. Test pressure shall be minimum 16 bar.

8.5 ELECTRICAL AND CONTROL PANEL

The electrical and control panel shall be tested at the factory and serialized for traceability of the tests. Testing regime shall include input/output tests, power-up, logic and programming tests, and communications module testing.

9 SITE TESTING AND COMMISSIONING

Site testing shall be carried out by the unit installer. Completion of commissioning of any unit shall mark the start of the warranty period for that unit.

9.1 GENERAL

All operational tests on the pumping units shall be conducted using Queenstown Lakes District Council's Code of Practice, connection to council services application and integrated three waters bylaw, with the pumping unit only connected to the sewerage reticulation system after these tests using town water have been successfully carried out.

9.2 LEAKAGE TEST

A leakage test shall be carried out after completion of all pipework connections, but before the electrical control panel is switched on. The test shall be performed as below:

- The pump well shall be filled to the underside of the lid.
- Losses shall be observed after a minimum of 2 hours.
- No leakage should be observed.
- This test is to test the pump well, pipe seals and part of the connecting pipework.
- The connecting pipes may need to be plugged temporarily.

If leakage is observed, the collection tank and inlet penetration shall be inspected and any faults found rectified before retesting is undertaken.

9.3 SIMULATED POWER FAILURE TEST

The leakage test shall be conducted immediately before tests for operational readiness. As such, the initial operational tests will commence with the pump storage vessel filled to a high water level.

The pump should thus commence in an alarm mode when the power is turned on to the alarm panel, as per a power failure scenario.

This shall be the first test to determine if the alarms will automatically turn on and then off, as the pump reduces the volume stored in the storage vessel to below the high level alarm, and then to the normal pump 'OFF' levels.

9.4 TIME BASED OPERATIONAL TEST

The pumps shall be considered operationally ready when they have successfully operated for a period of one to four hours (or as needed to achieve 3 on/off cycles) with a constant inflow rate of around 0.1 to 0.2 L/s (this is the typical inflow from a garden hose discharging into the system at reasonable pressure). This test should involve at least three on/off cycles.

The variable time period above has been deliberately included to allow for regions where there are drought conditions being experienced or lack of water for other reasons. The test may be reduced to one hour to minimise any water wastage. QLDC shall instruct the unit installer as to the test parameters to be carried out.

9.5 ALARM TEST

In addition to the above operational test, the unit installer shall suddenly discharge quantities of water into the pumping unit's storage vessel rapidly from large water containers, such that the alarm level is exceeded. The pumping unit shall then be observed to see if the alarm initially comes on and subsequently if the alarm then automatically shuts off, after normal pumping levels have been achieved.

9.6 PUMP PROTECTION TEST

The pump shall also be tested against a closed valve, to ensure that the pump's safety cut-outs are working satisfactorily. This test need be conducted only once and due precautions shall be taken against sudden pipe failure. The pump shall be tested against the closed the boundary property valve.

9.7 COMMISSIONING OF PUMPS

The commissioning will consist of opening the isolation valve(s), and turning on the control panel for automatic operation. Commissioning will be considered complete after one week of fault free operation.

9.8 SYSTEM TEST

Based on the design calculations provided by the designer, the supplier and contractors shall carry out for QLDC to witness tests of the installed system. Flow rates and pressures shall be measured as part of this test to ensure that the system performs in accordance with the design. Any significant departure from the anticipated performance shall be referred to the designer and/or unit installer for rectification.

10 MANUALS

10.1 INSTALLATION MANUALS

Detailed instructions for the installation of the pump stations shall be provided in an installation manual specifically prepared for pressure sewer installations.

The Contractor shall ensure the LPSS is installed and commissioned in accordance with manufacturer's specifications.

10.2 OPERATIONS AND MAINTENANCE MANUALS

The grinder pump supplier shall have a suitably qualified local service agent to support privately owned grinder pumps. The service agent should hold adequate spares to support the install base. The suppliers phone number shall be on the alarm panel to enable the homeowner to contact them in the event of an alarm. The supplier shall demonstrate they have adequate 24/7 support to the homeowners and can achieve a response time within the 24hr emergency storage time.

The unit installer shall provide an operation and maintenance manual for the system. The manual shall comprise the following sections:

- Introduction;
- General principles of operation;
- Technical details of all equipment supplied;
- Typical installation schematics;
- Routine Maintenance (if applicable);
- Troubleshooting;
- Dismantling and re-assembly procedures;
- System design drawings for each area;
- Training Manual.

10.3 SPARE PARTS

A spare parts list and replacement equipment specifications shall be provided to ensure that the owners/operators always have adequate information for procurement and replacement of parts, and to allow service crews to take a replacement unit to all call outs.

Spare parts shall be available locally at all times.

10.4 WARANTIES AND INSURANCE

All warranties shall be provided to the owner as part of the owners operations and maintenance manual.

A warranty for each pressure sewer collection/pump unit shall, as a minimum, begin from the date of delivery and cease not less than twenty-four (24) months following the date of installation. The supplier shall also maintain a quality control system for managing the delivery of pumps and recording the pump numbers, unit serial numbers and delivery dates for warranty work.

The warranty shall be to rectify any defect in the materials and equipment supplied under the contract for the duration of the warranty period. The supplier shall also guarantee the components against installation defects if installed by an accredited pump installation contractor.

11 AS-BUILT INFORMATION PACKAGES

A file shall be maintained on each pressure sewer system area. Information shall be submitted to QLDC in an electronic format and shall include, but is not limited to the following:

REPORTS

- Concept Report
- Design Report
- Final Design Report

RETICULATION MAINS

- Work As Executed Drawings/ As-builts and asset data as per QLDC's standard requirements in the QLDC Subdivision and Land Development Code of Practice;
- Long sections to indicate pipelines that have been directionally drilled;
- Dates of construction completed for the pressure sewer system area;
- Dates made operational;
- Dates of boundary kits installed on the property
- Pressure test results and verification
- Dates of each property lateral laid

ON PROPERTY INFORMATION

- Property Address, lot number, GPS coordinates, owner's details, and any special property features;
- Work As Executed (WAE) drawing for each property;
- Sewer Service Diagram (SSD) requirements for the house drainage details (may be included with the Work As Executed drawings). The house drainage portion of the WAE to comply with all the rules and regulations of Queenstown Lakes District Council. Plans to include but not limited to the following details:
  - well location

- house sanitary drain connection location
- all pipe, valves and fittings up to the boundary kit
- control panel and power and control cable locations
- boundary kit location

- Tapping point and isolation valve location on common rising main
- The date work commenced on the property The date the work was completed and the installer had left the property
- The date the pump made operational and results of pump testing
- Date and number of pump commissioning certificate
- Manufacturer, serial number and warranty information of pump station/collection tank, electrical/control panel, Isolation details for the site
- Electrical details
- Operation and Maintenance Manual and emergency contact details
- For all trade waste installations and for private installations where the on-property equipment is to be privately owned, evidence that a service agreement is in place

APPENDIX A: TECHNICAL SCHEDULE – RESIDENTIAL UNITS

Pumping Equipment	***Ecoflow - E/One***	***Aquatec - Barnes***
Nominal Duty at 40m Head	0.5 l/s	0.5L/Sec
Maximum Continuous Operation Head	56m	60 metres
Manufacturer	Environment One - E/One	Aquatec Barnes (or approved equivalent)
Country of Manufacturer	USA	USA
Model	Extreeme Series Grinder Pump	OGT 10S2 AU
Type	Progressive cavity	Regenerative Turbine
Casing Material	Cast Iron	Cast Iron ASTM a-48, Class 30
Pump/Motor seal type/material	Mechanical Seal ceramic seat, carbon rotating surface	Mechanical/Silicon Carbide
Pump Shaft Material	One piece Stainless steel	416 Stainless Steel
Pump Impeller Casing	Cast Iron	Stainless Steel
Grinder/Type/Hardness	Forged 4140 cutter wheel with cutter teeth (Rockwell 55-58c)	440C Stainless Steel Hardened to Rockwell C-55
Motor Size (kW)	0.75kW IP68	0.75KW rated IP68 submersible to 9 meters
Motor Protection	Thermal Overload	Thermal Overload
Motor Insulation	Class F	Class F
Electrical Quick Disconnect	Radial Seals Nema 6P	Rated IP68
Pump and Pipework Protection over Pressure Protection (Optional)	Adjustable wattage sensor, typical trip out at 70m -1500W	Pressure control must cut power to unit at preset discharge head and reset automatically.
Sound Level Emissions outside of Pump Well	Not detectable	Not Detectable
Weight of Pump Unit (kg) Maximum	45kg	38kg
Lifting Material	Marine Grade Polypropylene rope	Marine Grade Polypropylene rope

Pipework & Fittings	***Ecoflow - E/One***	***Aquatec - Barnes***
Inlet coupling type/size	Proprietry E/One uniseal to suit 10mm thick wall	Flexible connector/100mm
Discharge Pipework Size & Material (describe fully)	32 PN16 flexible pipework with propriety E/One 316 S/S ballvalve and disconnection gooseneck.	32 PN16 flexible pipework with 316 S/S camlock couplings for disconnection.
Discharge Valve and Tank Outlet	32mm 2 piece 316 stainless steel ball valve and threaded tank outlet.	32mm 2 piece 316 stainless steel ball valve and threaded tank outlet.

Electric and Controls - Standard	***Ecoflow - E/One***	***Aquatec - Barnes***
Pump Controller	Single, Duplex pump operation.	Single, Duplex or Triplex pump operation.
Material	Polycarbonate (lockable)	316 stainless steel (lockable) or polycarbonate (lockable)
Proposed Location	Wall of dwelling	Wall of dwelling
Designed to Australian / New Zealand Standard (Nominate)	AS 3000:2018	AS 3000:2018
Level Switches	***Ecoflow - E/One***	***Aquatec - Barnes***
Type	Pressure switches in head of pump	Float Switch Level Control Assembly
Make	E/One or (Iota for smart controller)	Aquatec (or approved equivalent)

Pump Well - Residential	***Ecoflow - E/One 2013ip***	***Aquatec - Barnes***
Material	Polyethylene	Polyethylene
Designed to Australian / New Zealand Standard (Nominate)	AS/NZS 1546.1.2008	AS/NZS 1546.1.2008
Depth	1660	1.6m
Diameter	1032mm	1000mm
Total Volume	910L	950L
Storage between On level and overflow (L)	692	670

Pump Well - Commercial	***Ecoflow - E/One 2013ip***	***Aquatec - Barnes***
Material	Polyethylene - Large diameter horizontal pipe construction	Fibreglass
Designed to Australian / New Zealand Standard (Nominate)	AS/NZS 2566.1:1998	AS/NZS 1546.1.2008
Depth	Custom built to suit site specific application	2.2
Diameter	1500-1800mm (horizontal)	1070-1850
Total Volume	1500L-20,000L	1500L-15000L as standard with custom built chambers available on request
Storage between On level and overflow (L)	Custom built to suit site specific application	Min. 1168L

QUEENSTOWN LAKES DISTRICT COUNCIL

SOUTHERN LIGHT

PART TWO – TECHNICAL SPECIFICATIONS

Queenstown Lakes District Council

Date: February 2025

Document History	Date	Prepared By	Reviewed By	Approved
Council Adopted	9/2/2017	Alison Tomlinson/ Polly Lambert (QLDC) and Ian Campbell (Stantec)	David Wallace	Ulrich Glasner
Page 15 – clarification of NEMA socket	2/8/2017	Alison Tomlinson	Andrew Edgar	David Wallace
Clarification and update to new standards	16/05/2019 31/01/2022 10/07/2024	Ian Campbell (Stantec) Luke Steggles (WSP) and Alison Tomlinson (QLDC) Rodney Hawthorn (WSP) and Sam Metcalfe (QLDC)		

CONTENTS

Introduction

The purpose of this document is to ensure that lighting infrastructure in Queenstown Lakes meets the outcomes specified in the Southern Light, Part One – A Lighting Strategy. That is through providing safe environments for pedestrians, vehicles and to discourage illegal acts as well as ensuring that public lighting is attractive, robust, easy to maintain, cost effective and fit for purpose. This document will set out accepted best practice, minimum manufacturing and performance standards, as well as QLDC asset management and strategic objectives throughout the district, including QLDC vested road and outdoor lighting, private lighting and new developments, including parks and feature lighting.

This technical guide should be read in conjunction with the following which can be found on the QLDC website:

- QLDC District Plan.
- Southern Light, Part One – A Lighting Strategy
- QLDC Land Development and Subdivision Code of Practice

This document shall be used by developers, contractors, consultants, service/utility operators, QLDC design engineers, planners, project managers and others involved in the design, installation and management of new lighting installations. It may be used as a guide to repair or replace existing lighting infrastructure.

It is acknowledged the District has community specific urban design requirements and these will be referenced individually.

In summary this document describes how to complete the detailed design and calculations required for compliance with the applicable standards to achieve the following:

- Provision of vehicular route lighting for vehicle and pedestrian safety
- Provision of pedestrian route/area lighting for pedestrian safety, crime prevention and to enhance the environment
- Provision of lighting infrastructure (luminaires, columns, outreach arms, bracket arms and associated equipment) that is energy efficient, cost effective and will cope with regional climatic and environmental conditions such as extreme temperatures and weather conditions
- Provision of feature and festive lighting (whether temporary or permanent) that do not create excessive glare or spill light into neighbouring properties. Exemptions must be granted by QLDC where this lighting contravenes Southern Light.
- While achieving safe and compliant lighting (as described above) also minimising any negative impacts such as obtrusive (spill) light, glare, and light pollution (upward waste light contributing to sky glow)

Southern Light is a live document subject to periodic review and may be amended at any time as and when directed by QLDC.

1. SCOPE

The main scope of this document includes areas covered by the AS/NZS 1158

- Roads, accessways and rights of way (public & private)
- Reserves and public activity areas
- Pedestrian (Zebra) crossings
- Pedestrian and cycle paths
- Public precincts (e.g., shopping precincts)
- Public access areas (e.g., connecting elements including steps, ramps, subways, footbridges and CCTV)
- Car parks
- Bus stops

- Transport Hub and bike stands
- Vested infrastructure such as pumpstations, reservoirs, treatment plant sites

This document also provides indicative design guidelines for areas outside AS/NZS 1158 which includes, but not limited to

- Parks and Reserves and sports fields
- Illuminated Signs
- Feature Lighting (up-lighting & spot lighting)

Additional guidelines for lighting can be found in AS/NZS 1680, AS/NZS 2293 and the NZ Building Code.

Guidelines for sports lighting (interior/exterior) can be found in AS 2560.

2. STREET LIGHTING ON PRIVATE ROADS

QLDC's policy for street lighting on private roads was amended on 1st January 2004 and encompasses the following:

- Maintenance and operating costs of lights installed on private roads and rights of way after 01 January 2004 shall be the responsibility of lots serviced by such private access roads; and
- All lights installed on private roads, accessways and Rights of Way after 01 January 2004 shall be isolated from the QLDC lighting network.
- All lights installed on private roads, accessways and Rights of Way shall follow the guidance and technical considerations of this document. Refer to Section 28 for further detail.

3. APPLICABLE STANDARDS AND REGULATIONS

The following section lists the standards and regulations applicable to the design, installation, and maintenance of road lighting installations. The latest copies of standards and their amendments shall apply.

Professional Practice and Design:

Engineering New Zealand Practice Note 1 – Guidelines on Producer Statements

Engineering New Zealand Practice Note 2 – Peer Review

Health and Safety at Work Act 2015 (HSW Act)

Safety in Design:

Guide to Health and Safety by Design

Electrical:
The Electricity Act 1992
The Electricity (Safety) Regulations 2010
The NZ Electrical Codes of Practice
The NZ Building Code
AS/NZS 3000: Electrical installations (known as the Australian/New Zealand Wiring Rules)
AS/NZS 7000: Overhead Line Design

Lighting:
AS 2560 (Series): Sports lighting
International Dark Sky Association IDA-Criteria for Community-Friendly Outdoor Sports Lighting
AS/NZS 4282: Control of the obtrusive effects of outdoor lighting
AS 60529: Degrees of protection provided by enclosures (IP Code)
AS/NZS 1158.0: Lighting for roads and public spaces, Part 0: Introduction

AS/NZS 1158.1.1: Lighting for roads and public spaces, Part 1.1: Vehicular traffic (Category V) lighting - Performance and design requirements
AS/NZS 1158.1.2: Lighting for roads and public spaces, Part 1.2: Vehicular traffic (Category V) lighting - Guide to design, installation, operation and maintenance
AS/NZS 1158.2: Lighting for roads and public spaces, Part 2: Computer procedures for the calculation of light technical parameters for Category V and Category P lighting
AS/NZS 1158.3.1: Lighting for roads and public spaces, Part 3.1: Pedestrian area (Category P) lighting - Performance and design requirements
AS/NZS 1158.4: Lighting for roads and public spaces, Part 4: Lighting of pedestrian crossings
AS/NZS 1158.5: Lighting for roads and public spaces, Part 5: Tunnels and underpasses
AS/NZS 1680 (Series): Interior and workplace lighting
AS/NZS 2293 (Series): Emergency escape lighting and exit signs for buildings
AS/NZS 60598.2.3: Luminaires - Particular requirements - Luminaires for road and street lighting
SA/SNZ TS 1158.6: Lighting for roads and public spaces - Luminaires - Performance
BS 5489-1: Code of practice for the design of road lighting, Part 1: Lighting of roads and public amenity areas
IEC 62262, Ed. 1.0: Degrees of protection provided by enclosures for electrical equipment against external mechanical impacts (IK code)
NZTA M30: Specification and Guidelines for Road Lighting Design

Lighting poles (design and construction):
NZTA M26: Specification for Lighting Columns

Refer to the International Dark Sky Association (IDA) for general information and guidelines

4. DESIGN REQUIREMENTS

The applicable design standards shall be the New Zealand requirements of the AS/NZS 1158 series, and the following sections provide a summary of the main requirements. The designer shall be responsible for applying all the specific design requirements of AS/NZS 1158 (as well as any other QLDC specific rules or procedures) to the extent they are applicable whether or not they are included in this document.

Safety in Design

The Health and Safety at Work (HSW) Act requires persons controlling a business or undertaking (PCBU) to ensure so far as is reasonably practicable the health and safety of their workers and workers whose work is influenced or directed by the PCBU. PCBUs must also ensure that the health and safety of other persons is not put at risk as a result of their activities. Part of this duty involves the PCBU eliminating or minimising risks arising from work.

PCBUs, which design plant and structures that are to be used, or could reasonably be expected to be used, in a workplace, have a duty to ensure so far as is reasonably practicable that the plant or structure is designed to be without risks to Health & Safety.

Section 22 of the HSW Act defines 'Reasonably Practicable' as something which is, or was, at a particular time, reasonably able to be done in relation to ensuring health and safety, considering and weighing up all relevant matters including:

- The likelihood of the hazard or the risk concerned occurring;
- The degree of harm that might result from the hazard or risk;
- What the person concerned knows, or ought reasonably to know, about the hazard or the risk and the ways of eliminating or minimising the risk;
- The availability and suitability of ways to eliminate or minimise the risk; and

- That after assessing the extent of the risk and the available ways of eliminating or minimising the risk, the cost associated with available ways of eliminating or minimising the risk, including whether the cost is grossly disproportionate to the risk. A SID process aims to address the above matters by designing out safety risks where it is reasonably practicable to do so.

The designer must prepare a Safety in Design (SiD) register and supply as part of the design when presented for review. This shall encompass all assessed Health and Safety considerations created by the design provided for review.

The SiD register integrates hazard identification and risk assessment methods in the design process. It must demonstrate how to eliminate, isolate or minimise the risk of death, injury and ill health to those who will construct, operate and maintain. Where additional requirements to manage uncontrolled risks identified by the designer are needed in later stages of the project, these risks shall also be highlighted and shared (by the designer) with the Principal Designer and Constructors.

5. LIGHT SOURCES AND ADVERSE LIGHTING EFFECTS

All new lighting installations shall utilise light emitting diode (LED) technology luminaires. Refer to NZTA M30 for a list of acceptable luminaires. Alternative LEDs luminaires may be considered for amenity lighting on reserves, provided they meet the minimum manufacturing, testing and performance requirements of NZTA M30 including warranty period. QLDC reserves the right to exclude any alternative LED (not on the current NZTA M30 list) if the designer or supplier cannot clearly demonstrate full compliance with NZTA M30. Other lighting technologies may be considered and shall be confirmed by QLDC before final design is finalised.

As part of the lighting design process the designer shall consider and minimise any potential adverse or obtrusive lighting effects such as spill light, glare and sky glow (upward light). The limits of adverse lighting and methods of mitigation, as provided in AS/NZS 4282, shall be followed.

Private lighting must comply with district plan spill lighting requirements and spill lighting calculations on boundaries need to be included for these.

"No activity on any site shall result in greater than a 3.0 lux spill (horizontal and vertical) of light onto any other site measured at any point inside the boundary of the other site."

Feature and festive lighting outside of M30 may be approved by QLDC on an individual basis. Details of wattage / energy consumption must be supplied as part of the application process.

6. LIGHTING CATEGORIES

The primary aim of any road lighting scheme is to facilitate the safe movement of people. There are two main categories of lighting (Category V and P), and various subcategories, that provide varying levels of lighting based on a number of particular traffic (vehicular and pedestrian) parameters applicable for each type of road.

Category V lighting is applicable to roads where the visual requirements of motorists are dominant e.g. arterial or main roads, motorways and sub-arterial roads.

Category P lighting is applicable to roads and other outdoor public spaces where the visual requirements of pedestrians are dominant e.g., Town Centre areas, local roads, pedestrian pathways and cycleways.

The decision to install a lighting scheme in compliance with AS/NZS 1158 (and any other QLDC policies and procedures), including which subcategory of lighting is applicable, rests with QLDC. This decision is typically based on factors such as night-time traffic flows, composition of traffic (vehicular and/or pedestrian), the need to enhance prestige, risk of crime and other patterns of use.

The designer may select and design to the light category based on the guidance below and proceed at their own risk, however, if QLDC are not in agreement with the selected Sub-Categories we reserve the right to direct the designer to change at the review stage. If there is uncertainty over the category to be used for the design, the developer shall contact QLDC to reach agreement on category, prior to commencement of design.

Note that more than one subcategory may be required within one development, e.g., different road hierarchies and car park lighting.

The designer (or nominated QLDC representative) may be required to assist in the Sub-Category evaluation process for more complex applications, in this scenario no design shall be commenced until QLDC approval has been obtained.

Reference should be made to the relevant parts of the current AS/NZS 1158 series that provide indicative guidance on the application of the different categories and subcategories of lighting. Relevant parts include:

- Figure 2.1 from AS/NZS 1158.1.1 and AS/NZS 1158.3.1 - Example Road and Public Space Types and Indicative Lighting Categories and Subcategories
- Table 2.1 from AS/NZS 1158.1.1 - Category V Lighting Applications
- Table 2.1 from AS/NZS 1158.3.1 - Category P Lighting Applications for Road Reserves in Local Areas
- Table 2.2 from AS/NZS 1158.3.1 - Category P Lighting Applications for Pedestrian and Cyclist Paths
- Table 2.3 from AS/NZS 1158.3.1 - Category P Lighting Applications for Public Activity Areas (Excluding Car Parks)
- Table 2.4 from AS/NZS 1158.3.1 - Category P Lighting Applications for Connecting Elements
- Table 2.5 from AS/NZS 1158.3.1 - Category P Lighting Applications for Outdoor Car Parks (Including Rooftop Car Parks)

It is the responsibility of the designer to ensure they have current editions of AS/NZS 1158, BS5489.1 and any other QLDC lighting standards, policies, and procedures.

7. LIGHTING CATEGORIES AND THE DISTRICT PLAN

To assist in the interpretation of this standard, QLDC has summarised AS/NZS 1158.3.1 Tables 3.3 - 3.7 of the standard to reflect the local needs based on the District Plan zones. Refer QLDC Table 1 below.

Category P (pedestrian) will be the main lighting standard used as it provides standards applicable to most of the roads managed by the QLDC.

The designer should assess factors such as:

- Traffic flows – Using predicted / modelled flows at year 20 to inform the final Sub-Category selection. Contact assetmanagement@qldc.govt.nz to obtain any available held flows by QLDC.
- Composition of traffic (vehicular and/or pedestrian)
- The need to enhance amenity and the activities of adjacent businesses. For example, areas with high volumes of pedestrian movements associated with bars and restaurants will require different lighting consideration to business parks.
- Risk of crime
- The context of wider development within the area. This is especially important for Sub-divisions constructed in multiple stages. The traffic impact assessment should be referred to

inform lighting sub-category selection by way of confirming traffic modelling over a 20-year period for the entire development and not just individual stage.

8. LIGHTING CATEGORIES P-CATEGORY

QLDC Table 1 Lighting Category Summary for Road Reserves in Local Areas (Category P)

Area of Activity	District Plan Zone	Lighting Subcategory*	Average Daily Traffic Flow	Luminaire CCT
Local Roads or streets used primarily for access to abutting properties including residential properties	*** Township, Residential Zones, Rural Zones, Special Zones**	**PR6**	**Less than 1,500 vehicles**	**3000K**
	Town Centre, High Density Residential, Industrial and Business zones	PR5	**Greater than 1,500 but Less than 2,500 vehicles**	
Pathways (including cycle ways, footpaths along roads, walkways and park paths) where these have been identified for lighting.	Town Centres – designated safe routes and Cycle Commuter Connections	PP3 or PP4	N/A	
	Town Centres - other pathways	PP3	N/A	
	Pathways outside of Town Centres	PP5	N/A	
Town Centre pedestrian activity areas (malls, open arcades, town squares, civic centres	Town Centre	PA3	N/A	
Townships – Main Street Business Area	Township	PR1 or PR2	N/A	
Transport terminals and service areas with mixed pedestrian and vehicle movements during hours of darkness	All	PA3	N/A	
Lit Pedestrian Underpass Rural Access Only	All	Refer Section 20.3 NZTA M30:2014 (Applies day and night)	N/A	
Pedestrian Underpass Urban / Semi-Urban, forming part of a commuter route.	All	Refer Table 4 of BS 5489.1:2013 for Daytime Requirement (enclosed subway)	N/A	

		PE1 for Night		

9. LIGHTING CATEGORIES VEHICULAR TRAFFIC ROUTES

Although a number of high-volume vehicular routes within QLDC's geographical area belong to Waka Kotahi, there are still of high-volume roads that meet V-Category or higher P-Category criteria, and this will extend to key routes through new developments and subdivisions.

A site-specific assessment shall be undertaken by a lighting designer to confirm the appropriate lighting sub-category as per the requirements of Section 8 prior to undertaking any design. The following baseline guidance and ranges shall be considered for reference in attributing sub-categories for higher trafficked routes. Note that the use of V1 and V2 is not recommended for the QLDC region.

QLDC Table 2 Lighting Category Summary for Mostly Vehicular Traffic Routes (Category P and V)

Type of Road	Average Daily Traffic Flow	Lighting Subcategory*	Luminaire CCT
Collector Road or Arterial within a district centre Urban Environment with high pedestrian movements, adjacent retail, bars/restaurants, regular intersections and on street parking.	Greater than 2,500 Vehicles	P-Category (PR1 or PR2)	3000K
Collector Road or Arterial within an Urban or Semi-Urban Environment. Outside of and connecting to a district Centre.	Greater than 2,500 but less than 5,000 Vehicles	P-Category (PR2 or PR3)	
Collector Road or Arterial within an Urban or Semi-Urban Environment. Outside of and connecting to a district Centre.	Greater than 5,000 but less than 15,000 Vehicles	V4	
Collector Road or Arterial within an Urban or Semi-Urban Environment. Outside of and connecting to a district Centre.	Greater than 15,000 Vehicles	V3	
Collector Road or Arterial in Intrinsically Dark and Rural Areas	N/A	Unlit or Flag lighting	

10. LIGHTING CATEGORIES CAR PARKS

The following criteria shall apply to lit car parking within the region. Limits to private car parks have also been included in the interest of reducing upward waste light on new commercial developments.

QLDC Table 3 Lighting Category Summary for Off Street Surface Car Parks (Category P)

Type of Car Park	Description of Use	Lighting Subcategory*	Car Park Capacity	Luminaire CCT
Town Centre Public Car Parks, Public Transport Hubs and High Use Private Car Parks	Town Centre (Inner CBD) locations, such as Queenstown, Wanaka and Frankton. Recommended Criteria for Larger Private Business Development, such as supermarkets and retail parks.	PC2	N/A for Public Greater than 30 Spaces for Private	3000K
District Centre or Semi-Urban Public Car Parks and Low Use Private Car Parks	Outside of inner CBD areas listed above and all other lit car parks within the region. Recommended Criteria for all private small business facilities.	PC3	N/A for Public Less than 30 Spaces for Private	

11. DESIGN METHODOLOGY

The following definitions and sections describe the main types of road lighting calculations required and their application is dependent on the category of lighting required.

Table 4 Lighting design methodology

Calculation	Definition	Methodology	Category
Illuminance (E)	Illumination is a general expression for the process of light arriving at a surface and the physical measure of this is illuminance. Illuminance is the luminous flux (lumen - lm) arriving at a surface divided by the area of the illuminated surface.	Unit: lux (lx); 1 lx = 1 lm/m².	Illuminance calculations are required for category P roads and nominated locations on category V roads.
Luminance (L)	Luminance is the physical quantity of light corresponding to the	Unit: candela per square metre (cd/m²).	Luminance calculations are

Calculation	Definition	Methodology	Category
	brightness of a surface (e.g. a lamp, luminaire or reflecting material such as the road surface) when viewed from a specified direction.		only required for category V roads.
Uniformity (U)	The uniformity is a calculated ratio that is used to measure how evenly the light is distributed over a given area or length of roadway.	Uniformity calculations are required for both category V and P roads; however, the method of calculation differs between the two categories.	

CATEGORY V DESIGN OBJECTIVES

The principal design objectives for category V lighting are to provide the following:

(a) Luminance and uniformity of luminance of the carriageway surface to a specified level.
(b) Glare control to a specified level.
(c) Illumination on intersections, carriageway verges, splitter islands and other nominated locations to a specified level.
(d) Limitation of upward spill light from luminaires to a specified level.
(e) A maintenance regime such that the lighting scheme complies at all times during each maintenance cycle.
(f) Minimal energy consumption.
(g) Minimal whole of life cost and Warranty opportunities.

Refer to AS/NZS 1158.2 for the minimum design areas and applicable calculation fields.

CATEGORY P DESIGN OBJECTIVES

The principal design objectives for category P lighting are to provide the following:

(a) Illuminance and uniformity of illuminance over the road reserve to a specified level.
(b) Glare control to a specified level.
(c) Limitation of upward spill light from luminaires to a specified level.
(d) Limitation to a specified level of the light spilled into adjacent properties.
(e) A maintenance regime such that the lighting scheme complies at all times during each maintenance cycle.
(f) Minimal energy consumption.
(g) Minimal whole of life cost and Warranty opportunities.

Refer to AS/NZS 1158.2 for the minimum design areas and applicable calculation fields.

LIGHT TECHNICAL PARAMETERS

The principal design objectives (outlined in the above two sections) are formally specified in terms of the following Light Technical Parameters (LTPs):

(a) Parameters that relate to the attainment of the required level of lighting performance.
(b) Parameters that limit the adverse effects of the lighting on:

i. Reduction of glare to enable safe use of the lit space by pedestrians and vehicle drivers
ii. Reduce sky glow to enable night sky viewing conditions
iii. Minimise the amount of spill light to occupants of adjoining properties

Reference should be made to the relevant parts of the current AS/NZS 1158 series that provide the minimum levels of compliance that are required for each category and subcategory of lighting. Relevant parts include:

- Table 2.2 from AS/NZS 1158.1.1 - Values of LTPs for Category V Lighting
- Table 3.3 from AS/NZS 1158.3.1 - Values of LTPs for Category P Lighting of Roads in Local Areas
- Table 3.4 from AS/NZS 1158.3.1 - Values of LTPs for Category P Lighting of Pathways and Cyclist Paths
- Table 3.5 from AS/NZS 1158.3.1 - Values of LTPs for Category P Lighting of Public Activity Areas (Excluding Car Parks)
- Table 3.6 from AS/NZS 1158.3.1 - Values of LTPs for Category P Lighting of Connecting Elements
- Table 3.7 from AS/NZS 1158.3.1 - Values of LTPs for Category P Lighting of Outdoor Car Parks (Including Rooftop Car Parks)

It is the responsibility of the designer to ensure they have the current editions of AS/NZS 1158 and any other QLDC lighting standards, policies and procedures.

CALCULATION OF LIGHT TECHNICAL PARAMETERS

The calculations of all Light Technical Parameters (LTPs) for category V and P roads shall be carried out in accordance with the computer-based design procedures provided within AS/NZS 1158.2. This standard provides the basic formulae for the LTPs and the associated grid of points (calculation field) over which the calculations are to be made. Hand calculations shall not be accepted.

The use of a specific software application called “SAA STAN” is mandatory for the calculation of the luminance based LTPs for the category V straight road elements. This can be achieved using the software such as “Perfect Lite” or another shell program that is built around “SAA STAN” and which can be demonstrated to reproduce the values of all LTPs provided by “Perfect Lite”.

The calculation software “AGi32” shall be used for the illuminance-based calculations required for Category V road lighting designs.

The calculation software “AGi32” shall be used for the illuminance-based calculations required for Category P road lighting designs.

Other software packages confirming compliance with the AS/NZS 1158 calculation procedure may be utilised if appropriately demonstrated by the designer and agreed prior to design by QLDC.

It shall be the responsibility of the designer to ensure the appropriate software is used to carry out all the required calculations.

Spill light calculations shall be undertaken for all streetlights adjoining residential activities. Horizontal measured at the boundary by a line of points at ground level at 2m intervals and vertical measured at the boundary with the meter facing parallel to the boundary towards the light source by a line of points at 2m spacing from 0m to a height of 12m.

MAINTENANCE FACTOR

A design maintenance factor (MF) is used in the calculations to account for the combined light losses resulting from depreciation in the LED's lumen output and accumulation of dirt on the luminaire over a nominated maintenance period.

The MF is calculated as the product of the following depreciation factors:

(a) *Luminaire Dirt Depreciation Factor (LDD):* This is dependent on ingress protection of the luminaire, environmental zone and the cleaning Interval of the LED Luminaires. Refer to Table 5 below, for LDD for a luminaire with a visor or for a luminaire with exposed optics a LDD of 0.78 shall be used.

(b) Light Source Lumen Depreciation Factor (LLD): The amount of light (lumen output) available at the end of a nominated operating period (85,000 hours - 20 years), as a proportion of the initial lumen output (when the LED was new), expressed as a decimal fraction. The LLD takes into account the operating temperature, driver current and electrical properties and shall be obtained from the luminaire supplier.

Table 5 Luminaire dirt depreciation factor (LDD)

Environmental zone	LDD Factor			
	Cleaning Frequency			
	36 Months	48 Months	60 Months	72 Months
Rural - Category P Lighting	0.95	0.94	0.93	0.92
Urban - Category P Lighting	0.90	0.88	0.86	0.84
Urban and Rural – Category V Lighting	0.95	0.94	0.93	0.92

(c)

The design MF can be calculated as follows:

MF = LDD x LLD

As part of the design delivery process the designer is required to provide information on the MF used in the calculations including the calculation for the luminaires specified and luminaire data to support the selections.

The maximum design MF shall not exceed 0.8 even if the MF calculation yields a higher result.

DESIGN OUTPUT DELIVERABLES

The designer shall submit the following design documents for QLDC approval before commencement of the installation works. Refer to Appendix D of AS/NZS 1158.1.1 and Appendix C of AS/NZS 1158.3.1 for a full list of the mandatory design information required to be submitted. Onus is on the designer to prove the design meets the relevant codes and consents. Work shall not be started until the design documents have been approved by QLDC.

QLDC may request that any submitted design is peer reviewed by one of our approved Lighting Design Reviewers at the cost of the applicant.

Design Submission Check Sheet

The QLDC design checklist can be found on the QLDC website. Note any decorative/heritage columns or luminaires must be approved by Property &Infrastructure via the design check sheet sign off. Specific requirements are as follows.

Layout Drawings

The layout drawings shall be produced using a CAD based computer program, examples can be found in the Appendix and shall include the following minimum information:

The drawings shall show:

(a) Locations of all poles (dedicated lighting poles and/or overhead power poles) where the luminaires are installed and dimensions clearly showing the pole spacings.
(b) A dedicated Lighting Column setback for each position shall be provided showing the distance from the kerb or boundary line. A general note will not be accepted.
(c) All the roadway features including kerbs, carriageway edges, lane markings, property boundaries, traffic/splitter islands, pedestrian crossings, and any other features that form part of the road reserve or carriageway.
(d) Equipment legend detailing the luminaire types (e.g. LED count and driver current/size, power rating),
(e) Luminaire mounting arrangements (e.g. tilt angles, heights, outreaches, etc., poles and outreach arms
(f) Specific column installation details (ground planted, slip base, etc.).
(g) Interaction with above ground and below ground services - annotating minimum clearances required as well as applicable codes to determine those clearance.
(h) Any applicable calculation areas.
(i) Isolux plots from AGI32, showing the relevant contours for each lighting sub-category in the design including isolux lines for each of the minimum required horizontal illuminance values.
(j) The Lighting design drawings shall show the location of all overhead powerline assets and the associated horizontal ECP34 clearances for structure without engineering assessment.

Design Report or Design Statement

A design report or design statement shall be provided along with layout drawings and shall contain comprehensive information detailing all aspects of the design and (in conjunction with the layout drawings) shall be used as a method of verification that the design is fully compliant with the New Zealand requirements of AS/NZS 1158 and any other QLDC requirements. As a minimum the following information shall be provided:

(a) The applicable categories and subcategories for each road.
(b) A list of the design methods employed and presentation of the modelling results to demonstrate compliance. This can be a list of tabulated calculation results with suitable printouts from the lighting software used.
(c) Any areas of non-compliance with the NZ standards and/or QLDC requirements shall be noted along with explanatory notes describing why a fully complying design was not achieved. QLDC approval shall be required for any areas of non-compliance.
(d) Details of the lighting arrangement (e.g. single sided, staggered, opposite, etc.) and geometry (e.g. spacing, mounting height, overhang, up cast angle).
(e) Details of the lighting columns including type, size, material, finish and any particular mounting requirements (frangible, shear based, etc.).
(f) Luminaire details including luminaire name, description, input power, LED count, driver current, optical setting, lumen output and IP/IK rating.

(g) The origin of the photometric file (used in the design modelling) for the luminaires.
(h) The name and source of the computer software used.
(i) The MF used and the basis for the MF selection (refer to Section 12).
(j) Design report should make comment on key service crossing/s interactions, detailing those minimum separations and clearances have been maintained, and/or where technical deviations have been required and contain/reference consents from the respective utility provider for these.
(k) State who signed off the Lighting Design along with relevant credentials/training/experience, refer Section 22.2 of NZTA M30:2014 for acceptable experience.

Calculation Results (Refer to example in Appendix)

- A printout of the calculation results, directly from the lighting software, shall be required to be submitted for approval along with the other design information listed above. The calculation results must be printed directly from the lighting software (i.e. AGi32).
- QLDC will not accept tabulated results (on drawings) in lieu of the actual software printouts.
- Software files of the final accepted design (and any subsequent revisions) should be submitted to QLDC.

Obtrusive Light Calculation Results

Obtrusive light calculations shall be carried out in accordance with AS/NZS 4282 for all new category V street lighting installations, outdoor sports fields and industrial/commercial outdoor work areas adjoining residential properties. All obtrusive light calculations shall be carried out with a maintenance factor of 1.0. Spill light calculations are not required for category P lighting installations unless specifically requested by QLDC. Examples where spill light calculations may be required include (but are not limited to):

- All car parks bordering residential areas
- Lighting of pedestrian activity areas or narrow alleyways adjacent to residential (particularly multi-story apartments where windows may be close to light poles)
- Lighting of areas elevated above other residential developments

Note that the control of glare and upward waste light will need to be demonstrated for all new Category P lighting schemes in accordance with AS/NZS 1158.3.1

QLDC will reject any design that is submitted with missing or incomplete information, or any unjustified areas of non-compliance.

12. LOCAL AREA TRAFFIC MANAGEMENT DEVICES (LATMs)

LATM devices on:

a. V-Category Roads shall be lit to the requirements of AS/NZS 1158.3.1: Section 4.5.2 for the application for the design area. With the point horizontal minimum illuminance requirement being that as defined in Table 2.2 of AS/NZS 1158.1.1 for the selected Sub-Category.
b. P-Category non-local roads shall be lit to the requirements of AS/NZS 1158.3.1 Section 4.5.2.
c. Sub-Category PR5 and PR6 local roads within residential sub-divisions shall be lit (and treated) to the requirements of AS/NZS 1158.3.1 Section 4.5.3. However, the maximum '0.25S' stated in sub-clause (b) is replaced with '5 metres'. The intention of this requirement is to identify the potential hazard to the approaching driver, while reducing the over lighting of residential roads mostly accessed by local residents with their origin or destination in that road.

13. BUS STOPS

A lighting column shall be located on the approach side of the bus stop, within 10m of the start of the bus stop marking.

When a bus turns into or out of a bus stop the bus may overhang the kerb. To minimise the risk of bus vs column collision, any lighting column must be setback at least 3m from the face of kerb where no bus shelter is present, or in line with the shelter structure where a shelter is provided.

Lighting columns shall not be located within 2m of a bus shelter to limit potential public roof top access.

14. FLAG LIGHTING

At isolated rural unlit intersections, consideration of night-time safety issues should occur, the designer should provide details as to whether flag lighting has been considered and reasoning for the outcome. Flag lighting (in addition to reflective strips) should be used as a means of providing advance warning to alert approaching motorists to the presence of the intersection. In such cases specific illuminance design is not required and the following table has been provided as a guide to selecting the most appropriate luminaire and mounting parameters.

The designer should also follow any NZTA guidelines around the use of flag lighting at isolated rural unlit intersections.

QLDC Table 6 Parameters for Flag Lighting

Vehicle Volume (VPD)	Subcategory	Recommended Mounting Height (m)	Recommended Lumen Output (lm)
>15,000	V3	10 or 12	12,500
< 15,000	V4	8 or 10	7,500

15. INNOVATION AND LIGHTING TRIALS

The intention of this document is to inform a standardised approach to exterior lighting within the region. However, it is accepted that standards and technical specifications do not always keep up with industry trends and developments. QLDC would therefore consider any monitored 'trial' design proposal that utilises technology or practices not covered by the document that are focussed toward the reduction of lighting pollution in the interest of preserving the dark sky amenity of the region. The current topics of interest are listed as follows:

- Use of Amber LED Luminaires.
- Use of lower Correlated Colour Temperature White Light Luminaires.
- Part night Street Lighting Switch off in Rural Townships
- Dimming and presence detection to activate Street Lighting during low trafficked hours of operation.

Additional requirements such as community and stakeholder engagement may be required to facilitate some of the 'areas of interest' listed above. It is expected that any proposal submitted for review will identify all project requirements and have undertaken appropriate preliminary risk assessments in the respect of Traffic safety and potential changes in criminal behaviours associated with the proposed lighting trial. QLDC also requires that a cost benefit analysis is undertaken to ensure that no trial implemented under this clause has adverse effects on capital, maintenance or energy budgets.

16. TEMPORARY CONSTRUCTION LIGHTING

Where a roadway, public space or public right of way is currently illuminated by public lighting (or Street Lighting), it is required that the system be maintained to ensure public safety during the hours of darkness.

Where construction takes place within the aforementioned areas, changes to a public lighting installation may be required to facilitate those changes or for the purposes of asset renewal. In such instances, it is the mandatory requirement of QLDC that the Constructor maintains the existing street lighting system within their site, until a point in time where the new lighting is confirmed fully operable.

Temporary Lighting is to be provided where required to ensure the continued safe movement of all road users, however, there is a focus on pedestrians, cyclists and construction workers around the 'site', who are deemed to be at higher risk of incident.

1.16.I MINIMUM REQUIREMENTS

The levels of illumination on the road and/or public space prior to the full (or partial) demolition of the existing street lighting system shall be maintained throughout the hours of darkness until the new lighting system is in full operation.

It is anticipated that in most instances the Constructor will be able to achieve the temporary lighting minimum requirements by establishing new permanent street lighting prior to the removal of the existing assets.

Where permanent lighting systems cannot be maintained throughout construction activities for practical reasons, or no existing lighting is present on site and temporary lighting is required during construction, the Constructor must satisfy additional requirements. The main Constructor must seek advice directly from QLDC to confirm which measures are appropriate prior to physical works beginning.

1.16.II ADDITIONAL REQUIREMENTS

Where comprehensive changes are being made to the infrastructure, a risk-based analysis must be undertaken, and temporary lighting assets may be required during the various stages of construction to replace permanent lighting assets that must be removed for practical reasons. A temporary lighting proposal may take into account the use of Temporary Traffic Management in establishing a practical solution for the site.

It is the preference of QLDC that standard lighting columns with appropriately sized luminaires on moveable concrete foundations are provided. These shall be isolated from public access and shall be arranged to provide adequate illumination as per the minimum requirements. The Constructor will be required to engage a suitably qualified lighting designer (as nominated by QLDC) to confirm the layout required and assess any changes resulting from the construction staging.

Any proposed temporary layout shall be submitted to QLDC for approval prior to implementation and the Constructor must arrange for temporary supplies in liaison with Aurora or have an adequate solar arrangement to operate all night.

Where new roading features are created which require higher lighting levels than the previous usage of the space, these devices shall either remain isolated until permanent lighting is operational, or temporary lighting shall be provided to the requirements of the AS/NZS 1158 and the current version of this document.

1.16.III PEDESTRIAN WALKWAYS

Where pedestrians are affected by temporary works which create enclosed separation from the roading corridor by way of solid barriers greater than 1.5 m height, a 'shipping container' style walk through or under scaffold. The Constructor must provide illumination to a minimum of a 20lux average and 4 lux point horizontal illuminance, utilising white light. This is preferably achieved with 'batten style' linear fittings surface mounted to the underside of the walkthrough's ceiling or fixed to the side of the separating barrier system.

1.16.IV EXCLUSIONS

Proprietary generator-based lighting rigs to illuminate public spaces for the purposes outlined in this section shall not be permitted due to glare and noise issues.

17. DEPARTURES OF THE QLDC TECHNICAL SPECIFICATION FROM AS/NZS STANDARDS

Where there are differences between the QLDC Technical Specification and the AS/NZS Standards this Technical Specification takes precedence. The following are instances where QLDC's requirements differ from (or are in addition to) the Standards:

- Luminaire tilt angles shall not exceed 0° for Category P roads and 5° for Category V roads unless otherwise approved by QLDC.
- Obtrusive light shall be controlled as per District Plan
- On Category V roads the Threshold Increment (TI) shall not exceed 12% (AS/NZS 1158 allows up to 15%)
- AS/NZS 1158.3.1 Section 4.5.3 (b) '0.25S' is replaced with '5 metres'.
- Increased daytime lighting requirement for Pedestrian Underpasses, referring to BS 5489.1:2013 table 4.

The QLDC may also impose other requirements (that deviate from these specifications and/or the AS/NZS Standards) based on special site or community specific requirements, and in such cases the applicant shall be advised accordingly.

18. EQUIPMENT SELECTION AND INSTALLATION REQUIREMENTS

All equipment specified by the designer shall be subject to final approval by QLDC. The design life and durability performance shall be 20 years for all luminaires and 50 years for all other equipment.

QLDC are seeking to reduce the number of different equipment within the district with a view to improving the maintenance and renewal efficiency.

Any new design shall adhere to the approved equipment process. Where decorative equipment has been used in existing development, QLDC's preference will be to discontinue their use in future stages of the development, to reduce future district wide variance in equipment.

The use of different Street Light families within a design to address localised design criteria, such as the increased illuminance requirements for LATM devices, is prohibited. A consistency of assets on the network is preferred.

19. LUMINAIRES

The following LED minimum performance requirements are applicable to all new lighting installations and shall be read in conjunction with NZTA M30

QLDC Table 7 LED Minimum Performance Requirements

LED Minimum Performance Requirements	
Main Characteristics	
Colour Temperature	Not more than 3000K
CRI	≥ 70
Rated Optical Life	≥ 85,000 hours
Insulation Class	II
Protection Degree	IP66
Impact Protection	IK08
LED Modules	Removable
Luminaire Tilt Angle (when installed)	0º - 5º above the horizontal (Adjustable on site).
Weight	≤ 15kg
Mounting	Bracket attachment ø42mm to ø60mm
Temperature Range	-10º to +40º
Gear Tray	Removable plate
DALI	Dimmable driver
NEMA socket	7-Pin
Electrical Characteristics	
Rated Voltage	230V (50Hz)
Power Factor	>0.9 (at full load)
Integrated Surge Protection	Up 10kV/10kA
Total Harmonic Distortion	≤ 20%

All luminaires shall be designed to enable the LED light engine to be replaced and/or upgraded. The IP66 rating of the complete luminaire shall not be compromised as a result of either replacement or upgrade of the luminaire components.

The integral Surge Protection Device (SPD) shall be an electronic device capable of sustaining 5 strikes with automatic reset capability and must be of a type capable of protecting all electronic components within the luminaire. Varistor type SPD devices shall not be used as their operating times are not always fast enough to protect electronic components. Suppliers shall provide details of the SPD's characteristics and demonstrate that the installed device will protect all electronic componentry.

The 20-year design life applies to all component parts of the luminaire and includes the housing, lens, gaskets, LEDs, compartments, drivers, and control gear.

In addition to meeting the above minimum standards the LED manufacturer and/or supplier shall provide a 10-year performance warranty on the luminaire, based on normal LED operation within the QLDC district. The warranty must be in the name of QLDC, and details must be provided with As-built information.

The introduction of smart central management systems (CMS) can provide greater flexibility in how lighting systems are operated. Simple on/off functionality can now be replaced with a CMS which allows remote control and dimming functions to be implemented. QLDC requires each LED luminaire to be provided with a DALI dimmable driver and a 7-Pin NEMA socket (complying with ANSI C136.41) complete with Zodian SS6 20:20 photocell QLDC will advise each applicant of any other CMS requirements.

Refer to NZTA M30 Specification and Guidelines for Road Lighting Design for the acceptable LED testing procedures and methods of determining optical performance, production of photometric files (IES and CIE format) and method of measuring lumen depreciation.

NZTA M30 contains a list of accepted LED luminaires that have been assessed as meeting the M30 criteria.

QLDC are seeking to reduce the number of different luminaires and columns within the district with a view to improving the maintenance and renewal efficiency. Refer to the QLDC approved luminaire list for more detail.

QLDC varies from NZTA M30: where it is deemed more appropriate to apply a lower colour temperature. Specifically, 3000K is the colour temperature required for exterior lighting. Note that there may be some instances where a higher colour temperature (above 3000K) is justified subject to QLDC approval . These areas may include:

- Major transport hubs or outdoor areas where high-definition CCTV coverage is required
- Outdoor sports fields
- Outdoor work areas e.g., truck depots, materials handling facilities, freight hubs, public works infrastructure and facilities etc

20. LIGHTING COLUMNS

The new luminaires shall be mounted on any combination of the following configurations:

(a) New street lighting columns.
(b) Existing overhead power poles using suitable outreach arms mounted onto each power pole.
(c) Joint use mast arm (JUMA) or joint use signal (JUSP) lighting columns.
(d) Mounted directly onto buildings (or other infrastructure) using suitable mounting brackets and hardware.

All new lighting columns (and mounting hardware) shall comply with the relevant structural standards and the performance and durability requirements of NZTA M26 in addition to any local environmental conditions such as high wind and/or snow loadings and poor ground conditions.

In the case of any building mounted luminaires, permission from the building (or asset) owner is required prior to installation.

New Lighting Columns

Unless otherwise advised by QLDC all new lighting columns shall be octagonal steel (hot dip galvanised) ground planted poles complete with curved outreach arms.

The column shall be unpainted unless there are visual or environmental concerns that need to be addressed. QLDC shall approve the column via the QLDC Design checksheet found on the QLDC website, any deviations during implementation shall need to be resubmitted for approval. If painted, painting shall be carried out by the column manufacturer during fabrication and assembly.

All new octagonal lighting column shall be of the frangible type as a minimum requirement, however certain ground conditions or safety issues may require the columns are flange based (with either a stub base or concrete foundation). High speed areas exceeding 70kph may require use of shear-based columns where appropriate safe setbacks cannot be achieved. Specific design may also be required at locations that have particular environmental or physical constraints i.e., Bridges, retaining walls, gabion baskets, or other structural elements that may be present.

Decorative or heritage lighting columns and luminaries may be permitted on some P category residential streets, minor roads and in some intermediate roads as part of a new subdivision, or in amenity areas provided they meet all the performance requirements listed within this design guide and be on the QLDC approved list. It should be noted that decorative columns are not expected to meet the frangible criteria and therefore their use must be restricted to low speed (<50kph) environments and columns must be appropriately setback from the kerb (preferably back on the boundary). These must be approved by QLDC via the QLDC design checklist.

Lighting columns shall be positioned so that the gear doors are safely accessible to a maintenance operative or either handedness. Columns placed behind physical structures such as safety barriers or bridge railings will require special consideration to ensure that access to the gear compartment is not blocked and that the door is orientated correctly. This may lead to the bespoke requirement for a custom height door on bridge mounted columns for example, so that the gear compartment is accessible from the bridge deck without the need for an elevated work platform.

Column Numbers

All Columns must be fitted with a unique QLDC pole number. The pole numbers become a key reference for each asset and the location and details of these numbers must align to the asset data provided to Council as part of the 224c Application or any capital works.

The column numbers should meet the following specification.

S1343, Rotag Diamond Engraved anodised marine grade aluminium QLDC streetlight number; 175x25mm each. A cost will be charged for these.

Column numbers can be obtained by contacting QLDC at services@qldc.govt.nz.

These should be installed between 1.8-2 meters high from ground level.

Luminaire Mounting Parameters

New lighting columns shall be designed and constructed based on the luminaire mounting parameters, weights and sail areas specified in the following table.

Table 8 Luminaire Mounting Parameters

Luminaire Mounting Height (m)	Maximum Bracket Outreach (m)	Maximum Luminaire Weight (kg)	Maximum Luminaire Sail Area (m^2)
12.00	4	15	0.15
10.50	4	15	0.15
9.00	3	10	0.12
7.50	3	9	0.10
6.00	2	9	0.10

Where possible the above standard mounting heights shall be used, however there may be special circumstances where other mounting heights and/or outreach lengths are required, and in such cases compliance with the structural and durability requirements of NZTA M26 will need to be demonstrated in addition to obtaining QLDC approval prior to column selection.

Refer to Appendix for typical arrangement.

Bollards are not considered to provide adequate street lighting and will only be acceptable for amenity (Parks and Reserves) lighting, or for private lighting schemes that are not to be vested to QLDC. Bollards must meet the requirements for shielding of upward light. Approval for use of bollards from Property & Infrastructure Engineering Team from QLDC must be obtained at Engineering Acceptance.

Existing Power Poles

At locations where there are existing overhead power poles and it is not practical to install new street lighting poles, the luminaires may be able to be mounted onto the existing poles using suitable steel (hot dip galvanised) outreach arms, subject to approval from the local electricity distribution company.

All new outreach arms (and mounting hardware) shall comply with the relevant structural standards and the steel performance and durability requirements of NZTA M26.

Traffic Poles

Where new lighting is required at signalised intersections involving the addition of new signal poles the preference is to mount the luminaires onto Joint Use Signal Poles (JUSP) or Joint Use Mast Arm (JUMA) or poles. Refer to Appendix 6.3 and Appendix M – specification for Traffic Signals.

21. POWER SUPPLY AND CONTROL REQUIREMENTS

Power Supply and Electrical Requirements

The design and installation of power supplies to the new lighting, including alterations and extensions to the street lighting network (SLN), shall be undertaken by an experienced and competent engineer and/or contractor “approved” by the local electricity network company.

All work (including design and construction) shall comply with the Electricity Act 1992, the Electricity (Safety) Regulations 2010, the NZ Wiring Rules (AS/NZS 3000) and (as applicable) any electricity network company rules and procedures.

Works

Any work (including design and construction) associated with extending, modifying or establishing the SLN infrastructure shall be carried out by an experienced and competent contractor "approved" by the local electricity network company. The work shall be carried out in accordance with the requirements of the local electricity network company and any other relevant electrical regulations and standards including the Electricity Act 1992, the Electricity (Safety) Regulations 2010 and NZECP 35.

Electrical Installation unmetered street lighting

For Street Lighting assets within the legal road reserve, the following applies.

All installation work associated with the internal wiring (excluding the SLN cabling works) shall be undertaken by a competent person in accordance with the Electricity Act 1992, the Electricity (Safety) Regulations 2010 and the NZ Wiring Rules (AS/NZS 3000). The installation works shall include:

- Supply and installation of fuse panel board (made from non-conducting material such as Formica or similar electromechanical grade laminate) within the fuse panel cavity at the column base.
- Supply and installation of front wired 32A rated fuse holder (complete with 10A HRC fuse link) onto fuse panel.
- Supply and installation of earthing equipment including neutral and earth studs, neutral-earth link, earth electrode (driven earth rod) and all earthing conductors. Note that the connection onto the earth electrode shall be accessible for inspection either from within the column fuse panel or access pit adjacent the column.
- Supply and installation of luminaire and internal cable from the fuse panel to the luminaire. The internal cabling installation includes the earth and neutral conductors from earth/neutral studs and phase conductor from top (or exit) side of the main fuse holder and connection onto the luminaire terminals.

Refer to Appendix 6 for further details. Note that Appendix 6 provides typical details only and alternative equipment may be installed (e.g., miniature circuit breaker rather than fuse holder) provided the complete electrical installation complies with the Electricity Act 1992, the Electricity (Safety) Regulations 2010 and the NZ Wiring Rules (AS/NZS 3000).

Electrical Installation – other

The application of this section applies in the following circumstances:

1. Public Street Lighting assets outside of the legal road reserve (e.g., Council Owned Parks and Footpaths), or a freehold situation, where an easement may be required for the electrical cabling.
2. QLDC owned Feature or Amenity Lighting assets.

Both installation types are to be serviced via a QLDC owned reticulation network and electrical cabinet with a metered utility supply. The designer shall be responsible for designing the electrical reticulation and associated control to the requirements of AS/NZS 3000.

The following minimum requirements (applying Sections 22 (a) and (b)) for the design of this new infrastructure shall be expected:

a. The designer shall ascertain the existing supply characteristics and details (e.g. transformer, etc.).
b. The designer shall ascertain any existing cabling networks' details (e.g. cable sizes, cable lengths, etc.) by checking the As-Built Documentation (e.g. drawings, schedules, etc.);
c. The above information shall be used by the designer for the calculations of the Voltage Drop, Earth Fault Loop Impedance and Fault Levels at the various new luminaire's locations – to prove compliance with the Mandatory Testing requirements of AS/NZS 3000, Section 8.

d. The designer shall check for and ensure that sufficient space can be utilised within the QLDC owned electrical cabinets:
   a. for the installation of the new meter c/w Current Transformers (where required) and
   b. that the point of Isolation for the new lighting circuits supply is agreed with QLDC.
e. The designer shall check and co-ordinate the new protection devices of the new lighting circuits with the protection (e.g. MCB, Fuse, etc.) placed on the QLDC owned cable – to prove discrimination.
f. For these design requirements the following shall be documented and submitted for approval:
   - Drawings and the detailing of the proposed lighting
   - New conduits / ducts routes c/w sizes shown on the drawings.
   - New or revisions to existing Lighting Controls schematic diagrams to be provided.
   - Schedules / drawings detailing new circuits' protection, cable sizes, controls, etc.
   - Specification details – proving compliance with AS/NZS standards.

a) Public lighting assets outside of the legal road reserve

Typically, these lighting installations (columns and streetlights) fall within QLDC parks, rights of way and recreational spaces where they are considered public lighting assets but are unsuitable for conventional utility unmetered street lighting arrangements due to being outside of the legal roading designation.

The Designer shall design a cable configuration along the pathway or area to fit the number and location of supply points. The design should have an objective of providing a cost-effective outcome with the least number of supply points along the route.

At each supply point establish a switchboard cabinet with a meter.

The number of lights connected to a single circuit shall be limited to ensure that the load is no more than 50% of the circuit protection rating and with no greater than 2.5% voltage drop from the point of connection to the network, at the furthest luminaire.

Preferably, run a three phase 4core 10mm^2 (minimum) Cu NS PVC/XLPE, with luminaires connected in alternating sequence to phase L1, L2 & L3.

b) Feature and amenity lighting assets

Where feature or amenity lighting is to be used, this typically requires luminaires of a non-standard street lighting type with varying size and application. For example, inground, bollard and under seat strip lights. Whether these assets are in a road reserve or non-road reserve area, they are unsuitable for utility un-metred street lighting supply arrangements. Therefore, a bespoke electrical reticulation installation (which shall be metered as described above) is required which the designer shall undertake to the requirements of AS/NZS 3000. Asbuilt details must be supplied indicating cable location.

In the case of 230V luminaires, use round 2core+ECC 2.5mm2 (minimum) Cu PVC/PVC cable in conduit in accordance with AS/NZS 3000. IP68 joint and tail down as required at each light (to suit the available cable entry and termination space for the luminaire). 230V rated supplies shall not be installed within benches, seating platforms, handrails, etc.

In the case of extra low voltage (ELV) luminaires, run 2core 1.5mm2 (minimum) Cu PVC/PVC cable in conduit. Remote drivers will be located in a suitable IP rated cabinet location, preferably at the point of supply and easily accessible.

c) Electrical installation – small connected non-street lighting loads

Where small quantities of lighting assets are required for the purposes of feature lighting or to illuminate short lengths of parkland footpaths, such as bollards in a sub-division – the dedicated supply points and associated meters required by the criteria above is not desirable, as this could lead to a proliferation of electrical meters on the network.

To offer flexibility, where small electrical loads (less than 100W) and less than 4 luminaires are required, a designed QLDC owned ‘sub service’ can be utilised from the nearest adjacent Street Lighting Asset. This approach **must** be agreed with QLDC prior to design taking place and approval will be given on a case-by-case basis. This approach is only acceptable for localised use within a project to address a limited number of lights, it would not be permitted across multiple clusters on the same Road or Development project. In that instance, the dedicated supply criteria above would apply.

The Street Lighting Asset feeding this arrangement will be required to have sufficient space within the gear area to house the additional fusing and control arrangement, normally a ‘double door’ column will be needed. The design of the electrical fuse board arrangement and control to accommodate the subservice will require detailing in the design submission and shall satisfy the requirements of AS/NZS 3000.

The preference is for this arrangement to be utilised in conjunction with 230V luminaires (integral gear) with wiring of round 2 core + Earth 2.5mm^2 (minimum) Copper PVC/PVC cable in conduit.

For Extra Low Voltage luminaires, the issue of restricted space associated with housing remote drivers within the adjacent lighting column may prove difficult to resolve and thus this is not preferred. The minimum wiring size shall be round 2 core 1.5mm^2 (minimum) Copper PVC/PVC cable in conduit.

For these design requirements the following reduced requirements shall be documented and submitted for approval:

- Drawings and the detailing of the proposed lighting
- New circuiting details provided on the drawings.
- New conduits / ducts routes c/w sizes shown on the drawings.
- Schedules / drawings detailing new circuits’ protection, cable sizes, controls, etc.
- Specification details – proving compliance with AS/NZS standards.

22. STREET LIGHTING CONTROL SYSTEMS

Road lighting control systems typically involve any combination of the following:

(a) Manual switching from a central location (area substation) supplying a group of luminaires.
(b) Photocell control from a central location supplying a group of luminaires or individual photocells mounted on each luminaire.
(c) Central Management System (CMS) or Supervisory, Control and Data Acquisition (SCADA) control using signals transmitted over a local network to remotely control and/or dim groups of lights.

As a minimum all new luminaires shall come with dimmable drivers in accordance with M30, refer to section 20 Table 7 above.

23. COMMUNITY SPECIFIC DESIGN GUIDELINES

This section draws attention to urban design, the QLDC District Plan, community specific requirements as well non roading related elements. It is important to adhere to the Southern Light Part One - A Lighting Strategy, the operative QLDC District Plan and the QLDC Urban Design Strategy which provides design guidelines and other urban design reference documents.

Where community specific guidelines are available these shall be taken into consideration throughout the design and construction of subdivisions and development. Contact should be made to QLDC to ascertain current status of community specific plans.

24. DESIGN GUIDELINES FOR LIGHTING NOT COVERED IN AS/NZS 1158

AS/NZS 1158 provides minimum performance and design requirements for the lighting of roads and public spaces. However, there are other forms of outdoor lighting that are not covered within the AS/NZS 1158 series (or are included in other standards), and the following sections provide guidance to designers and others responsible for lighting schemes (permanent or temporary) that fall outside AS/NZS 1158.

As a minimum requirement all lighting listed within this section shall comply with the requirements of AS/NZS 4282 which covers the control of the obtrusive effects of the following outdoor lighting applications:

- For work or recreation (outdoor workplace lighting shall also comply with AS/NZS 1680.5)
- For safety or security
- For amenity
- For advertising or display

Vested infrastructure must be cost effective and should be a nationally and readily available product, approved by QLDC.

25. FEATURE LIGHTING (UP-LIGHTING AND FLOOD LIGHTING)

Adherence to the Southern Light Strategy and Technical Specifications gives the Council and private owners the opportunity to celebrate and highlight the special features in our community without over saturation of lighting. While some festive and feature lighting may contravene the upward waste light requirement, there are some circumstances where this will be allowed through both permanent and temporary installations. Special dispensation must be approved by QLDC, and consideration may reflect the communities' intention to seek accreditation for Dark Skies.

Feature lighting (including in-ground up-lighting, projectors, and above ground floodlighting) shall only be provided for specific locations that are of special or historical significance. There are no specific minimum or maximum illumination levels, however each individual design shall be submitted (for approval by Council) with accompanying calculations clearly showing the horizontal and/or vertical illuminance values corresponding to each feature being lit. Any design submitted shall identify the ambient light of the general area and calculated ratio of the illuminated feature against the background lighting. Recommended Ratios:

- 2:1 – To be visible.
- 5:1 – To 'Stand out'

In the case of a statue, tree, building façade or sign the vertical design area shall match (as closely as possible) the item being illuminated. Where multiple floodlights are required to illuminate the perimeter of a tree or statue a vertical calculation shall be required for each floodlight aimed at the item.

Any lighting installation, either temporary or permanent, that is installed within a QLDC tree or within the root zone of a QLDC tree shall be required to be assessed regarding any potential harmful or negative effect the installation may have on the wellbeing of the subject tree. This assessment shall be undertaken by the QLDC Arborist, and should it be considered that the installation will likely have a detrimental effect on the wellbeing of the subject tree, approval shall not be granted.

Should approval be granted, it will likely be subject to conditions to ensure that there is no subsequent detrimental effect on the subject tree, such conditions may include:

- The installation and removal of any decorative lighting within the crown of a QLDC tree shall be installed by a suitably qualified professional arborist
- Any works within the root zone of a QLDC tree (cable installation etc) shall be overseen and monitored by a suitably qualified professional arborist
- Only low wattage LED shall be installed in trees. Conventional incandescent light sources create excessive heat that can be harmful to the tree

All floodlights shall be directionally aimed and focused towards the items required to be illuminated, and in no case shall any up-light be aimed straight up into the atmosphere. The Council's preference is to have building or pole mounted floodlights aimed down (below the horizontal) towards the items being lit. The Council recognises that this may not always be practical and will allow in-ground floodlights to be used subject to their approval.

The Council reserves the right to withhold approval for any feature lighting in a public setting if the adverse lighting effects are deemed to be too excessive, and in such cases the lighting designer may be required to submit an alternative design using lower lumen output fittings.

All feature lighting equipment (i.e. luminaires, housings, columns, fixing brackets, etc) shall comply with the durability requirements in section 4. Any in-ground luminaires, located where vehicles may be active, shall have a maximum surface load capacity of 5,000 kg.

All feature lighting must be circuited and controlled by time clock/ control system to ensure that upward waste light is limited by way of part night switch off. Feature Lighting shall be subject to the following time restrictions:

- Monday to Thursday – Switch on at Dusk, Switch off at 11pm
- Friday to Sunday – Switch on at Dusk, Switch off at 2am (next day)

26. PARKS AND OPEN SPACES

Parks and Open Spaces must adhere to public spaces within AS/NZS 1158 where appropriate. Areas containing feature lighting (e.g., trees, shrubs, or monuments) are covered in Feature Lighting.

27. ILLUMINATED SIGNS

All illuminated signs shall adhere to QLDC Operative District Plan Section 18 and Proposed District Plan Section 31. Signs exceeding 150cd/m² of illumination require QLDC consent.

For externally illuminated signs it is preferential that the light source is positioned to point downwards towards the sign rather than upwards to minimise upward light pollution (sky glow). Refer to Feature Lighting for further details.

28. PRIVATE EXTERIOR LIGHTING – NON-DOMESTIC

Through the consenting process, QLDC seeks to limit the environmental impact of new artificial lighting by following the general intentions of this document. Private lighting installations contribute to upward waste light and are largely unregulated. The intent of the criteria below is to limit the use uncontrolled luminaires with high colour temperatures used in conjunction with excessive lighting design criteria. The following will apply to any consent application for non-domestic private development with respect to exterior lighting:

- Mandatory use of luminaires with a maximum CCT of 3000k (except Private Sports Fields or by QLDC granted exemption).

- Luminaires used for general area lighting, i.e. safe movement and security shall provide no more than 1% upward waste light ratio as installed.
- Feature lighting (such as building façade and inground luminaires) will require QLDC approval upon application and if granted will be subject to the operating times defined in Section 26.
- Lighting Levels shall be selected based on the Sub-Categories listed in the Tables in Sections 9, 10 and 11 for general area, security, and access lighting.
- Lighting Levels for specific exterior work tasks shall be selected based on (and not exceed) the guidance in AS/NZS 1680.5
- Lighting Levels for private sports fields shall be considered on application by QLDC with detail of the activity being required to assess suitability.
- All lighting must comply with the requirements of AS/NZS 4282.
- Lighting Design Results shall be reasonably close to the Light Technical Parameters utilised in the design to avoid excessive lighting. QLDC reserves the right to instruct any applicant to reduce designed lighting results if they are assessed to be excessive by our consents team or nominated technical review panel.

As part of any new consent application, the applicant must provide a design plan showing the proposed exterior lighting. The Plan and submission shall include the following as a minimum:

- General Site Layout.
- Luminaire Positions and Mounting Heights.
- Luminaire Datasheets for each selected type.
- Clarify Lighting Design Requirements utilised and the Results achieved.
- Show Calculation Results (points and Isolux lines) in a legible format.

QLDC has no interest in assessing the longevity or technical robustness of products selected.

QLDC accepts that some business activities may have bespoke requirements which do not align with some of the above criteria, in this event, it is requested that the applicant provides written justification and details of any proposed departure for QLDC consideration.

29. PRIVATE EXTERIOR LIGHTING - DOMESTIC

While the QLDC does not have a vested interest in domestic outdoor lighting installations, there must still be compliance with the District Plan rules.

Glare

(a) All fixed exterior lighting shall be directed away from the adjacent sites and roads; and

(b) No activity on any site shall result in greater than a 3.0 lux spill (horizontal and vertical) of light onto any other site measured at any point inside the boundary of the other site.

This document does not cover outdoor domestic lighting, however AS 4282 contains some informative text on good practice including the use of passive infra-red movement detectors or low brightness (dimmed) lighting when continuous (over-night) operation is required.

It is recommended that domestic development follows the criteria listed above for 'Private Exterior Lighting – Non-Domestic' in order to assist in the preservation of the dark sky amenity in the region.

30. OPERATIONAL POLICIES

31. STREET LIGHTING RENEWALS

QLDC's policy is to replace decorative poles and luminaires where possible with standard poles and luminaires.

This will not be the case in areas where there are specific design criteria or guidelines such as Arrowtown's Historic Precinct.

32. ATTACHMENTS ON LIGHTING POLES

Any attachment to be placed on to a Lighting Pole must go through an approval process prior to installation, this is to protect the structural integrity of the poles.

Examples of the attachments are as follows, but not limited to:

- Flags and banners

  There is existing FlagTrax infrastructure on lighting on Shotover Street, Queenstown and Ardmore Street, Wanaka) which facilitates flags and banners. Please refer to existing 'Banner and Event Signage Policy'.

  In special amenity areas such as the town centres or lake front, a decorative cover may be fitted to enable flags or banners. Applications to utilise these flag/banner locations must go through the QLDC Events team.

- Utility attachments such as communications, CCTV, traffic monitoring devices

Contact the QLDC Customer services team in the first instance, this will be referred to the QLDC Operations & Maintenance team for approval on a case-by-case basis and a charge may apply. Application for permanent infrastructure may take the form of a Licence to Occupy (LTO). Details of attachments must be provided as part of the application process.

It is essential that any attachments which connect to the streetlighting power supply must seek approval and provide details of any energy draw. Any such devices found on QLDC lighting infrastructure without written permission, may be removed at Council's discretion.

This does not apply to attachments on lights on the State Highway, please contact Waka Kotahi New Zealand Transport Agency for approval.

33. DATA PROVISION REQUIREMENTS SPECIFIC FOR LIGHTING AND ELECTRICAL INSTALLATIONS

The following documentation shall be provided by the installation contractor following completion:

- As built layout drawings. This can be the design with an 'As-built' statement. This is especially crucial where there is cabling or lighting that cannot be entered onto the RAMM sheet.
- Software design files
- QLDC RAMM Roading Asset Register (RAMM update sheets) – the latest version can be found on the QLDC website – please always download the latest version as these are being improved https://www.qldc.govt.nz/services/resource-consents/land-developments-and-subdivisions#code-of-practice
  - This information shall include column types and luminaire descriptions etc.~~,~~ The luminaire description shall include make, model, optic, LED count or module size, driver size and power rating e.g. OrangeTek TerraLED Mini 24 AP2 300mA 24W LED.
- Producer statement(s) for all columns installed.
- Luminaire 10-year supplier warranty statement.
- Signed and completed Electrical Certificate of Compliance (CoC) and Electrical Safety Certificate (ESC).
- Signed and completed Record of Inspection (RoI) form.
- Details of any warranties

Note: that the issuing of a 224c certificate (certifying that all subdivision conditions have been met) is conditional upon the electrical installer providing signed CoC/ESC and RoI forms as well as the completed RAMM data.

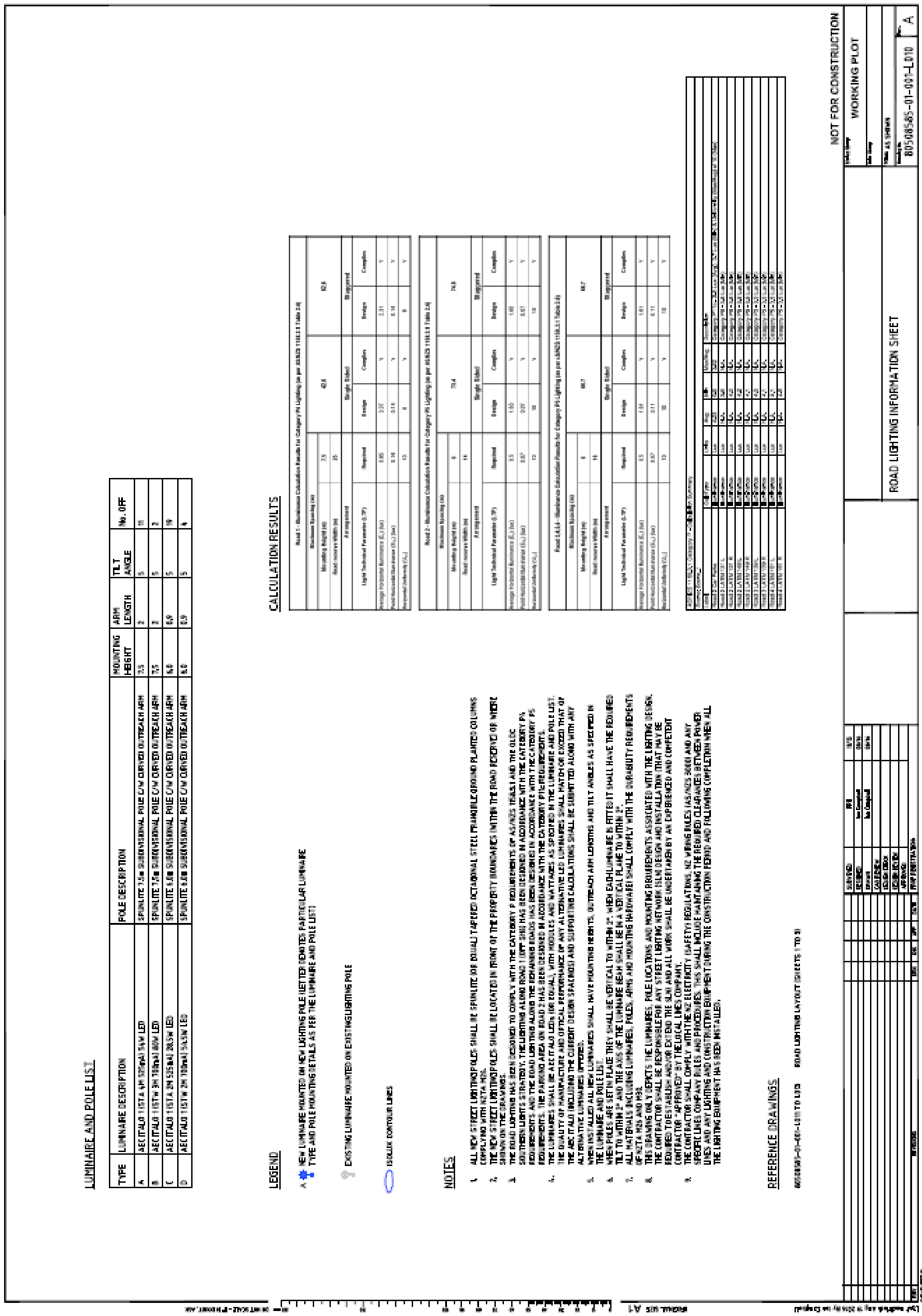
34. POST CONSTRUCTION REQUIREMENTS

Proof to be sent to QLDC on the following items:

- Street lights are livened
- Photocell switches function correctly-
- All columns are vertical, and all luminaires are installed with the correct tilt angles and orientation.
- Columns are labelled in accordance with QLDC requirements. Column numbers can be obtained from the QLDC Street Lighting Maintenance Contractor
- A label is attached to the underside of each luminaire describing the optic and wattage e.g., AP2 24W.

This is to be sent to the QLDC subdivision inspectors. QLDC may also require a visual inspection if deemed necessary.

APPENDIX 1 - TYPICAL INFORMATION SHEET DRAWING



APPENDIX 2 - TYPICAL DESIGN NOTES AND CALCULATION RESULTS

Drawing Notes (alternative to design report):

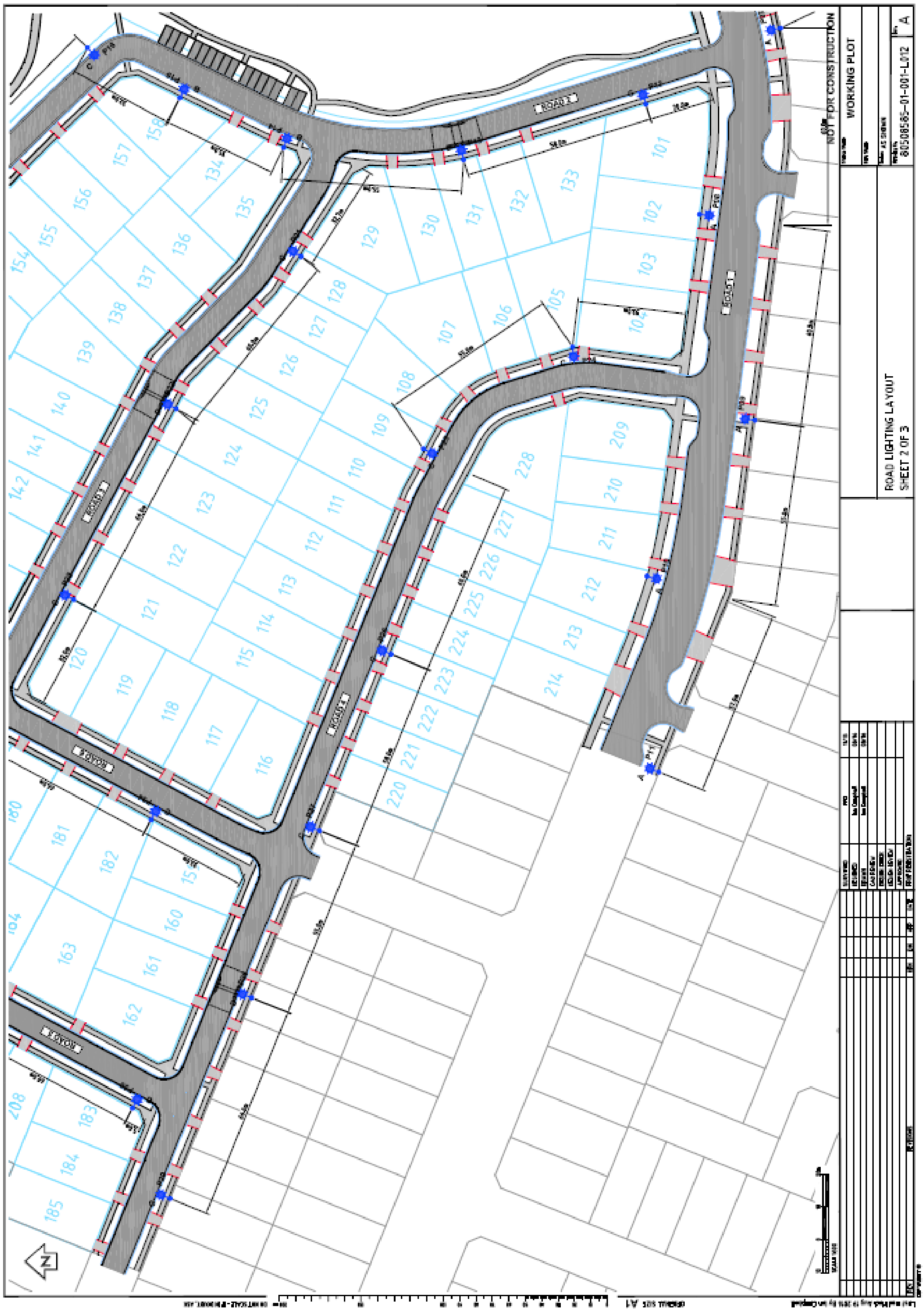
NOTES

1. ALL NEW STREET LIGHTING POLES SHALL BE SPUNLITE (OR EQUAL) TAPERED OCTAGONAL STEEL FRANGIBLE GROUND PLANTED COLUMNS COMPLYING WITH NZTA M26.
2. THE NEW STREET LIGHTING POLES SHALL BE LOCATED IN FRONT OF THE PROPERTY BOUNDARIES (WITHIN THE ROAD RESERVE) OR WHERE SHOWN ON THE DRAWINGS.
3. THE ROAD LIGHTING HAS BEEN DESIGNED TO COMPLY WITH THE CATEGORY P REQUIREMENTS OF AS/NZS 1158.3.1 AND THE QLDC SOUTHERN LIGHTS STRATEGY. THE LIGHTING ALONG ROAD 1 (OFF SH6) HAS BEEN DESIGNED IN ACCORDANCE WITH THE CATEGORY P4 REQUIREMENTS AND THE ROAD LIGHTING ALONG THE REMAINING ROADS HAS BEEN DESIGNED IN ACCORDANCE WITH THE CATEGORY P5 REQUIREMENTS. THE PARKING AREA ON ROAD 2 HAS BEEN DESIGNED IN ACCORDANCE WITH THE CATEGORY P11c REQUIREMENTS.
4. THE LUMINAIRES SHALL BE AEC ITALO LEDs (OR EQUAL), WITH MODULES AND WATTAGES AS SPECIFIED IN THE LUMINAIRE AND POLE LIST. THE QUALITY OF MANUFACTURE AND OPTICAL PERFORMANCE OF ANY ALTERNATIVE LED LUMINAIRES SHALL MATCH OR EXCEED THAT OF THE AEC ITALO (INCLUDING THE CURRENT DESIGN SPACINGS) AND SUPPORTING CALCULATIONS SHALL BE SUBMITTED ALONG WITH ANY ALTERNATIVE LUMINAIRES OFFERED.
5. WHEN INSTALLED ALL NEW LUMINAIRES SHALL HAVE MOUNTING HEIGHTS, OUTREACH ARM LENGTHS AND TILT ANGLES AS SPECIFIED IN THE LUMINAIRE AND POLE LIST.
6. WHEN POLES ARE SET IN PLACE THEY SHALL BE VERTICAL TO WITHIN 2°. WHEN EACH LUMINAIRE IS FITTED IT SHALL HAVE THE REQUIRED TILT TO WITHIN 2° AND THE AXIS OF THE LUMINAIRE BEAM SHALL BE IN A VERTICAL PLANE TO WITHIN 2°.
7. ALL MATERIALS (INCLUDING LUMINAIRES, POLES, ARMS AND MOUNTING HARDWARE) SHALL COMPLY WITH THE DURABILITY REQUIREMENTS OF NZTA M26 AND M30.
8. THIS DRAWING ONLY DEPICTS THE LUMINAIRES, POLE LOCATIONS AND MOUNTING REQUIREMENTS ASSOCIATED WITH THE LIGHTING DESIGN. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY STREET LIGHTING NETWORK (SLN) DESIGN AND INSTALLATION (THAT MAY BE REQUIRED TO ESTABLISH AND/OR EXTEND THE SLN) AND ALL WORK SHALL BE UNDERTAKEN BY AN EXPERIENCED AND COMPETENT CONTRACTOR "APPROVED" BY THE LOCAL LINES COMPANY.
9. THE CONTRACTOR SHALL COMPLY WITH THE NZ ELECTRICITY (SAFETY) REGULATIONS, NZ WIRING RULES (AS/NZS 3000) AND ANY SPECIFIC LINES COMPANY RULES AND PROCEDURES. THIS SHALL INCLUDE MAINTAINING THE REQUIRED CLEARANCES BETWEEN POWER LINES AND ANY LIGHTING AND CONSTRUCTION EQUIPMENT DURING THE CONSTRUCTION PERIOD AND FOLLOWING COMPLETION WHEN ALL THE LIGHTING EQUIPMENT HAS BEEN INSTALLED.

Illuminance Calculation results (exported from AGi32):

AS/NZS 1158.3.1 Category P - Calculation Summary						
Scene: Scene_1						
Label	CalcType	Units	Avg	Min	Max/Avg	Description
Road 2 Car Parks	Illuminance	Lux	4.23	0.9	2.62	Category P11c - 3.5 Lux (Avg), 0.7 Lux (Min) & Uniformity (Max/Avg) of 10 (Max)
Road 2 LATM 131 L	Illuminance	Lux	N.A.	3.6	N.A.	Category P5 - 3.5 Lux (Min)
Road 2 LATM 131 R	Illuminance	Lux	N.A.	4.0	N.A.	Category P5 - 3.5 Lux (Min)
Road 2 LATM 149 L	Illuminance	Lux	N.A.	4.2	N.A.	Category P5 - 3.5 Lux (Min)
Road 2 LATM 149 R	Illuminance	Lux	N.A.	4.1	N.A.	Category P5 - 3.5 Lux (Min)
Road 3 LATM 139 L	Illuminance	Lux	N.A.	4.6	N.A.	Category P5 - 3.5 Lux (Min)
Road 3 LATM 139 R	Illuminance	Lux	N.A.	4.1	N.A.	Category P5 - 3.5 Lux (Min)
Road 4 LATM 161 L	Illuminance	Lux	N.A.	4.1	N.A.	Category P5 - 3.5 Lux (Min)
Road 4 LATM 161 R	Illuminance	Lux	N.A.	4.5	N.A.	Category P5 - 3.5 Lux (Min)

APPENDIX 3 - TYPICAL LAYOUT DRAWING



APPENDIX 4 - TYPICAL PERFECT LITE CALCULATION RESULTS

```
                Road 1_P4_SS 42m_7.5+2+5_Italo 1 STA 525mA 54W

                    P Category Lighting - AS/NZS 1158.3.1:2005
                    ******************************************


          I-table Filename: C:\Data\Road Lighting\Photometric Files\AEC\Italo
                            Range 2015-08-20\Italo 1\ITALO 1 OF2 STA 4.5-4M.ci
                            e

                  Job Name: Hanley Downs DP1 - Road 1

     Luminaire Description: IT1 OF2 STA 5-4M     5440 lms
       Lamp Wattage & Type: 54W
         Initial Lamp Flux: 5440 lms
        Maintenance Factor: 0.8
               Stores Code:
              Upcast Angle:  5 degrees
               Arrangement: Single Side
           Offset Distance: 2.56 m
 Upward Waste Light Ratio: .0 %
              Light Source: LED - Light Emitting Diode
 Luminaire Classification: Not specified

         Lighting Category: P4 (Local Area Roads - Tables 2.1 & 2.6)

     Illuminance Criteria:  Average Illuminance (Eav) >= 0.85 lx
     (Maintained values)    Minimum Illuminance (Eph) >= 0.14 lx
                          Illuminance Uniformity (Up) <= 10

          Calculation Grid: 20 x 11 points - Figure 3.7 of AS/NZS 1158.2

 @B Mounting                 Maximum Spacing for different
 @B Height                        Road Reserve Widths
 @B --------                 -----------------------------

         25.0
      +--------+
   7.5 |  42.6 |
      +--------+

   Value/s in above table are all in metres.
   The table contains maximum spacings which, for the specified luminaire
   and lamp combination, provide compliance with the light technical
   parameters (LTPs) of Table 2.6 of AS/NZS 1158.3.1:2005.

   Refer next page for list of LTP's at compliant maximum spacings.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             Light Technical Parameters at Maximum Spacing
             *********************************************

        Mounting Road     Maximum  Eav      Eph      Up        Emax
        Height   Reserve  Spacing                  (Emax/Eav)
        (m)      (m)      (m)      (lx)     (lx)               (lx)
        -----------------------------------------------------------

          7.5     25.0     42.6     3.37     0.14       6      20.42


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 @IPlePcat - Vers 3.09 (Built: 18/10/12)          Run: 16/ 8/2016 at 16:38:41

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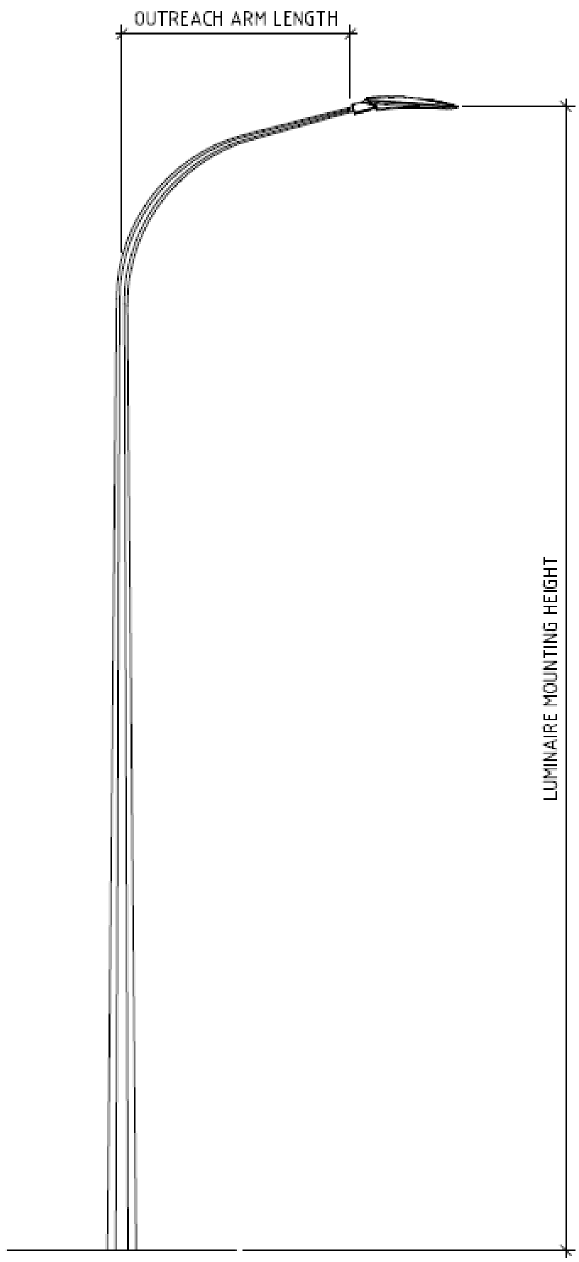
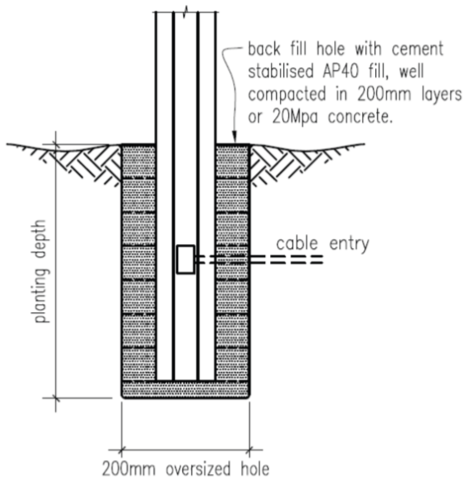
APPENDIX 5 - TYPICAL POLE DETAILS

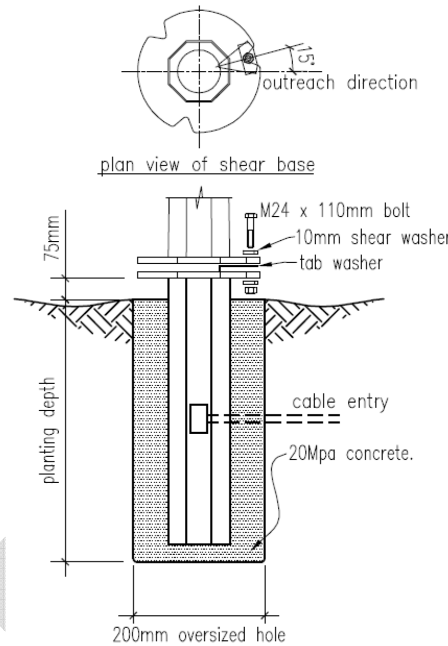
5.1 Tapered Octagonal Steel Lighting Pole c/w Curved Outreach Arm



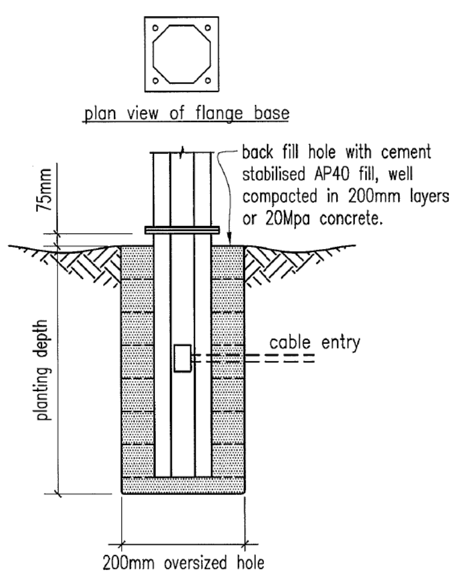
5.2 Typical Lighting Pole Foundation Details



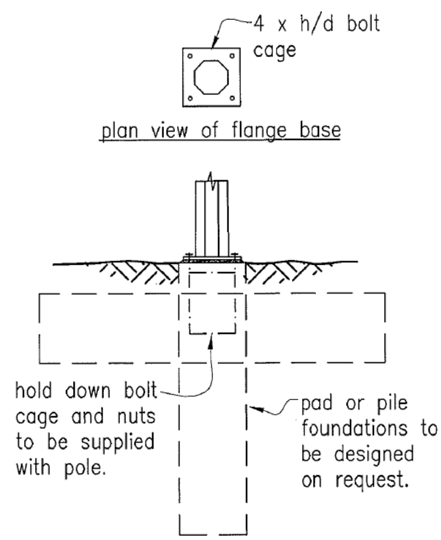
Typical Ground Planted Foundation



Typical Shear Based Stub Foundation



Typical Flange Based Stub Foundation

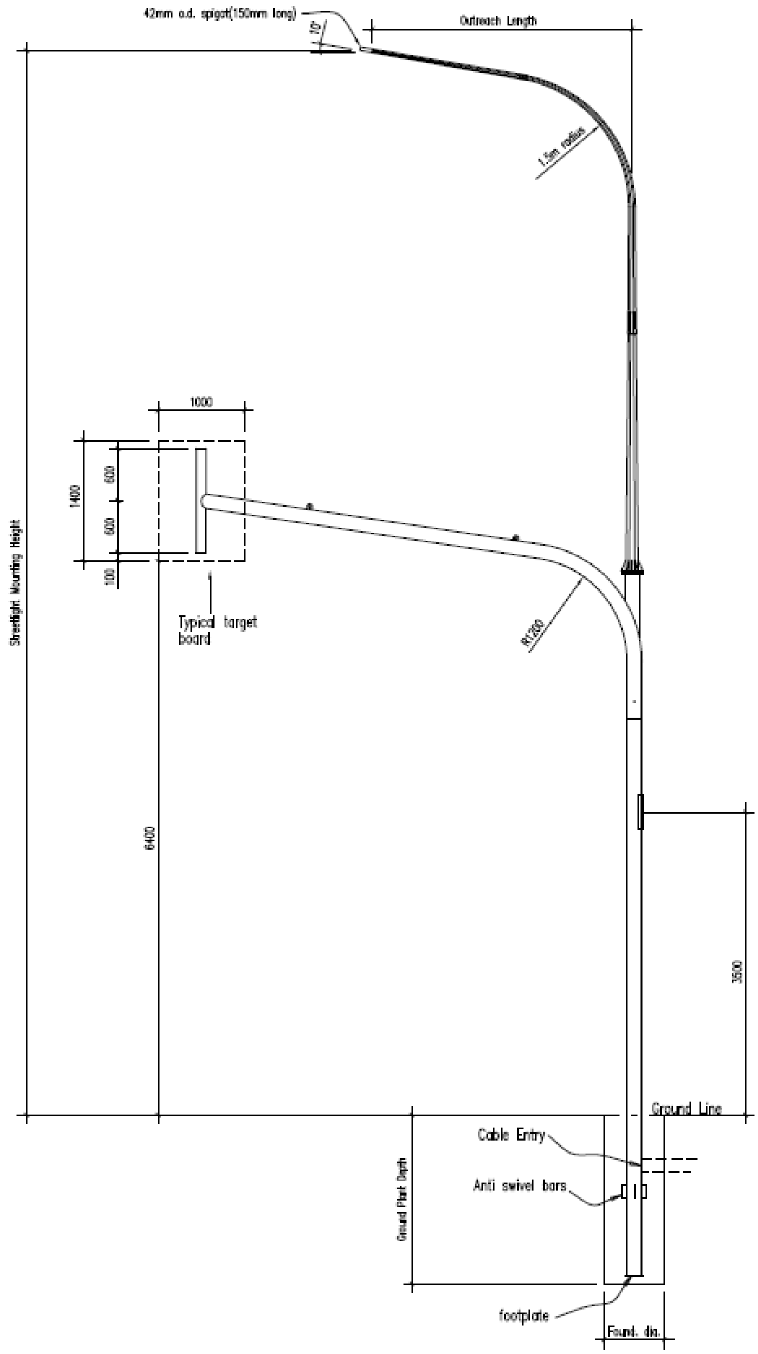


typical flange based foundation

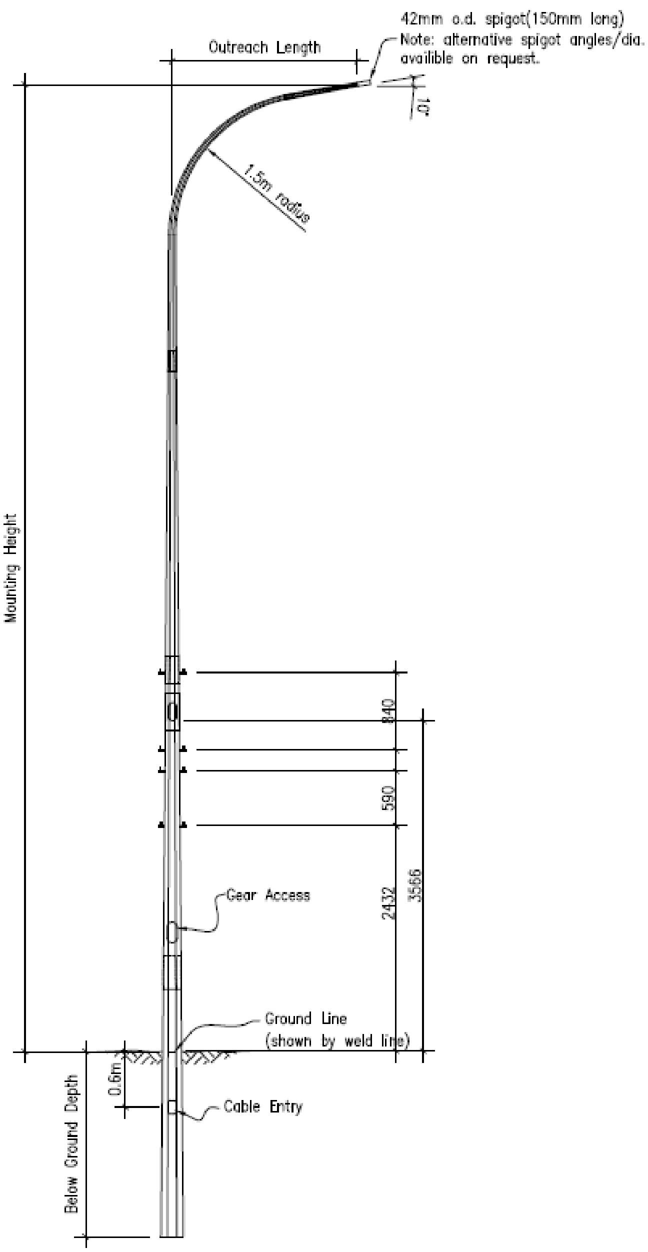
Note: The above arrangements depict typical details only and the actual mounting details may vary between pole suppliers. Specific design may also be required due to site specific ground conditions.

5.3 JUMA and JUSP Signal Poles

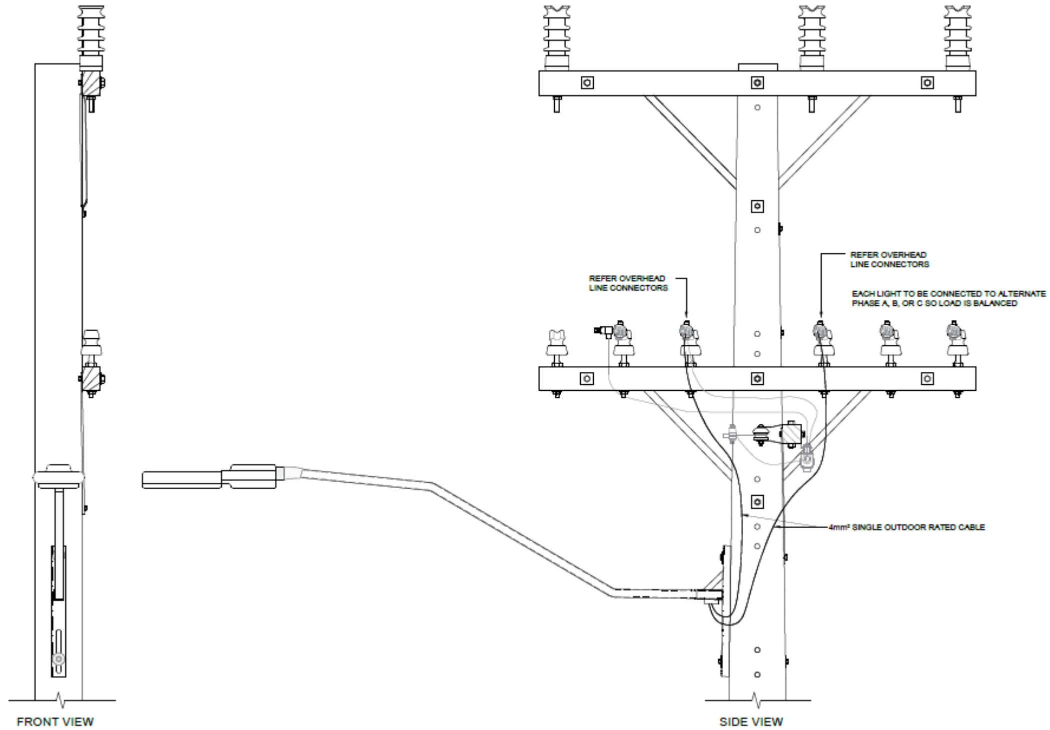
JUMA Signal Pole:



JUSP Signal Pole:



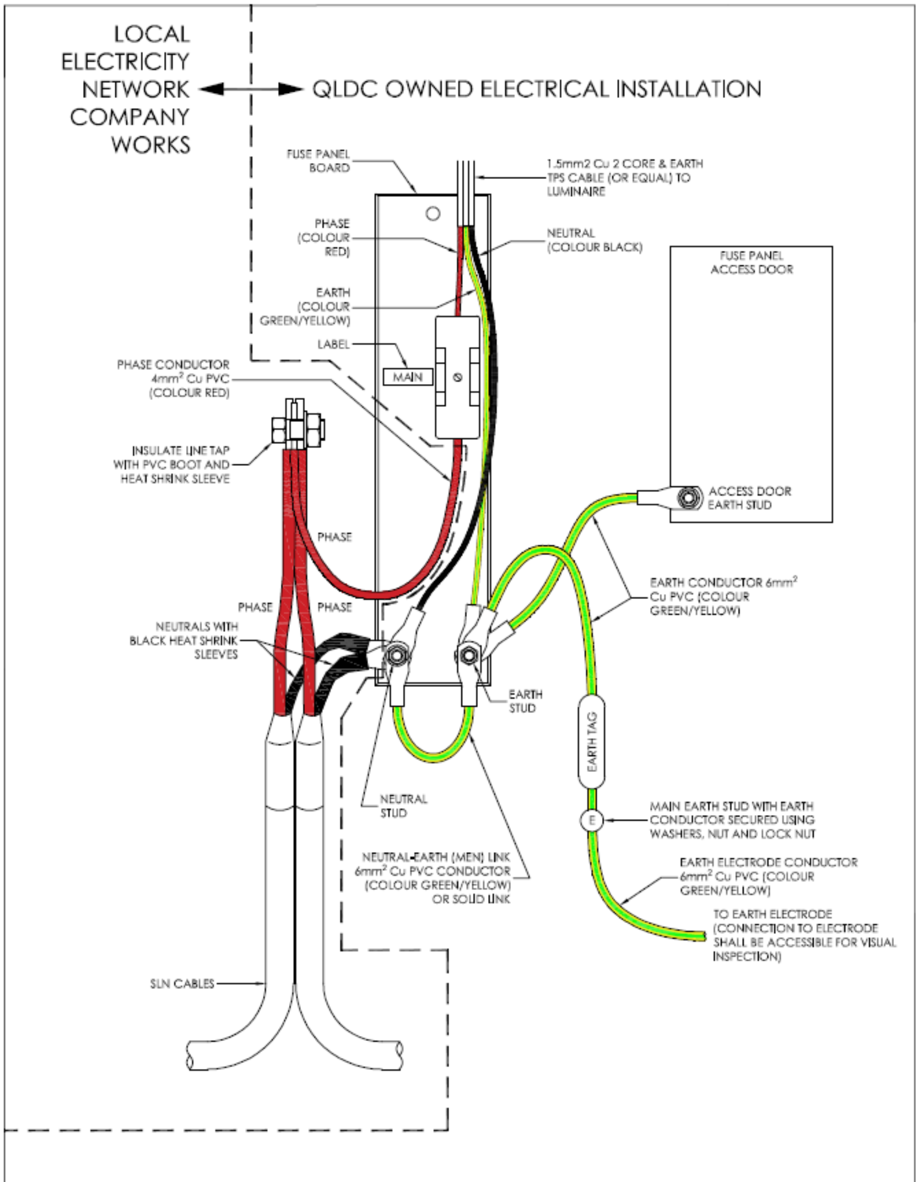
5.4 Typical Power Pole Mounting Details



Note: The above arrangement is typical only and any work on or near overhead lines shall be undertaken by the local electricity network company or a contrcator approved by the local electricity network company.

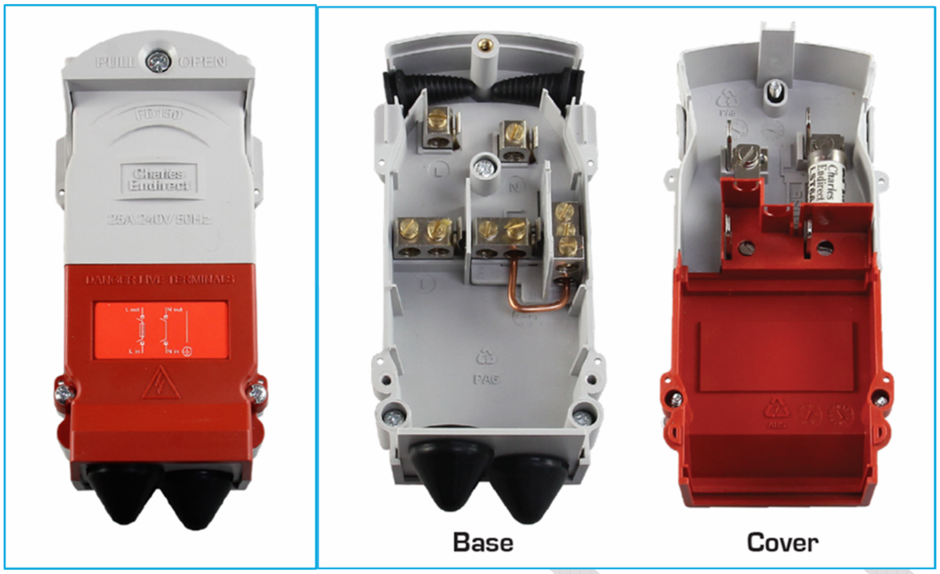
APPENDIX 6 – LIGHTING COLUMN POWER SUPPLY AND ELECTRICAL DETAILS

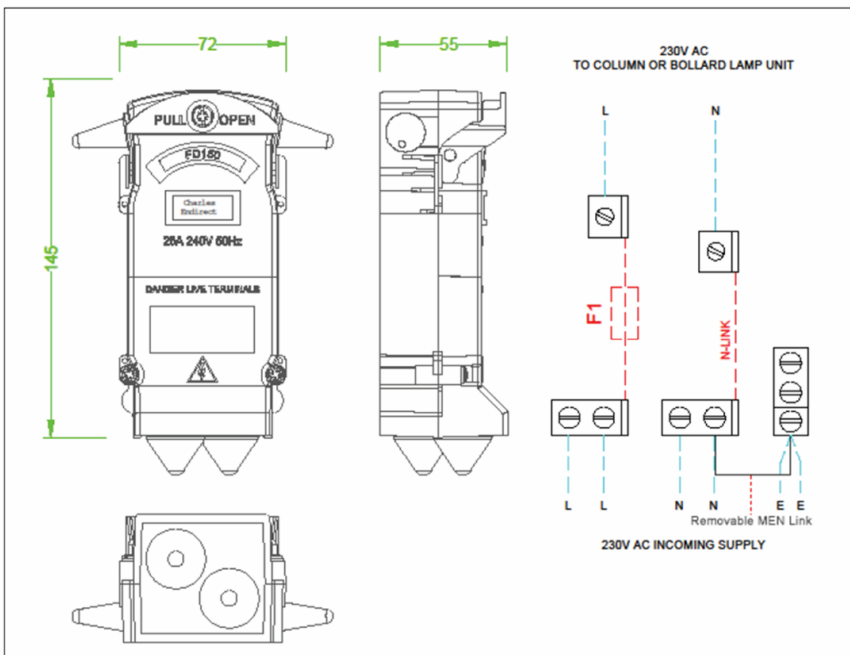
6.1 Typical Wiring showing Ownership Boundaries



TYPICAL LIGHTING COLUMN POWER SUPPLY AND ELECTRICAL CONNECTION DETAILS

6.2 - Street Light FD150 Cutout Assembly





6.3 Fused Street Light Board

6.4 Typical Earth Rod Inspection Pit

APPENDIX 7 - EXAMPLE OF COMMUNITY SPECIFIC DESIGN (CARDRONA)

The following images have been presented as an example of a community specific design that was applied to a lighting upgrade at Cardrona where equipment (luminaires and poles) were selected to blend in with the historical context of the Cardrona Hotel and surrounding environment.

Image date December 2009 (before upgrade):

Image date July 2015 (after upgrade):

APPENDIX 8 – EXAMPLE FORMS

8.1 Electrical CoC and ESC Form

ELECTRICAL CERTIFICATE OF COMPLIANCE & ELECTRICAL SAFETY CERTIFICATE

REFERENCE/CERTIFICATE ID NO.:

This form has been designed to be used by licensed electrical workers to certify that installations or Part installations under **Part 1 or Part 2 of AS/NZS 3000** are safe to be connected to the specified system of electrical supply.

Location Details:

Contact Details: (Name and address)

Name of Electrical worker: | **Registration/Practising licence number:**

Phone & email:

Name and registration number of person(s) supervised:

Certificate of Compliance

Type of work: ☐ Addition ☐ Alteration ☐ New work

The prescribed electrical work is: ☐ Low risk ☐ General ☐ High-risk (Specify):

Means of compliance: ☐ Part 1 of AS/NZS 3000 ☐ Part 2 of AS/NZS 3000

Additional Standards or electrical code of practice were required: ☐ No ☐ Yes (specify):

Date or range of dates that prescribed electrical work undertaken:

Contains fittings that are safe to connect to a power supply? ☐ Yes ☐ No

Specify type of supply system:

The installation has an earthing system that is correctly rated (where applicable) ☐ Yes ☐ No

Parts of the installation to which this certificate relates that are safe to connect to a power supply?

☐ All ☐ Parts (specify)

The work relies on manufacturers instructions: ☐ Yes ☐ No

If yes – identify the instruction manual including name, date and version. Also attach a copy of manufacturer's instructions to this certificate.
(Or provide reference to readily accessible electronic format, eg Internet link.)

Identify:
Link:

The work has been done in accordance with a certified design: ☐ Yes ☐ No

If yes – identify the certified design including name, date and version. Also attach a copy of the certified design to this certificate.
(Or provide reference to readily accessible electronic format, eg Internet link.)

Identify:
Link:

The work relies on a Supplier Declaration of Conformity (SDoC): ☐ Yes ☐ No

If yes - identify the SDoC including name, date and version OR EESS registration. Also attach a copy of the SDoC to this certificate.
(Or provide reference to readily accessible electronic format, eg Internet link.)

Identify:
Link:

The installation has been satisfactorily tested in accordance with the Electricity (Safety) Regulations 2010 ☐ No ☐ Yes

Description of Work:

Test Results (provide values)		
Polarity (Independent earth):		
Insulation resistance:		**Ohms**
Earth Continuity:		**Ohms**
Bonding:		**Ohms**
Fault Loop impedance		**Ohms**
Other (specify):		

By signing this document I certify that the completed prescribed electrical work to which this Certificate of Compliance applies has been done lawfully and safely, and the information in the certificate is correct.

Certifier's signature: **Date:**

Electrical Safety Certificate

By signing this document I certify that the installation, or part of the installation, to which this Electrical Safety Certificate applies is connected to a power supply and is safe to use.

Certifier's name: | **Registration/Practising licence number:**

Certifier's signature: | **Certificate Issue Date:** | **Connection Date:**

CUSTOMER COPY – THIS IS AN IMPORTANT DOCUMENT AND SHOULD BE RETAINED FOR A MINIMUM OF 7 YEARS

This Electrical Safety Certificate also confirms that the electrical work complies with the building code for the purposes of Section 19(1)(e) of the Building Act 2004.

8.2 Electrical RoI Form

RECORD OF INSPECTION (ROI) OF HIGH- RISK PRESCRIBED ELECTRICAL WORK
PURSUANT TO THE ELECTRICITY (SAFETY) REGULATIONS 2010

Reference/Record ID Number:

Issuer (Inspector) details:

Name of Inspector: | Registration #:

Email address: | Telephone:

Location of installation:

Location details:

Location type: ☐ Domestic ☐ Non-Domestic Accommodation ☐ Industrial ☐ Commercial ☐ Educational ☐ Healthcare ☐ Miscellaneous (other)

Certifying Electrical Work and Certificate of Compliance (CoC) details:

Name of Electrical worker(s): | Registration #:

CoC details: | ☐ CoC(s) attached

Certifying Electrical Work and RoI details:

What was inspected:

Specify the regulation(s) and companion standard(s), or identify the certified design, followed when carrying out the inspection:

What are the results of the inspection:

High Risk Category:

☐ Not to AS/NZS 3000 Part 2 – 6A(2)(a)(i) ☐ Photovoltaic system – 6A(2)(a)(iv) ☐ Electrical medical area – 6A(2)(a)(vi)

☐ High voltage installation – 6A(2)(a)(ii) ☐ Hazardous area – 6A(2)(a)(v) ☐ Mains work – 6A(2)(b)

☐ Mains parallel generation – 6A(2)(a)(iii) ☐ Animal stunning or meat conditioning – 6A(2)(c)

☐ Other – please describe:

Declaration

I hereby confirm that the work described above has been done in accordance with the regulations; and the installation on which the work has been done is, and will be, when enlivened, electrically safe.

Signature: | Date:

Record of Inspection (RoI) – Version: May 2014

WATER SUPPLY RESERVOIRS

Queenstown Lakes District Council Land Development and Subdivision Code of Practice Addendum

Date: February 2022

QUEENSTOWN LAKES DISTRICT COUNCIL

CONTENTS

ABBREVIATIONS

ANSI	American National Standards Institute
AS	Australian Standard
ASME	American Society of Mechanical Engineers
ASNZS	Australian/New Zealand Standard
AWWA	American Water Works Association
BoD	Basis of Design
BWL	Bottom Water Level
CAD	Computer Aided Drafting
CCTV	Closed Circuit Television
CoP	(QLDC) Code of Practice 2020 including appendices
DWSNZ	Drinking Water Standards New Zealand
HAZOP	Hazard and Operability Assessment
NZBC	New Zealand Building Code
NZFS	New Zealand Fire Service
NZS	New Zealand Standard
NZSEE	New Zealand Society for Earthquake Engineering
ORC	Otago Regional Council
P&ID	Process (or piping) and Instrumentation diagram
QLDC	Queenstown Lakes District Council
TWL	Top Water Level
WSA03	Water Services Australia: Water Supply Code

GLOSSARY

Bottom Water Level	Level above datum at crest of outlet bell mouth – refer figure in Appendix D.
Datum	For QLDC projects the level datum shall be taken as: VD2016 (new national standard). This will replace current use of the Dunedin 1958 datum.
Dead Storage	Water stored below BWL – refer figure in Appendix D.
Designer	Suitably qualified and experienced professional design lead (as determined by Engineering New Zealand bearing a CPEng) for the reservoir facility. The Designer is responsible for the overall design of the reservoir facility including issue of instructions and specifications to the Tank Supplier. Where the tank is designed by a specialist supplier, the tank designer shall take on design responsibility for the components that they design.
Gross Capacity	Total capacity of the tank from floor level to Overflow weir.
Net capacity	Capacity between bottom water level and top water level.
Overflow Level	Level at the crest of the overflow weir, refer Appendix D.
Service Reservoir	DWSNZ terminology for drinking water storage associated with the water distribution system. For the purposes of this document shortened to reservoir or tank.
Tank Supplier	Designer and supplier of the steel tank and associated appurtenances to defined contractual limits.
Top water level	Refer figure in Appendix D. Same as High Operating Level, that is, the level at which pumps normally stop. Note that water levels can exceed this level if there is a system malfunction.

1.0. INTRODUCTION

1.1 SCOPE

This document records the QLDC requirements for the design of reservoir sites with bolted cylindrical steel tanks founded on cast in situ concrete bases.

1.2 RELEVANT APPLICABLE STANDARDS

The design shall be in accordance with the New Zealand Building Code and the following relevant standards:

The latest version of DWSNZ Guidelines Section 16.2.1 - design considerations for service reservoirs.

QLDC Code of Practice for Land Development and Subdivision

QLDC District Plan

QLDC AM3 Approved Materials

Drinking Water Standards NZ 2018

NZS3101	Concrete Structures
NZS3106	Concrete Structures for Storage of liquids
NZS3109	Concrete Construction
NZS3404	Steel Structures
NZS4219	Seismic performance of engineering systems
NZS4442	Welded Steel pipes and fittings for water
SNZ4509	NZFS Firefighting water supply CoP
NZSEE	Seismic Design for Storage Tanks (Red Book)
ASNZS1111/2	Nuts and Bolts
ASNZS1170	Structural Design Actions
ASNZS1252	High-strength Steel Bolts for structural engineering
ASNZS1319	Safety signage
ASNZS1477	uPVC Pipes
ASNZS1554	Structural Steel Welding
ASNZS1657	Platforms, walkways etc
ASNZS1664	Aluminium Structures
ASNZS1665	Welding of Aluminium Structures
ASNZS1768	Lightening Protection
ASNZS2280	Ductile Iron Pipes

ASNZS3894	Site testing of protective coatings
ASNZS4020	Products in Contact with Drinking Water
ASNZS4130	PE Pipes
ASNZS4600	Cold Formed steel
ASNZS4765	mPVC pipes
AS1252	SS Bolts
AS1275	Bolts Hot dip galvanised
AS1657	Ladders access and handrails
AS2239	Anodes for cathodic protection
AS2304	Fire Tanks
AS2129	Steel Flanges
AS4020	Drinking Water Products
AS4087	DI Pipe fittings and flanges
AS4100	Steel Structures
AS4158	Gibaults
AWWA D103-19	Factory Coated Carbon Steel Tanks for Water
ANSI/AWWA C652	Disinfection of water storage facilities
ANSI/AWWA D108	Aluminium Domed Roofs for Water Storage
ANSI/ASME B36.19	Stainless Steel pipe
API650/(NZSAPI)	Welded Steel Tanks
WSA-03	Water Supply Code of Australia
Water NZ	Hygiene practices to prevent water supply contamination
Building Act and code	Liquid retaining structures are buildings in terms of the Building Act 2004 and must therefore meet the performance requirements of the NZ Building Act and Code.

2.0. DESIGN CRITERIA

2.1 RESERVOIR USABLE STORAGE VOLUME CALCULATION

The minimum gross storage across each network shall be the greater of:
• 24 hours of average day demand • 12 hours of peak day demand • 6 hours of average day demand plus the greatest firefighting storage requirement for the network as defined by SNZ PSA 4509:2008

Flow rates for calculating the above shall be calculated by considering the current water demand usage with the consideration of water demand management over time. These are to be confirmed with QLDC.

2.2 DESIGN FOR DURABILITY

Component	Design Durability Life in Years	Comment
Tank steel walls, tank wall to concrete joint, tank roof	50	NB this relates only to durability and not return period for loading
Tank Concrete Foundations, Concrete valve pits, Concrete retaining structures	100	NZS 3101:2006 section 3 Durability
Site buildings	50	NZBC Clause B2 VM1 and NZS 3101:2006 section 3 Durability
Above and below ground pipelines including fittings	100	Relevant pipeline design standards
Mechanical components including valves	50	
Tank epoxy coatings	Design life 25 years Guaranteed life 2 years	All bolted tank plates must be factory epoxy coated in accordance with AWWA D103-19.
Tank sealants	Design life 25 years Guaranteed life 2 years	Joint sealant shall comply with the requirements of AWWA D103-19. Sealants shall be compatible with cathodic protection where fitted. Sealants shall be compatible with tank disinfection processes.
Cathodic protection (if required to provide design life of tank)	20	

Component	Design Durability Life in Years	Comment
Electrical assets	20	
Instrument and control assets	15	
Dissimilar metals	No situation where dissimilar metals may cause a galvanic cell to occur.	
Water quality testing	Designers must obtain an incoming water quality assessment to confirm the suitability of the tank proposed.	

2.3 DESIGN FOR ULTIMATE LIMIT STATE STRUCTURAL CAPACITY

Item	Design Life years	Importance Level	Standard
Tank superstructure and tank foundation	50	4	NZS 1170.0
Buildings, pits, and structures other than the tank	50	4	NZS 1170.0

Design working life	Importance level	Annual probability of exceedance for ultimate limit states		
		Wind	Snow	Earthquake
50 years	1	1/100	1/50	1/100
	2	1/500	1/150	1/500
	3	1/1000	1/250	1/1000
	4	1/2500	1/500	1/2500
100 years or more	1	1/250	1/150	1/250
	2	1/1000	1/250	1/1000
	3	1/2500	1/500	1/2500
	4	*	*	*

2.4 GENERAL REQUIREMENTS AND SERVICEABILITY

Element of Design	Requirement
Reservoir facility land status	Facilities shall be sited on freehold land vested to QLDC. Facilities within easements are acceptable but require approval from QLDC. Access roads and service/pipe alignments outside of the facility shall be within vested road reserve. Where this is impractical easements or vested freehold are acceptable alternatives. Leased land options are not acceptable.
Tank design standards - general	Bolted steel tanks to be designed to the *American Water Works Association Standard AWWA/ANSI D103-19: Factory Coated Bolted Steel Tanks for Water Storage*. Where applicable AS/NZS1170, NZS3101 and NZS 3404 must have precedence. Seismic design shall be in accordance with NZS 3106, and shall reference NZSEE Seismic Design of Tanks, 2009. The Designer shall refer to QLDC seismic design return period memo, refer to Appendix C. The design must consider the potential for wind and snow loading and ice formation in accordance with NZS 1170.2
Tank foundation and floor design standards.	The tanks shall be founded on an in-situ cast reinforced concrete floor designed in accordance with NZS 1170.0, NZS 3101, NZS 3106 and ANSI/AWWA D103-19, Section 13.4.6 Design of concrete structures for the storage of liquids. Use of post tensioned construction of the floor must be agreed with QLDC.
Underdrainage requirements	The concrete base of the tank shall have underfloor drains to assist with any leakage tracing. These drains shall be provided in at least 4 zones and shall discharge to a collection chamber where individual drain outlets can be identified – refer to figure in Appendix A. The drains shall be PVC of 50 mm diameter, set in no fines concrete and shall be configured to run within 1 m of any floor penetrations and otherwise equally spaced.
Liner forbidden	The tank must not have nor require a separate liner.
Minimise confined spaces	Facilities are to be designed to minimise or remove the need for any confined spaces.
Freeboard above top water level	Freeboard shall be sufficient for overflow to function and to contain sloshing caused by earthquake. If slosh mode contacts roof this is to be specifically identified in the design attributes report and to be allowed for in structural design.

Element of Design	Requirement
Number of reservoirs per site	Minimum two tanks and provision for at least one future tank. For sub-division reservoir facilities sufficient reservoir capacity must be delivered by the developer at the time the developer is seeking compliance for the sub-division. Determine the Total Gross Reservoir Storage required at each 10 year increment. Determine how delivery of the required storage can be staged. A minimum of 2 reservoirs are required at the 30 year primary design horizon. More than 2 reservoirs can be acceptable at the 50 year MPD horizon. Reservoirs to have a minimum of 6 m between each other. Reservoirs to have a minimum 4 m wide platform annulus around them. Above ground obstacles (excluding slopes) to be a minimum of 6 m from reservoirs. Where facilities do not meet the 6 m spacing, 4 m annulus or 6 m separation from obstacles must demonstrate appropriate constructability and long-term maintenance. The demonstration needs to include vehicle movements for maintenance and construction. Reservoir facilities that cannot demonstrate feasible long term constructability, and/or constrain the 3 Waters maintenance contractor to undertake regular or heavy maintenance are unacceptable.
Maximum tank height	Bottom water level to top water level shall not exceed 6 m.
Pipework arranged to allow for taking one tank offline	Pipework layout and valving to be arranged so that one of the tanks can be taken offline for maintenance and the other tank(s) are to be able to continue to function.
Flow shortcutting	Tank inflow and outflow to be designed to minimise the potential for shortcutting through the reservoir. This is normally achieved by having a high level inlet and low level outlet with at least 90° radial separation.
Protection of emergency and fire reserve	Reservoir systems must be designed to: • Prevent overflows. • Prevent drawdown of emergency/fire reserved storage except for those purposes.
Vermin and contaminant protection	Provide robust provision of screens to keep out birds, vermin, insects, and other pests from the tank. All permanent openings (not hatches) into the tanks including vents are to be protected

Element of Design	Requirement
	by 2 mm stainless steel insect mesh. No openings shall face upwards. Roof/wall joints shall be completely sealed to prevent dust, vermin, insects, rainwater penetration. The tanks shall be detailed to discourage any bird nesting.
Tank roof design	Provision of roof vents shall be compliant with AWWA D103-19.
Maximum valve and service chamber depth	Where chambers are required, they shall not be greater than 1.5 m deep. Control valves, flow meters and telemetry sensors shall be housed within in-ground chambers. However, the number of in-ground chambers needs to rationalised, made communal and wherever possible not needed to be trafficable, i.e. be at least 6 m from a reservoir. Above ground pipework or valves require specific approval. Trafficable chambers require specific approval.
Burst valves and earthquake, Altitude valve provisions	Burst valves, also known as earthquake isolation valves, shall be provided to preserve the tank contents in the event of an earthquake large enough to fracture the supply/falling main. It is essential that all reservoirs are able to withstand the design earthquake event without significant loss of stored water. • Each tank within the facility is to be fitted with its own EQ valve. • The designer is to consult QLDC to confirm manufacturer of the preferred burst valve. The burst valve shall be installed on the outlet main adjacent to the inside of the boundary fence. • Burst valve closure to be controlled by an overspeed function signal from each reservoir’s outlet main high flow trigger set point or triggered by a seismic alarm. • Discuss with QLDC arrangements to get water from the tanks to road tankers in post-earthquake conditions. It may be required to provide an emergency hose connection or tap array at or near to the boundary fence. If required, this hose position should have an access road layout to facilitate road tanker manoeuvring. • In a multi-tank facility one of the tanks can be set to not automatically close its EQ valve, this ensures continued supply for LoS and firefighting with a false positive EQ, or where fighting a fire takes precedence over water loss. Non-auto EQ tank can be remotely

Element of Design	Requirement
	operated/isolated by operator, similarly auto EQ tanks can be remotely operated/opened by operator. A communal altitude valve provides protection from overflow for all reservoirs. The altitude valve shall be activated by pressure via a signal pressure pipe connected to the reservoir. The balance pipework may be used as a tapping point for the pressure signal pipe. A flow meter and flow control valve may be required on the inlet of some reservoir facilities to control their fill rate.
Plinth height	Mechanical plant to be mounted on plinths 200 mm high.
Cable trays/conduits	Cables are to be installed below ground in covered ducts/conduits or fixed above head height on cable trays, or in vertically mounted galvanised steel conduits attached to the tanks.
Barriers and fall protection	Provide handrails/chains around potential falling hazards.
Cathodic Protection	Provide suitable cathodic protection to appropriately protect integrity of steel tank structure.

2.5 PIPEWORK REQUIREMENTS

Design Element	Requirement (Refer to Appendix A for typical pipework arrangements)
Pipe materials	Below ground inlet and outlet pipework beyond the tank contractual limit shall be PE100 of a suitable pressure rating (PN16 minimum). PE pipe shall be suitably derated for fatigue and temperature as per PIPA guidance (POP0101). Above ground pipework within the tank shall be in accordance with QLDC AM3 approved materials document. All non-pressurised drainpipes shall be uPVC of a suitable class (minimum SN8). Flanges shall be to AS4087 of a suitable pressure class. Cast in concrete pipework shall be ductile iron or cement lined steel.
Internal pipework requirement	All above ground pipework shall be inside the tank and pass through the floor slab.

Design Element	Requirement (Refer to Appendix A for typical pipework arrangements)
Dedicated rising main	Reservoirs are to be supplied via a dedicated rising main unless specifically approved by QLDC. Some existing reservoir facilities have Rising / Falling mains and some future facilities may also require Rising / Falling main functionality. This is detailed further below.
Water Stops	All pipework passing into or out of the tank (through the concrete base slab) must be provided with suitable water stops/water bars and hydrophilic seals at all places where potential leakage paths exist.
Provision for differential movement	Pipework connecting structures with ground or other structures shall be designed to withstand differential movement. Suitable self-restraining flexible connections shall be provided within 1 m of the external face of the tank foundation and can comprise of either rocker pipes, PE pipe lengths, mechanical couplings, and/or bellows with EPDM flexible components.
Tank inlet	Inlets shall be high level bell mouths above normal operating level and the overflow outlet to provide an air gap. The inlet pipework shall be sized based on the design flow rates to the tank. Designer to confirm the design inlet flow rate with QLDC. Inlet pipes above ground (inside the tank) shall be ANSI/ASME B36.19 stainless steel 316L to a suitable pressure Schedule. Inlet pipes below ground shall be DI PN16 minimum or PE100 PN16 minimum.
Scour Pipes	An internal scour sump and scour outlet pipe shall be installed in the tank base to allow the tank to be fully drained. The internal scour sump shall be square in plan and twice the size of the outlet diameter with a minimum size of 500 x 500 mm. The scour pipe shall be connected to an external pump out chamber designed to allow sucker truck intervention if sediments are present. The required pump out chamber volume shall be equivalent to 10 mm of depth of water in the reservoir, however shall have a maximum volume no larger than a commonly available sucker truck, i.e. 6-8 m^3, and be no smaller than 1.5 m^3. The pump out chamber shall be combined with the overflow discharge chamber. The outlet of the pump out chamber shall have a normally closed valve prior to any piped connection to the calamity basin SW discharge system. The closed valve shall be openable to allow the tank to discharge direct to the SW discharge system if deemed acceptable by the

Design Element	Requirement (Refer to Appendix A for typical pipework arrangements)
	operator. However, the valve must normally be returned to a closed position.
Outlet Pipes	Outlet pipes shall be ductile iron or cement lined steel with bell mouth installed through the floor of the tank. They shall be sized to suit the maximum design outflow. Diameter may be locally reduced to allow an economical design of pipework, valve, and fittings. The outlet bell mouth shall be located within 2 m of the tank wall to minimise sub floor pipework. The outlet pipe arrangement must be arranged to ensure a minimum 100 mm dead zone above the tank floor to retain any accumulated sediment from being drawn into the outlet pipe. The Designer shall consider any requirement for an anti-vortex baffle.
Rising / Falling Main	If QLDC requires Rising / Falling main functionality then this must be achieved with separate inlet and outlet pipes as discussed above. A singular inlet / outlet pipe into a reservoir is not allowed. A non-return valve will be required to ensure turnover of the reservoir/s i.e. the reservoir is filled through the high-level inlet pipe and drained via the outlet pipe. A dedicated flow meter is still required on the outlet pipe to record flows and is linked to BCV operation. A flow meter is also required on the inlet pipe such that instantaneous demand can be deducted during reservoir filling. The inlet flow meter can be common to all reservoirs within the facility, similar to the installation of a common altitude valve. Although most flow meters have bi-directional capability they shall not be used where flow can be in both directions, i.e. on the Rising / Falling main, as this confuses processing of data provided by the meter.
Bypass valve between inlet and outlet	Some existing reservoir facilities have a by-pass pipe between inlet and outlet pipework. QLDC may require some future facilities to have this functionality The by-pass shall consist of a normally closed pipe, with a valve at each end and a means to purge the closed pipe from its end nearest the valve to the outlet pipe.
Internal overflow	The tank must be provided with an internal overflow pipe capable of taking maximum inflow without the water level reaching the roof structure. Maximum inflow to a single tank is calculated by dividing the maximum inflow into the reservoir facility divided by the

Design Element	Requirement (Refer to Appendix A for typical pipework arrangements)
	number of tanks less 1, i.e. total inflow divided by 1 for 2 tanks, and divided by 2 for 3 tanks. The overflow shall be conveyed to the scour pump out/overflow inground chamber. The overflow will initially bubble up from the chamber and be obvious to the operator. Any overflow beyond the capacity of the calamity basin's SW discharge system shall intentionally flood the calamity basin. The overflow pipe shall have a non-return valve installed at the exit point to prevent vermin from entering the pipe.
Balance pipework	To allow for any differential filling or decanting between individual tanks a smaller diameter balancing pipe is to be provided between tanks, or as a manifold where there are more than 2 tanks. Balance pipe work shall have an isolation valve no further than 1 m from each tank circumference.
Pipe routes	Within the reservoir facility the designer must ensure the configuration of inlet, outlet, overflow and drainage pipe work minimises the number of pipe crossings and the need for multiple vertical separations. Where possible the inlet and/or outlet pipes shall run in the verge adjacent to the access road.
Service duct routes	The Designer shall run ducts for control cables alongside the inlet and/or outlet mains where practical. Control cable ducts may be in the same trench as the pipelines provided code of practice separation is maintained.
Sample points	Sample points shall be provided on the outlet pipework as per the QLDC Standard detail B2-10, refer to Code of Practice, Section 6.
Freezing protection	Appropriate freezing protection to above ground pipelines is required. This is to be assessed on an individual basis. This may apply to smaller pressure 'signal' and water sampling pipework.
Pipe restraints	All fixings shall be by bolts, cast in fixings or chemical bolts. Corrosion and bi metal effects must be considered and mitigated. Clamping and bolting preferred to welding.

2.6 POWER, CONTROL AND INSTRUMENTATION SYSTEM REQUIREMENTS

Element of Design	Requirement
Level sensors	Reservoir level is to be measured by dual transducers operating in a duty/standby configuration. Hydrostatic pressure transmitters installed via small bore penetrations at the tank base are preferred. The penetration shall include an isolation valve to allow for the safe removal of the level instrument while the tank is in service. Suitable mechanical protection shall be provided to protect the devices from damage. The duty level sensor shall be utilised to control the filling of the reservoir. The duty service device shall be selected by the operator and shall change automatically to the standby device in the event the duty instrument fails. Alarms shall be configured for Low, Low-Low, High, and High-High levels. In addition, an alarm shall be raised if the measured level on the two level sensors shows a difference exceeding 10%. The instrument make/model shall be confirmed with QLDC in advance of detailed design, refer to Appendix B.
Level Switches	A secondary level device is to be provided in the form of high and low float switches. Float switch positions are shown in Appendix D. Float switches to be installed close to main hatch for easy access. The instrument make/model shall be confirmed with QLDC in advance of detailed design, refer to Appendix B.
Flow Meters	An Electromagnetic flow meter is required to measure the flow leaving the reservoir site. The meter shall be mounted in a suitable lidded flow meter pit with good all-weather access and drainage. If the site includes multiple falling mains an individual flow meter shall be provided on each main. The flow meter make/model shall be confirmed with QLDC in advance of detailed design, refer to Appendix B.
Telemetry and SCADA	A Swampfox RTU shall be provided to enable communication and control through the QLDC SCADA system. Where practical, communications with the pump station filling the reservoir shall be via a hard-wired connection (copper, Ethernet, or fibre).
Electricity Requirements	Where practical all reservoir sites shall be provided with mains electricity. Where practical the electricity supply shall be brought to site underground and within the access road corridor. Where the

Element of Design	Requirement
	access road corridor is switchback or convoluted, a more direct route can be arranged. Where the provision of a mains connection is not possible or practical a solar array with suitably sized battery pack shall be provided.
Lightning Protection	Lightning protection risk assessment to AS/NZS 3000 shall be provided by the Designer.
Lighting	For sites with a mains power supply external security lighting with passive infra-red sensor shall be provided. The designer shall consider the requirements for task lighting provisions, to be agreed with QLDC on a site by site basis. All lighting shall be LED.
Security	Hatches and portholes shall be fitted with position switches to be linked to SCADA for monitoring and alarming.
Local Switchboard	A local Switchboard shall be provided and shall incorporate circuit breakers, level and flow monitoring transmitters and telemetry equipment. The board shall be constructed from stainless steel and rated for external conditions. The Designer shall confirm with QLDC their requirements for kiosks or small buildings to house the equipment.
Backup power generation	Electrically actuated burst control or EQ valves will require a sufficiently sized UPS allowing for a minimum of 2 actuations for each valve at the facility. The Designer shall discuss any requirement for a back-up generator or provision for a mobile generator with QLDC. Where a lift pump station is included at the facility to supply water to an upper pressure zone, it is likely that an on-site back-up generator will be required.

2.7 CIVIL AND SITE REQUIREMENTS

Element of Design	Requirement
Site signage	The site shall include the following signage: • Access gate sign showing name of site, QLDC contact details etc.

Element of Design	Requirement
	• H&S signs (chlorination related, no smoking, confined space, electricity, speed limit, hearing protection, visitor instructions, etc) refer to AS/NZS 1319. • Security Notices. • Face plate on each tank giving tank manufacturer, reservoir name, volume TWL and BWL.
Calamity basin	The designer must consider the consequences of a catastrophic failure of one of the tanks and incorporate mitigation strategies (such as a safe overland flow path or a calamity basin) into their design. A calamity basin shall comprise a bund surrounding the tanks with a volume capable of retaining the volume of one full tank. The bund shall be at least 4 m from the tank base and shall have a cross section with 1 in 3 slopes and a 1 m wide crest. The bund will be continuous apart from where the reservoir facility vehicle access track crosses the bund. The track forms an overflow weir and determines the TWL of the calamity basin. For clarity the volume of calamity basin is calculated by multiplying the area of the basin, less the footprint of intact tanks by the depth of water in calamity basin. Where the access track crosses the bund it shall have 1 in 5 ramps with suitable vertical curves to allow vehicles to transit over the crest. The calamity basin is to have a SW drainage system connected to a suitable watercourse or stormwater system. In the event of an overflow or tank rupture the discharge from the calamity basin will be intentionally and specifically limited to the capacity of the basin's SW drainage system and receiving environment. Should an overflow continue without intervention, or more than one tank rupture, then an overflow from the calamity basin may occur over the access track and be conveyed in a controlled manner as overland flow. It is unacceptable to have no designated overland flow path from the reservoir facility in the event of an overflow or tank rupture. Calamity basin reservoir depths to overflow exceeding 0.50 m, and facilities with lift pump stations and other electrical equipment within the basin, will require specific approval. Electrical switchgear shall be kept above the calamity basin TWL. Calamity basin reservoir depths to overflow exceeding 1.3 m are not acceptable.
Stormwater drainage	Reservoir site stormwater drainage shall be configured to prevent any standing water accumulating in a 10 year ARI storm event. The designer shall not create a large catchment for the calamity basin. Storm events in excess of a 10 year ARI may cause standing water within the calamity basin, but the designer must ensure that any

Element of Design	Requirement
	standing water up to a 250 ARI event will drain away in less than 8 hours. The designer shall also ensure that the maximum design volume of water in the calamity basin will drain completely within 12 hours. The stormwater discharge system shall connect to an appropriate receiving environment. Design of the facility platform (the invert of the calamity basin) should avoid excessive change in platform level, i.e. +/-250 mm maximum.

Access road	The access road shall provide for the following:
	
	• All roading shall be in accordance with the QLDC District Plan Decisions Document April 2021, Section 29.
	
	• The access road shall be compliant with the QLDC Code of Practice Section 3. The access road shall be minimum 4m wide and shall have a pavement design suitable for construction and maintenance traffic.
	
	• Maximum gradient shall be as follows:
	
	    o Maximum extended grade 14% for straight lengths, hardfill surfacing as a minimum.
	
	    o Maximum localised grade 16% (20m max extension) for straight lengths, concrete surfacing as a minimum.
	
	    o Maximum grade for tight corners (>90 degrees) 12.5%, hardfill surfacing as a minimum.
	
	• Curve radii shall be sufficient to allow for construction and operational traffic. Refer to curve/turning circle figures in the above referenced document. A turning circle should always be achievable with a 4m wide annulus provided around each tank, unless the tanks are very small diameter. Utes should be able to turn around tanks larger than 6.0m diameter and 8.8m medium rigid vehicles should be able to turn around reservoirs larger than 12.0m diameter. At QLDC's discretion smaller reservoir facilities may not need a contiguous annulus around each tank, and a hammerhead design maybe acceptable, at QLDC's discretion.
	
	• The access road must have a safe flat section for vehicles to park while the driver unlocks the gates to the facility. This is to mitigate the risk of 'roll-back' events. The flat section should comfortably accommodate a Ute and allow for swinging of the gates. Flat sections for parking less than 8m long and/or with a gradient in any direction greater than 1v:33h (3%) will need specific approval.

Element of Design	Requirement
	• Road design shall provide for access in bad weather and shall have stormwater system designed to contain a 1 in 10-year event. • The access road shall be provided with signage. • A minimum 4 m wide unsealed annulus around each tank is required for access by ute, 8.8m medium rigid vehicle, or elevated work platforms (EWPs).
Access hatches	Permanent personnel access facilities to the roof are required. At a minimum the access facilities will comprise a platform beside the tank with a handrail at the tank gutter height. The platform is intended for accessing the roof top inspection hatch/s and is not intended for access on to the roof itself. Depending on the height of the tank wall above ground level (AGL) a lower intermediate platform may be required. Any fixed ladders shall not extend below 3.6 m AGL, or will require an infallible mechanism to prevent use by unapproved persons. Removable ladders shall extend no more than 6 m AGL and will require a proprietary ladder attachment system to ensure safe use. One access hatch on the roof is required to allow for monitoring, instrumentation, and drone access. This hatch shall have a clear opening of 600x600 mm. Two diametrically opposite access ces (porthole type), minimum 1000 mm clear diameter in the tank shell, just above floor level are required for internal tank inspections when the tank is empty. Portholes shall be hinged so they swing open and do not need to be lifted. Portholes shall be fully sealed, leak free and lockable.
Security, fencing and gates	The reservoir platform shall be surrounded by a security fence with chain link mesh a minimum of 2.2 m high with single barbed wire top line and additional rabbit proof fencing buried to 300 mm. Fences should be a minimum of 8 m horizontally from tanks to allow the operation of plant. Fences can be placed on slopes with a gradient in any direction not exceeding 1v:2h. The designer shall avoid having fences on top of berms or in other visually dominant areas. Compound access gates shall be double leaf with a minimum 4 m wide opening and a single barbed wire top line. Gates shall be the same height as the security fence and shall be provided with standard QLDC padlocks.

Element of Design	Requirement
Cut and fill batters	Cut batter slopes not exceeding 1v:2h are acceptable, however still need to be covered by the geotechnical advice for the site. The design shall contemplate the long-term erosion protection and general stability of the slope. 3 Waters maintenance contractors require landscaping to be low maintenance and should avoid lawns, or other plants needing seasonal maintenance. The maximum gradient for grass planting requiring mowing is 1v:3h. Slopes with a gradient in excess of 1v:3h require mass planting with shrubs/tussocks or a mechanical means to avoid erosion. Cut batter slopes with a gradient in excess of 1v:2h require a specific geotechnical assessment. Slopes with a gradient in excess of 1v:1h require alternate means to stabilise and/or promote fibrous plant stabilisation and also required specific approval. Cut-off drains above cut batter slopes may be required to mitigate the risk of erosion. Any cut slope requiring mechanical stabilisation will require specific approval. Any cut batter slope that offers a risk of falls to itinerate users of the land (approved access or otherwise) is unacceptable. Any cut batter slope that does not contemplate long term maintenance and erosion control is unacceptable. Fill batter slopes not exceeding 1v:2h are generally acceptable, however need to be covered by the geotechnical advice for the site. The design shall contemplate the long term erosion protection and general stability of the slope. Fill batter slopes with a gradient in excess of 1v:2h require a specific geotechnical assessment. Any fill area requiring mechanical stabilisation will require specific approval. Any fill batter slope that offers a risk of falls to itinerate users of the land (approved access or otherwise) is unacceptable. Any fill batter slope that does not contemplate long term maintenance and erosion control is unacceptable.
Rockfall protection	A formal assessment of the site is required by the designer in order to confirm the necessity, or otherwise, for rock fall or other

Element of Design	Requirement
	protection. If required, an appropriately qualified designer shall design the system.
Vehicle and foundation loading on pipes	All external below ground pipework shall be designed for at least HN loading. The Designer shall consider structural loading to AS/NZS 2566 where required but especially at road crossings and under any foundations.
Bollard protection	Valve groups and other non trafficable chambers shall be protected from traffic by bollards.
Landscape Design	A specific landscape design is required. Trees which may threaten the infrastructure are not to be included. Trees and planting shall be native species suitable for local conditions. Trees shall be planted on the outside faces of the calamity basin and not within the security fencing of the facility. The 3 Waters maintenance contractor will not accept maintenance of plantings. There may be situations where plantings within the security fencing of the facility are appropriate, this will need to be agreed with QLDC.

3.0. DESIGN DOCUMENTATION

3.1 PRELIMINARY PROJECT REQUIREMENTS AND CONSTRAINTS MEMO

The consultant shall prepare a preliminary Project Requirements and Constraints memo. The purpose of the memo is to specifically, clearly, and succinctly record the project requirements and constraints that the design will be prepared to address. Designer shall liaise with QLDC to confirm and specifically record the aspects below in a formal memo addressed to the QLDC project manager:

- Purpose of storage, e.g., potable water, raw water, or recycled water.
- Requirement for designations and designation boundary.
- Easement requirements.
- Land availability including legal boundaries.
- Any pre-existing ground/foundation information.
- Access road requirements, both for operation, maintenance and construction.
- Tank volume calculation.
- Tank operating levels.
- Location of existing rising and falling mains and connection to network.
- Water supply demand forecast.
- Relationship with, and operational requirements of, associated water treatment facilities.
- Details of consents and designations obtained and requirements for any new consents.
- Site specific planting and landscaping requirements.
- Specific requirements for electricity supply and back up generation.
- Any special security requirements.
- Any special hygiene, office, or other accommodation requirements.

3.2 CONCEPT DESIGN REPORT

To record how the design approach to address the project requirements and constraints recorded in the Preliminary Project Requirements Memo the designer shall develop a Concept Design Report.

The specifics of the design and the method of achieving the project requirements are to be recorded in this document. The purpose of the document is to agree the form of the solution prior to proceeding with detailed design and finalisation of the drawings and specification. As a minimum the document is to clearly identify the following items

- Site layout including topographic data, land boundaries, existing services and other land issues
- Consent constraints that may occur including stormwater discharge, resource consents etc
- Pipe layout including connection to the network and pipe layout within the site

- Tank layout and tank geometry and provision for future tanks
- Preliminary landscape layout
- Stormwater control within the site and stormwater from adjacent sites
- Requirement for retaining structures and earthworks
- Geotechnical information and geotechnical interpretation supporting the layout developed
- Site access layout
- Design requirements as listed in section 2 of this document

3.3 DETAILED DESIGN REPORT

To accompany the completed design documents (specification, drawings and other documents) the Designer shall prepare a Detailed Design Report. The purpose of the Detailed Design Report is to record the design inputs and solutions and the decisions and assumptions made. The Detailed Design Report is intended as the mechanism to record for future reference the design assumptions and design decisions and the intended operation of the facility. It is intended that the Detailed Design Report elaborate and expand on the items in the Concept Design Report and also record subsequent changes in assumptions or scope.

3.4 COMMISSIONING AND TESTING PLAN

The Designer shall prepare a Commissioning Plan for QLDC approval detailing how the filling, testing, cleaning and disinfection and commissioning of the tanks will be carried out.

The commissioning plan shall include for testing of alarms and super-chlorination as part of the commissioning.

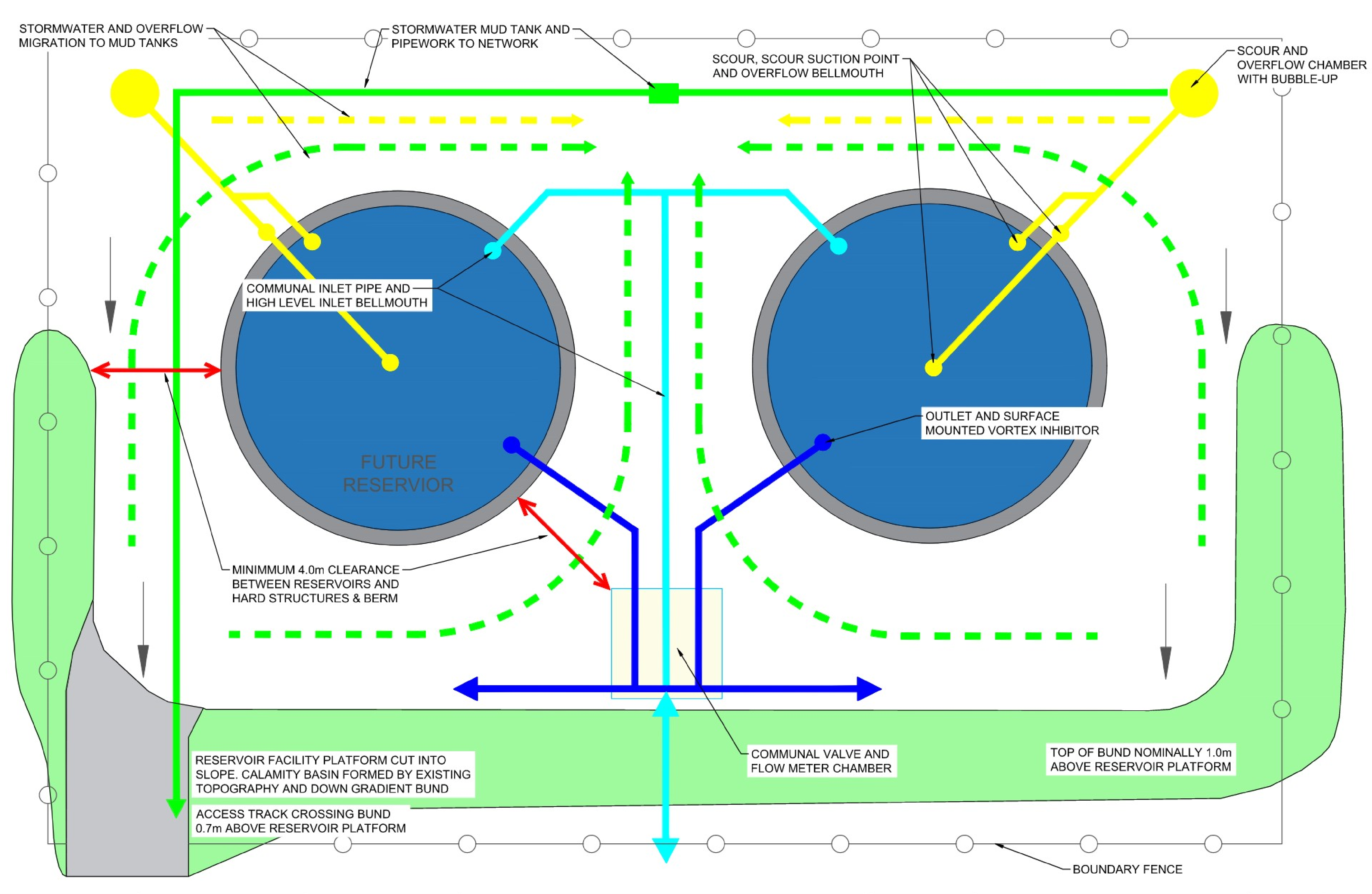
Minimum requirements shall include.

- Stabilisation period and level monitoring requirements
- Leak testing of the roof shall be carried out in accordance with Section 13.9 in AWWA D103. This testing shall be carried out in the presence of QLDC staff or nominee.
- Test procedure to test the tank overflow operation
- Test procedure for scour operation
- Cleaning and disinfection requirements. Disinfection shall be to the Water New Zealand Good Practice Guide 'Hygiene Practices to Prevent Water Supply Contamination, December 2019,' The adopted disinfection method is to be discussed and agreed with QLDC operations staff.
- Bacteriological testing. Samples shall be taken and tested in line with the Water New Zealand Good Practice Guide and the Drinking-water Standards for New Zealand 2005 (Revised 2018) to demonstrate a successful disinfection procedure.
- Transducer testing. The pressure transducer and associated float switches shall be configured to stop the rising main pumps to prevent overflows. Switch levels and alarms

shall be provided as shown in Figure SK4 (Appendix D). Switch and alarm signals shall be tested as part of the commissioning plan.

- Holiday conductivity testing of all panels shall be completed in accordance with AWWA D103-19.

APPENDIX A TYPICAL SITE LAYOUT AND PIPEWORK DRAWINGS



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QUEENSTOWN LAKES DISTRICT COUNCIL

QLDC Wanaka Water Trunk Main
Engineering Design
Typical Reservoir Facility

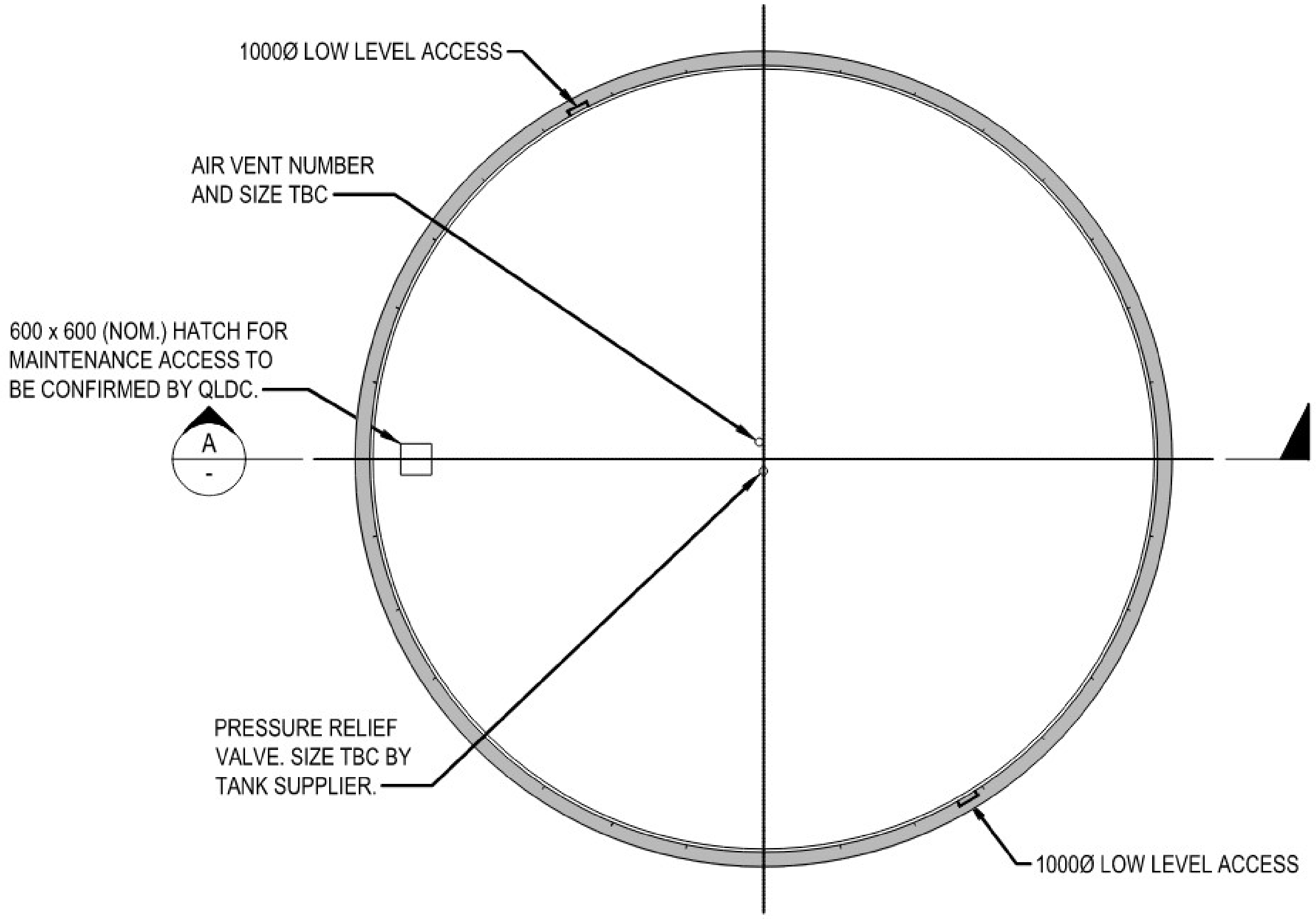
DESIGN	JS
DRAWN	BS
APRVD	JS

PROJECT #: 2-0343

REV	DETAILS	DATE
A	Initial design	21/01/2022

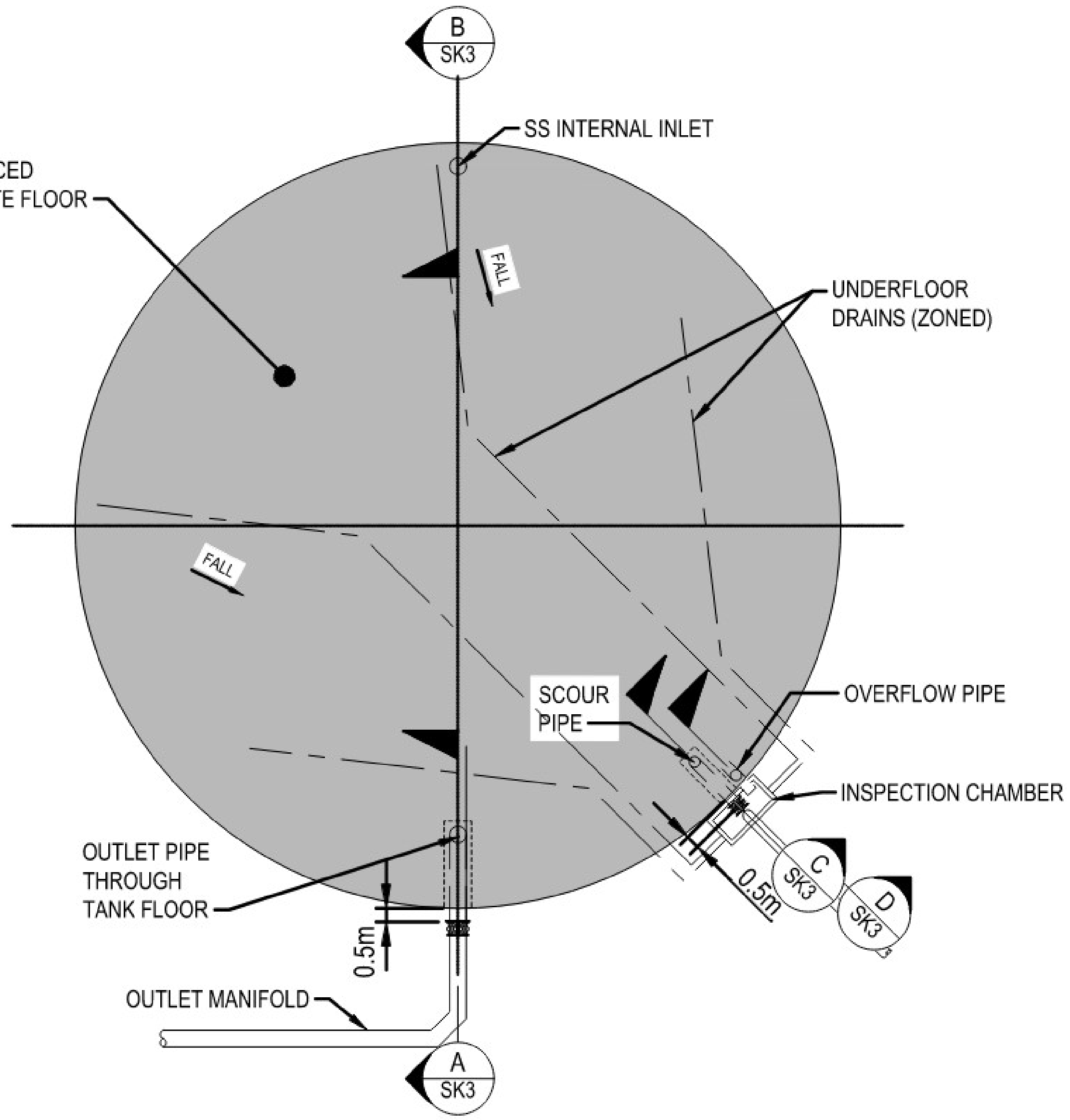
DWG No.	2-0343.01
SCALE	N.T.S
REVISION	A

FOR APPROVAL



RESERVOIR ROOF PLAN

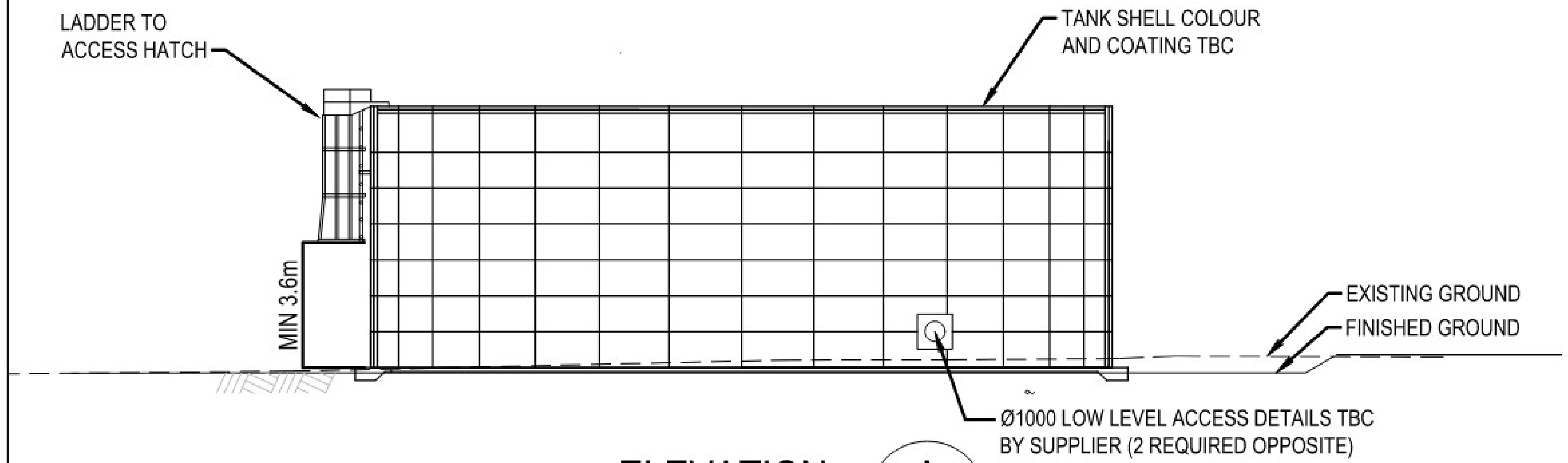
(TYPICAL)



RESERVOIR FLOOR PLAN

(TYPICAL)

REFER SK3 FOR PIPEWORK DETAILS.



ELEVATION A

SCALE 1 : 250

-

INDICATIVE ONLY - REFER TO PRINCIPALS REQUIREMENTS

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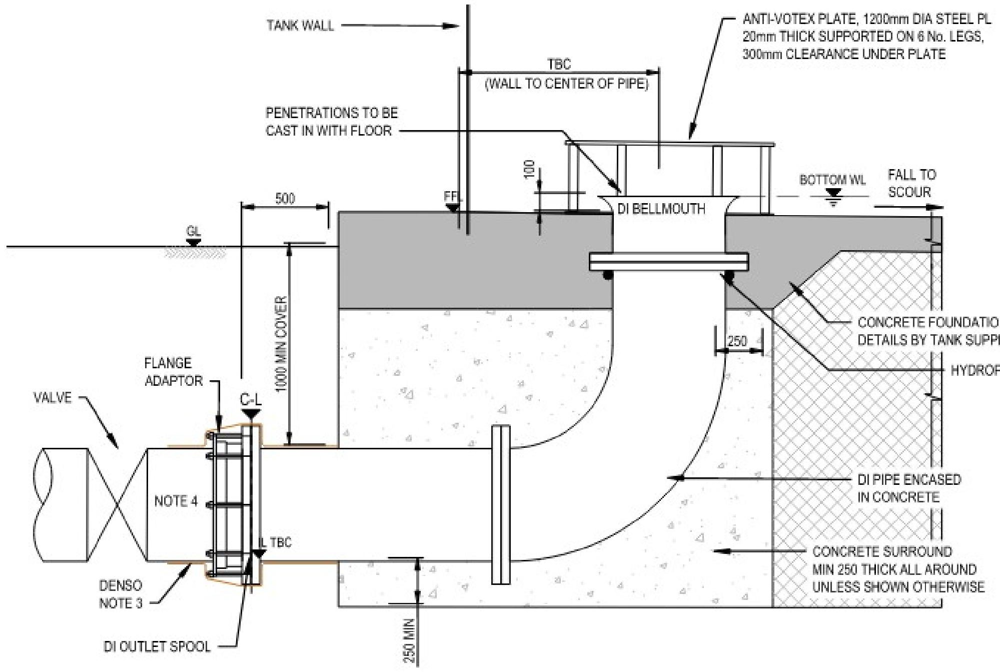
QUEENSTOWN LAKES DISTRICT COUNCIL

QLDC Wanaka Water Trunk Main
Engineering Design
Reservoir (Typical) Plan and Elevation

DESIGN	JS			2-0343.01	FOR APPROVAL
DRAWN	BS			DWG No.	
APRVD	JS				
PROJECT #: 2-0343		A	Initial design	23/08/2021	N.T.S	A
		REV	DETAILS	DATE	SCALE	REVISION

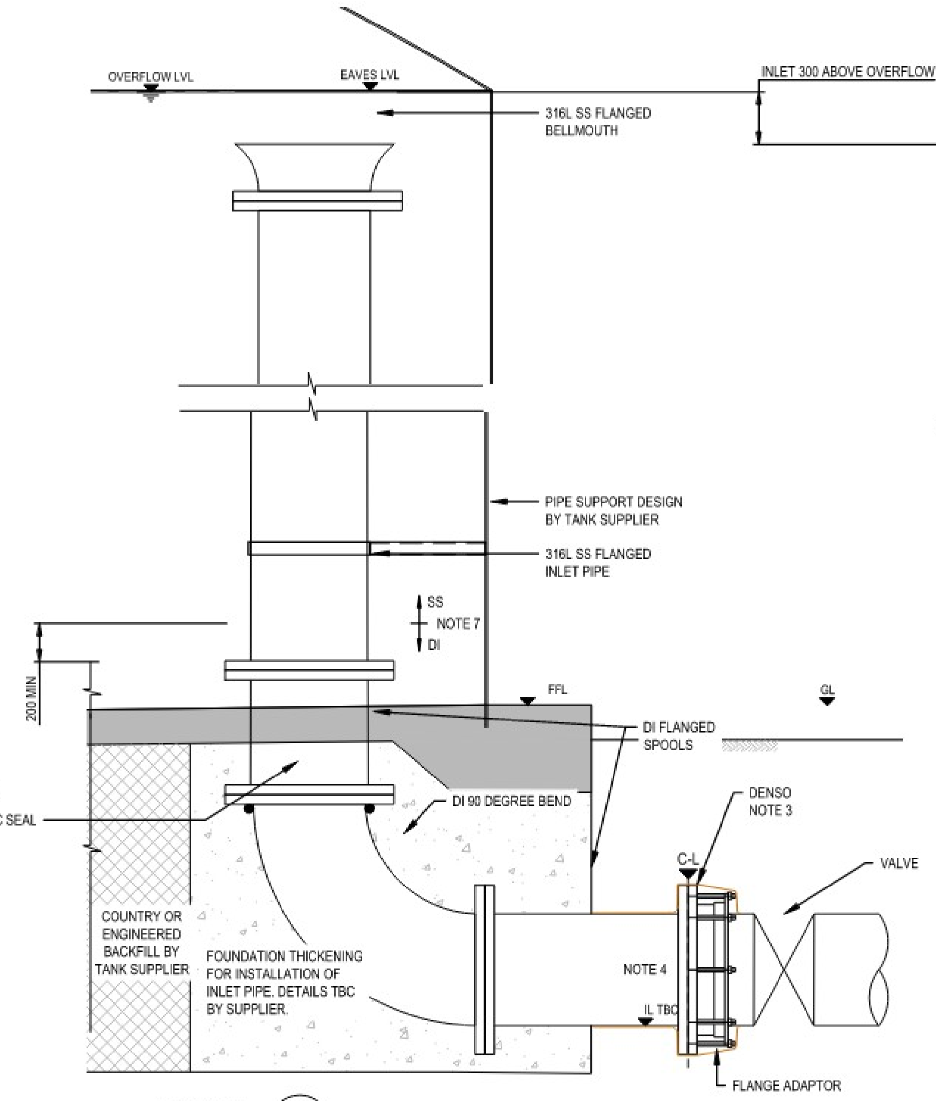
RESERVOIR CONNECTION NOTES

1. REFER TO QLDC DOCUMENT 'RESERVOIR PRINCIPALS REQUIREMENTS'.
2. ALL STAINLESS STEEL PIPE TO BE 316L STAINLESS
3. ALL MILD STEEL AND DUCTILE IRON BOLTED CONNECTIONS ARE TO BE WRAPPED USING FULL DENSO SYSTEM PRIMER, MASTIC FILL, PETROLEUM TAPE AND MPHD OUTER WRAP WHEN NOT CAST INTO CONCRETE.
4. PIPES TO BE CONNECTED TO A ROCKER PIPES TO TAKE ANGULAR DISPLACEMENTS OF AT LEAST 5 DEGREES.
5. BLANK FLANGES TO BE PROVIDED AT CONTRACTUAL LIMITS.
6. C-L = CONTRACTUAL LIMITS (TO BE CONFIRMED)
7. DESIGNER TO APPLY GALVANIC ACTION PREVENTION AT DISSIMILAR METAL INTERFACE.
8. INLET INVERT TO BE MINIMUM 100mm ABOVE TOP WATER LEVEL.
9. SIMPLE BELLMOUTH OR OVERFLOW SHOWN. DESIGNER TO CONSIDER WEIR TYPE OVERFLOW TO MINIMISE TANK HEIGHT.
10. DESIGNER TO CONSIDER REQUIREMENTS FOR THRUST BLOCKS.



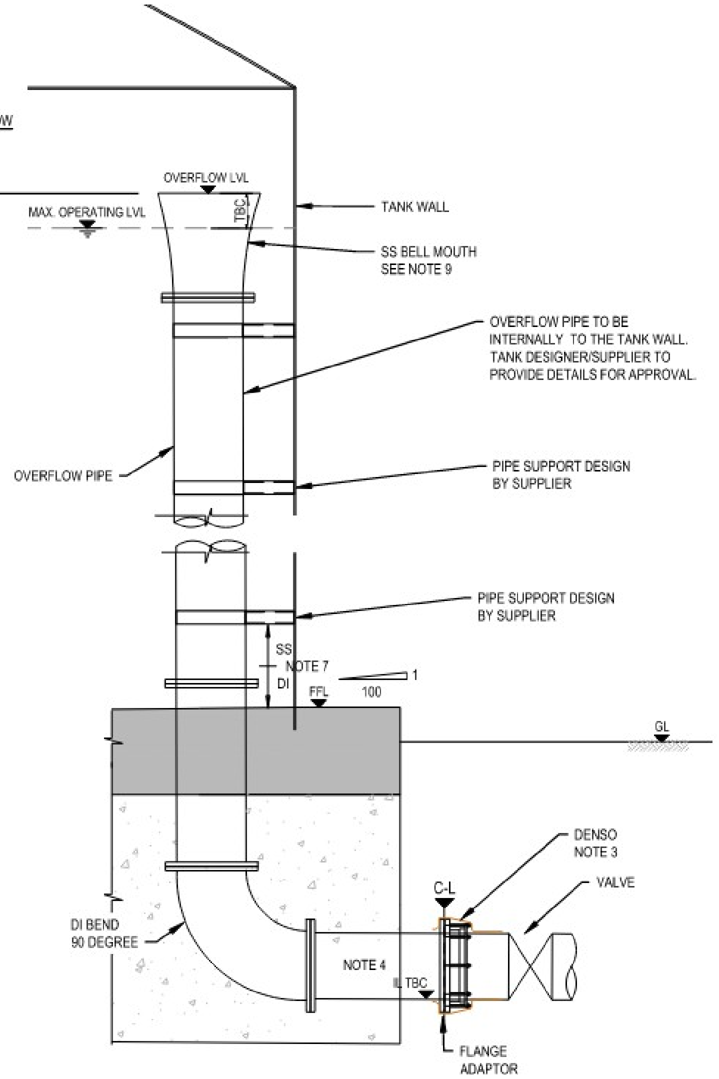
TYPICAL RESERVOIR OUTLET CONNECTION

SECTION A SK2
NOT TO SCALE



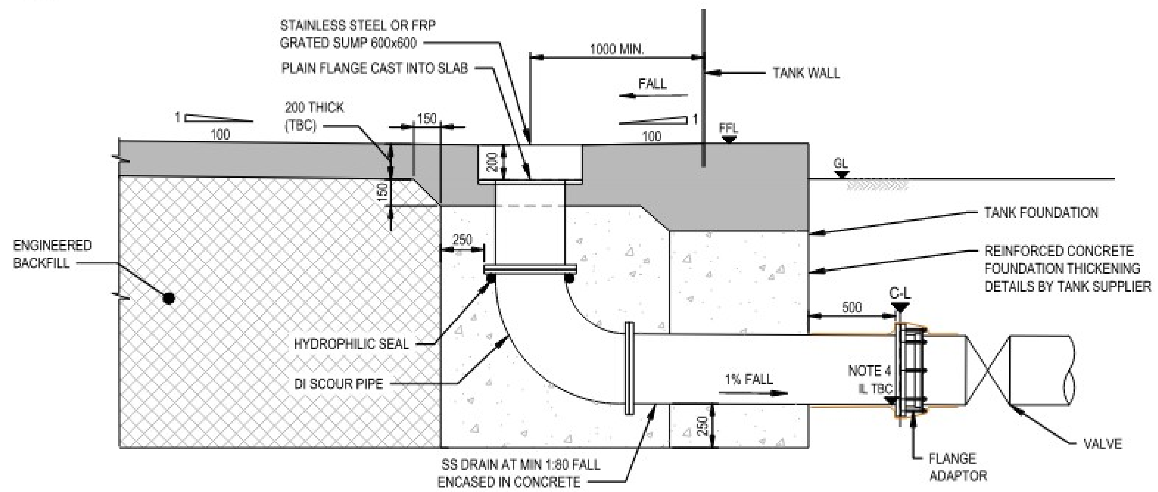
SECTION B SK2
NOT TO SCALE

RESERVOIR INLET CONNECTION



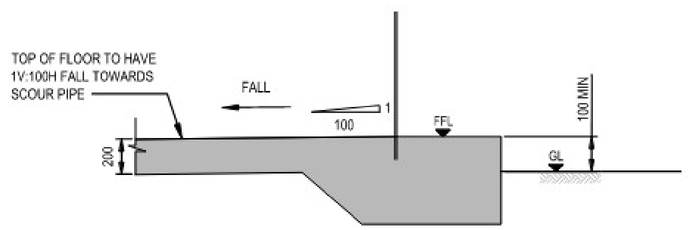
RESERVOIR DRAINAGE AND OVERFLOW (NOTE 4)

SECTION D SK2
NOT TO SCALE



SECTION C SK2
NOT TO SCALE

TYPICAL SCOUR PIPE OUTLET



TYPICAL FOUNDATION DETAIL

SCALE 1 : 20

NOTE:- ORIGINAL SIZE A1

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QLDC Wanaka Water Trunk Main
Engineering Design
Reservoir Pipework Detials

DESIGN	JS			2-0343.01	FOR APPROVAL
DRAWN	BS			DWG No.	
APRVD	JS			1:200 A3	A
PROJECT #: 2-0343	A	Initial design	23/08/2021		
	REV	DETAILS	DATE	SCALE	REVISION

APPENDIX B QLDC PREFERRED INSTRUMENTATION

Preferred instrumentation for the reservoir facility is as noted below:

Pressure Transducer	Endress and Hauser FMX21
Float Switch	Flygt ENM-10

APPENDIX C SEISMIC DESIGN MEMORANDUM

Memorandum

22 May 2019

To	QLDC		
Copy to			
From	Amy Williams	Tel	04 495 5833
Subject	Seismic Return Period Requirements - Water supply reservoir	Job no.	12506856//

1 Background

The following memo outlines the design philosophies used in determining design seismic loads for new freshwater reservoirs and how these are applied to QLDC.

The RFP documentation provided by QLDC outlines that the reservoirs are designed to Importance level 4 with a 100 yr design life.

The combination of a very high importance level and longer than 50 year design life puts the design seismic loading outside of the parameters typically set by the loading standard 1170.0 .

The following outlines the factors considered in determining the return period of design seismic loads. The combined effect of these factors can require a utility to be subject to a hazard analysis. The design recommendation are then considered in the context of other utilities throughout New Zealand and in the wider context of American Lifelines guidance.

2 Design Working Life

The concepts of "Design Working Life" used in determining loading and "Specified Intended Life" used when determining durability requirements. While they have separate meanings, both of these terms are often referred to as Design Life. AS/NZS 1170 outlines the design working life, in relation to determining design loads in commentary CL C3.3 below:

"The 'design working life' is a reference time period expressed in years. It is a concept used to select the probability of exceedance of different actions. This does not mean that when the design working life is reached the structure will fail; nor does it mean that the design working life has to correspond exactly with the intended useful life the designer has in mind or with the durability of the construction materials."

3 Importance Level

The importance level of a structure is related to the risk that its's loss of service poses to the community.

If the reservoir is the sole source serving an importance level 4 facility, such as fire services or emergency surgeries, the reservoir must also be treated as IL4.

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Level 2 Grant Thornton House 215 Lambton Quay Wellington 6011 PO Box 1746 Wellington 6140 New Zealand
T 64 4 495 5800 **F** 64 4 472 0833 **E** wgtnmail@ghd.com **W** www.ghd.com

Outside of this requirement, reservoirs typically fall between Importance level 3 (IL3) and importance level 4 (IL4). The distinction between the two levels can be effected by the levels of redundancy in the supply network or its requirement to provide service to post disaster services.

On this basis, the selection of IL4 as a design basis allows emergency services to rely on these facilities for post emergency functions.

4 Seismic Design Return Period

The importance level and design working life affect the magnitude of the seismic loading to be applied in the design (through the selection of Design Return Period).

Reprinted below is Table 4.1 from the NZS 1170. This table gives guidance on the appropriate return period to select based on the various design parameters, i.e. IL, design working life, and probability of exceedance.

QLDC has specified that all reservoirs be to be considered IL4 structures – appropriate for structures required for Post-Disaster functions. This requirement is set out in their RFP documents.

The importance level informs both the ultimate limit state (ULS) return period and the serviceability limit state (SLS) return period. For a standard 50 year design working life structure (Building Code), the required return periods for an IL4 structure will be 1/2500 and 1/500 respectively. However, because QLDC require the design life to be extended to 100 years, there is a need to review both the SLS and the ULS return periods.

Figure 1: Extract from AS/NZS1170

TABLE 3.3

ANNUAL PROBABILITY OF EXCEEDANCE

Design working life	Importance level	Annual probability of exceedance for ultimate limit states			Annual probability of exceedance for serviceability limit states	
		Wind	Snow	Earthquake	SLS1	SLS2 Importance level 4 only
Construction equipment, e.g., props, scaffolding, braces and similar	2	1/100	1/50	1/100	1/25	
Less than 6 months	1	1/25	1/25	1/25	—	
	2	1/100	1/50	1/100	1/25	
	3	1/250	1/100	1/250	1/25	
	4	1/1000	1/250	1/1000	1/25	
5 years	1	1/25	1/25	1/25	—	—
	2	1/250	1/50	1/250	1/25	—
	3	1/500	1/100	1/500	1/25	—
	4	1/1000	1/250	1/1000	1/25	1/250
25 years	1	1/50	1/25	1/50	—	—
	2	1/250	1/50	1/250	1/25	—
	3	1/500	1/100	1/500	1/25	—
	4	1/1000	1/250	1/1000	1/25	1/250
50 years	1	1/100	1/50	1/100	—	—
	2	1/500	1/150	1/500	1/25	—
	3	1/1000	1/250	1/1000	1/25	—
	4	1/2500	1/500	1/2500	1/25	1/500
100 years or more	1	1/250	1/150	1/250	—	—
	2	1/1000	1/250	1/1000	1/25	—
	3	1/2500	1/500	1/2500	1/25	—
	4	*	*	*	1/25	*

* For importance level 4 structures with a design working life of 100 years or more, the design events are determined by a hazard analysis but need to have probabilities less than or equal to those for importance level 3.

Design events for importance level 5 structures should be determined on a case by case basis.

QLDC'c requirement for water reservoirs (IL4 structures) is that at ULS the structure is to be designed for a 1/2500 year return period earthquake and that at SLS2 the structure is to be designed for a 1/500 year event. This requirement is appropriate for structures that must function following a major event where they must provide the necessities of life. The loading code requires hazard analysis for such structures, when the design working life is extended beyond 50 years, but notes that loadings must not be less than for IL3 structures with a 100 year design life.

5 Hazard Analysis

A hazard analysis is required for the combination of IL4 and 100 year Design working life in order to determine the seismic loading. This type of analysis is highly specialised and typically only delivered by GNS. Preliminary discussions with GNS indicate that these studies can take month with a cost of 50-70K per site. Current indications are that they do not have the capacity to commence any new studies until August 2019.

6 Context of return periods

GHD have looked at the design decisions in the context of the decisions made in the design of similar facilities

6.1 New Zealand Context – return periods

We have found the combination of IL4 and 50 Year Design Working life to be adopted in the following situations:

Wellington Water Limited – New Reservoir Design

Wairoa District Council – Wairoa Reservoir

WaterCare Auckland – design of new Hunua pipe lines & supply reservoirs

QLDC – Glenorchy Reservoir

6.2 International Context – return periods

Further to this, the 1/2500 return period for ultimate limit state design is in line with the American Life lines guidance documents.

7 Required Clarification

We propose to design the reservoirs to seismic loads based on the following criteria:

Table 1: Seismic Loading Cases for IL4 Structures

Load Case	Performance Requirement	Annual Exceedance Probability (AEP)
Serviceability Limit State 2 (SLS2)	No loss of service (operational continuity). Repairable damage. Interpreted: No loss of water-tightness / tolerable water ingress permitted.	1/1000
Ultimate Limit State (ULS)	No loss of life, no collapse. Damage may be uneconomic to repair. May lose water-tightness.	1/2500
Maximum Considered Earthquake (MCE)	No collapse. Damage likely to be uneconomic to repair.	N/A

The return periods above are based on and IL4 structure with a 50 year Design Working Life. As outlined previously, this approach is in line with the return periods used in other parts of New Zealand and also agrees with the American Life lines guidance documents.

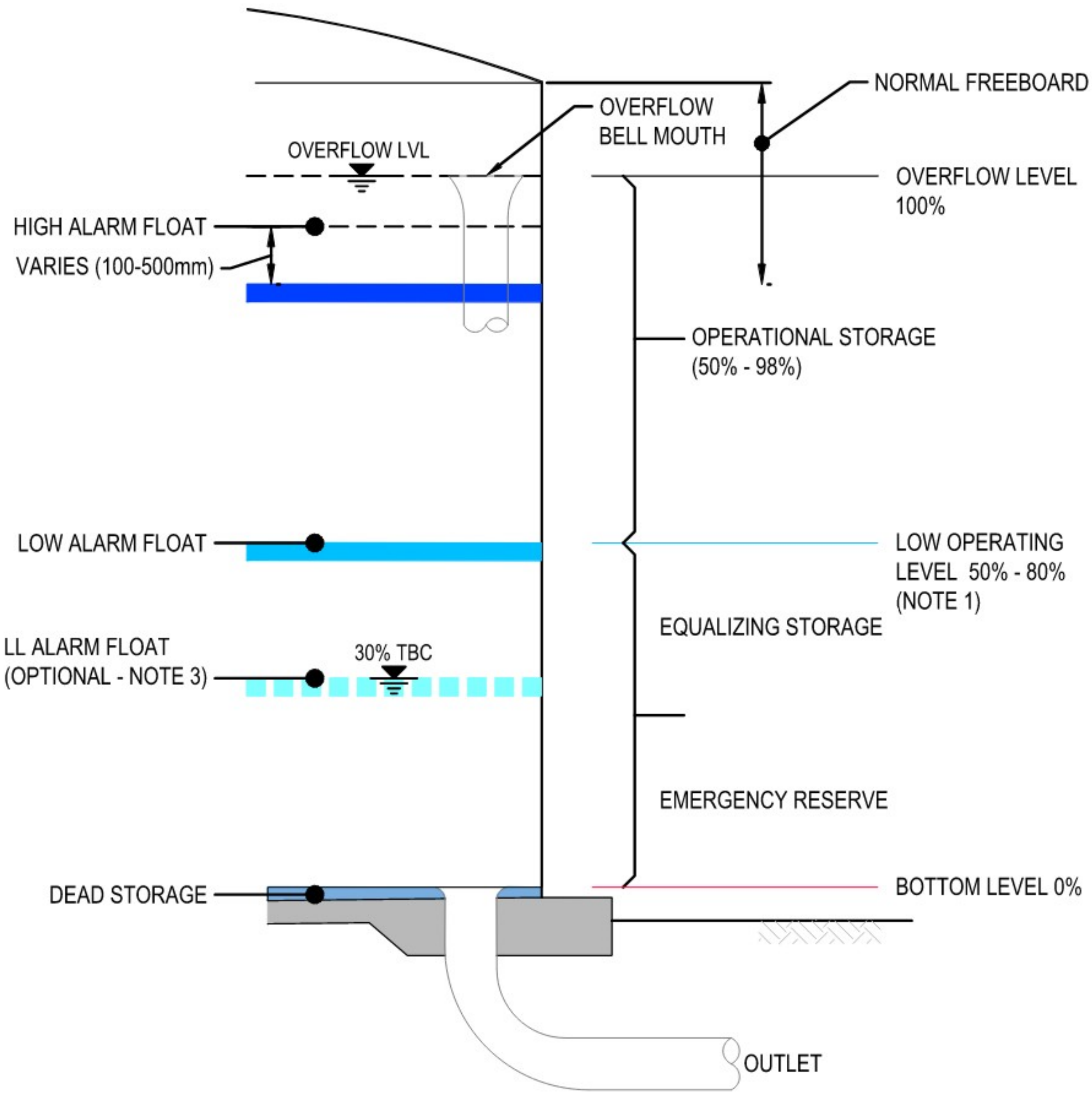
The alternative, is to instigate a 100 year Design Working Life, and commission site specific seismic hazard study. This will have significant impacts on both the programme and budget of this project.

Please advise if QLDC agree with the recommendation to adopt the return periods in Table 1.

Regards

Amy Williams
Structural Team Leader

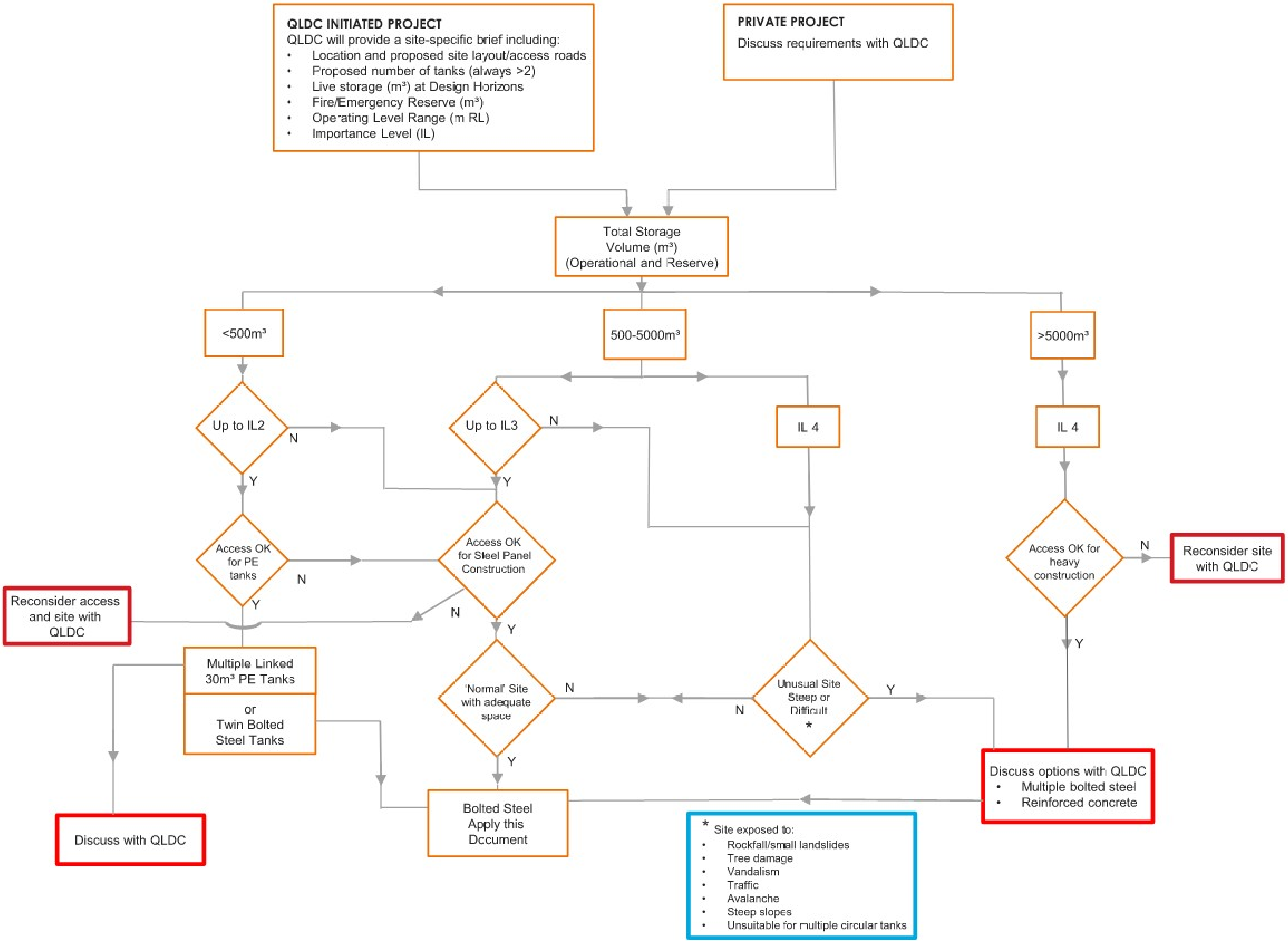
APPENDIX D RESERVOIR LEVELS



NOTES

1. LOW OPERATING LEVEL IN A RANGE FROM 50% TO 80% DEPENDING ON LOCATION / OTHER TANKS / REMOTENESS / SEASON.
2. SCADA ANALOGUE FROM HYDROSTATIC-PRESSURE LEVEL TRANSDUCER. TO BE MOUNTED WITH GUIDE/ OR STILLING WELL.
3. LL ALARM DESIRABLE - POSITION DEPENDS ON SAME CRITERIA AS NOTE 1 ABOVE.
4. OPERATING LEVELS CAN CHANGE SEASONALLY.

APPENDIX E TANK FLOW CHART


QLDC INITIATED PROJECT
QLDC will provide a site-specific brief including:
• Location and proposed site layout/access roads
• Proposed number of tanks (always >2)
• Live storage (m³) at Design Horizons
• Fire/Emergency Reserve (m³)
• Operating Level Range (m RL)
• Importance Level (IL)
PRIVATE PROJECT
Discuss requirements with QLDC
Total Storage Volume (m³) (Operational and Reserve)
<500m³
500-5000m³
>5000m³
Up to IL2
Up to IL3
IL 4
IL 4
N
N
Y
Y
Access OK for PE tanks
Access OK for Steel Panel Construction
Access OK for heavy construction
N
N
Reconsider site with QLDC
Reconsider access and site with QLDC
Y
N
Y
Y
Multiple Linked 30m³ PE Tanks
or
Twin Bolted Steel Tanks
'Normal' Site with adequate space
N
N
Unusual Site Steep or Difficult *
Y
Y
Discuss options with QLDC
• Multiple bolted steel
• Reinforced concrete
Discuss with QLDC
Bolted Steel Apply this Document
* Site exposed to:
• Rockfall/small landslides
• Tree damage
• Vandalism
• Traffic
• Avalanche
• Steep slopes
• Unsuitable for multiple circular tanks

Water Supply Trunkmains

Queenstown Lakes District Council Land Development and Subdivision Code of Practice Addendum

Date: February 2022

QUEENSTOWN LAKES DISTRICT COUNCIL

CONTENTS

INTRODUCTION

1.1. SCOPE

This document forms an addendum to the Queenstown Lakes District Council's (QLDC) Land Development and Subdivision Code of Practice (CoP) to cover specific requirements relating to the design and construction of bulk supply mains for potable water. These are referred to as trunkmains or falling mains throughout this document. The distinction between a trunkmain and a falling main is:

- **Falling Main** – Pipeline from the reservoir feeding into the **trunkmain.** The falling main may be above or below level of service pressure (300 kPa – 900 kPa) and shall have no offtakes.
- **Trunkmain** – Pipeline that is within the level of service window (300 kPa- 900 kPa) and may have offtakes for water supply. May be supplied via a **falling main**.

This addendum is not intended as a standalone document and must be used in conjunction with the QLDC CoP and standard design/project management practices. Unless otherwise specifically noted within this document all trunkmain designs must comply with the requirements outlined in the most up to date version of the QLDC CoP. Water supply requirements are outlined in Section 6 of the CoP.

For ease of reference the headings in this document have been amended to reflect the corresponding sections of the QLDC CoP.

Where smaller infrastructure is directly associated with a transmission system it must be completed to the transmission standards of the larger infrastructure that is connected to, e.g. the smaller sizes of a trunkmain system such as bypasses around line valves or the supply to a bulk supply point.

This addendum includes considerations for:

- Criticality and resilience
- Hydraulic design
- Location, layout and clearances of pipelines and associated infrastructure
- Pipe structural design

This addendum excludes specific requirements for:

- Pump stations
- Treatment plants and processes
- Structural design of associated structures such as bridges or buildings that are covered by the New Zealand Building Act
- Electrical and control/automation design
- Reservoir facilities – these are covered in a separate addendum

1.2 REFERENCED STANDARDS

This addendum must be read in conjunction with the Queenstown Lakes District Council's *'Land Development and Subdivision Code of Practice',* national, and international standards listed below. Where conflict or ambiguity exists this addendum shall take precedence. Where this is conflict between referenced standards, the higher level of standard shall take precedence.

1.2.1 NATIONAL AND INTERNATIONAL STANDARDS

NZS 1170 Structural design actions
    Part 5 Earthquake actions – New Zealand
    Part 5 Supp 1 Earthquake actions – New Zealand – Commentary

AS/NZS 4219 Seismic performance of engineering systems in buildings

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

1.2.2 OTHER PUBLICATIONS

Menon, E Shashi, 2015. Transmission pipeline calculations and simulations manual

American Lifelines Alliance, 2005. Seismic Guidelines for Water Pipelines

NICEE, 2007. Guidelines for Seismic Design of Buried Pipelines

Opus International Consultants, Water NZ, 2017. Underground Utilities – Seismic assessment and design guidelines

Roberts, R, New Zealand Geotechnical Society, 2017, New Zealand Ground investigation specification, Volume 0, 1, 2 and 3

Moore, I.D, 1993. Structural design of profiled polyethylene pipe

Gumbel, J.E and Wilson J, 1981. Interactive design of buried flexible pipes – a fresh approach from basic principles, V14 No.4

Mott, R L, 1994. Applied fluid dynamics, 4th Ed.

1.2.3 WATERCARE STANDARDS

DP - 10 Safety in Design guide

DP - 11 Watercare, 2017. Health and Safety in Facility Design DP-09 Electrical design standard

CG - General civil construction standard

ME - General mechanical construction standard

MS - Material supply standard 7363 - Watercare CAD manual

AI - Data and Asset Information standard

DW05 - Access structure drawings for wastewater infrastructure DW06 - Access structure drawings for water infrastructure

DW07 - Access structures general drawings for public and non-public areas

DW10 - pipelines for water greater than 250mm diameter drawing set DW11 - Valve chamber detail drawings for transmission water

DW12 - Water stand-alone sampling and rainfall metering COP-03 Code of Practice for commissioning

COP-04 Code of Practice for disinfection of water systems

1.3 EXISTING INFRASTRUCTURE

Replacing existing or installing new trunkmain infrastructure will typically involve connecting to or undertaking work on existing infrastructure. The age and operational changes to its original design may impact on the new infrastructure connecting to it. The designer shall include in their design appraisal of the following factors and information (to be provided by QLDC):

- As-built drawings
- Existing calculations
- Site testing records
- Field investigations
- Commissioning records
- Geotechnical reports
- Operation and Maintenance manuals
- Standard operating procedures

2 SCOPE

The following section contains notes for existing clauses; amendments to existing clauses; or additions to clauses of the QLDC CoP. For ease of reference, the numbering of clauses are consistent with those within the 2020 QLDC CoP. Where a clause is not listed in this addendum, the design guidance noted in the CoP shall be used.

6 WATER SUPPLY

6.2 General requirements

6.2.1 Objectives

(a) and (b) are not applicable to trunkmains.

6.2.2 Reference documents and relevant guidelines

Additional reference documents are noted in Section 1.2 of this document.

6.3 Design

6.3.4 System design

Water demand shall be specified by QLDC for all trunkmain infrastructure. The designer shall be responsible for requesting this information from Council.

6.3.5 Design criteria

6.3.5.2 Network analysis

Network analysis is required for all trunkmain infrastructure.

6.3.5.5 Minimum flows

Trunkmains shall not have maximum flow velocities less than 0.5 m/s.

6.3.5.6 Minimum water demand

Minimum water demand is to be discussed and confirmed with QLDC for each trunkmain project.

6.3.5.7 Sizing of mains

Sizing of mains are to be determined based on the trunk main's function and confirmed with QLDC for each trunkmain.

The sizing should consider:

- If the trunkmain is upstream or downstream from the reservoir
- The zoning of area that it services (commercial, industrial, residential)

The flow rates for calculating the size of the trunk main shall be calculated by considering the current water demand usage with the consideration of water demand management over time.

6.3.5.8 Pressure zones

Pressure zone requirements are to be discussed and confirmed by QLDC for each trunkmain project.

6.3.5.9 Maximum pressure requirements

Maximum pressure requirements are to be discussed and confirmed by QLDC for each trunkmain project.

6.3.7 Flow velocities

6.3.7.1 Surge analysis

A surge analysis shall be undertaken for all trunkmain projects. 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

Trunkmain layout shall consider the road layout and existing services. Layout of the trunkmain must be demonstrated to be the most appropriate option for the road category, and agreed with the Chief Engineer.

6.3.8.2 Reticulation layout

Not applicable for trunkmain projects.

6.3.8.4 Water mains in private property

No trunkmains or critical infrastructure are to be installed in private property.

6.3.8.6 Water mains near trees

No trunkmains are to be installed within the root zone of trees.

6.3.8.7 Shared trenching

No trunkmains are to be installed in a shared trench.

6.3.8.8 Rider mains and duplicate mains

Outside the scope of this document

6.3.9 Clearances

6.3.9.2 Clearance from structures

No trunkmains are to be installed in the 'zone of influence' of any building foundations. Trunkmains must have a minimum clearance to a wall or building of 3m (retaining walls or roading ancillary structures only).

6.3.9.4 Deviation of mains around structures

Trunkmains shall normally follow the road layout. Deviation of a pipeline to follow the road 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. 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

6.3.10.1 Standard pipe sizes

This clause is not applicable for trunkmains. The trunkmain is to be sized appropriately for the network requirements, and specific pipe ordered for the project.

6.3.10.3 Pipe PN class (pressure rating)

The minimum pipe and fittings PN to be used for trunkmains shall be PN 16 unless proof can be provided that PN 16 is unnecessary.

6.3.12 Structural design

6.3.12.2 Seismic design
All trunkmains shall be of pipe function class '3 – Critical' and shall be designed in accordance with the design safety factors set out in Table 1 below:

Table 1. Design Safety Factors

Pipe Function Class	Description	Design Safety Factors				Seismic return period factor (NZS1170) R_u
		Peak ground acceleration	Liquefaction /subsidence	Landslide /lateral movement	Surface loading	
3 Critical	Pipelines servicing larger numbers of customers (>10,000 people) that if lost causes significant economic impact or hazard to human life, the natural environment and properties.	**1.8**	**1.35**	**1.6**	**1.5**	**1.8**

6.3.12.8 Above ground water mains

This clause is not applicable for trunkmains. No trunkmains are to have above ground infrastructure.

6.3.12.9 Trenchless technology
Trenchless technology requires specific discussion with QLDC.

6.3.12.10 Embedment

6.3.12.10.1 Minimum pipe cover
All trunkmains shall have minimum 1.0 m cover. This depth may need to be increased for larger pipe diameters (typically over 800 mm) where impediments such as air valves or utility services exist. The pipe depth shall also consider existing and future connections to the trunkmains.

6.3.12.10.2 Minimum trench width
Pipe trench width design considerations shall be based on the minimum side clearances detailed in Appendix A**.**

6.3.12.11 Pipeline restraint

6.3.12.11.3 Restrained joint water mains
These systems are not appropriate for trunkmains. Refer to requirements outlined in 6.3.12.11.1 and 6.3.12.11.2.

Additional clauses as below:

6.3.12.12 Buoyancy prevention

(a) Buried structures and pipelines susceptible to hydraulic uplift shall be designed with buoyancy prevention to a safety factor of 1.5.

(b) The designer shall consider that filled pipes may require emptying for maintenance purposes. Hydraulic uplift shall consider all structures and pipelines in an empty state.

(c) The effects of liquefaction on filled, partially filled, and empty structures and pipes shall also be considered when determining suitable weighing or anchoring solutions.

6.3.13 Reservoirs and pumping stations

Design and construction of reservoirs and pumping stations fall outside the scope of this document. Refer CoP addendum for Reservoirs.

6.3.14 Valves

6.3.14.1 General

In addition to the CoP the following requirements apply to trunkmains:

If actuator valves are installed, these must be connected to SCADA for monitoring. If no actuator is being installed there is no requirement for a SCADA connection.

For trunk mains over 600 mm (ID), the isolation valve shall include an isolation bypass to allow for recharge and/or draining. Where an isolation valve is at a low point of the trunkmain, a double isolation bypass setup is required to allow drainage of either side of the isolation valve. Otherwise, only a single isolation bypass is required.

Gate/sluice valves are to be used for pipe sizes up to 300 mm and geared butterfly valves for larger sizes (note that these require chambers).

For trunk mains larger than 600 mm (ID) the trunk main pipe diameter may be locally reduced for the economic benefit of a smaller isolation valve **if** hydraulically feasible.

Valve trains in sequence shall be of the same size.

Bypass valves are typically smaller than the main isolation valve to facilitate mainline charging and drainage. Bypass pipework shall be PE100.

Where the supplier does not have a standard valve set with a built in bypass, the horizontal clearance between the main line and bypass shall be 300 mm minimum at the closest point.

Handwheels shall be at least 300 mm clear of obstacles.

Where pipe reducers are used they shall be eccentric reducers tapering down from the bottom of the pipe.

Drain/charge points shall be provided at each end of the trunkmain installation, the valves may be direct buried outside the chamber.

Pipework shall be designed to allow for vertical lifts on equipment that requires ongoing maintenance.

Above ground isolation valves on control valve trains shall be fitted with handwheels.

6.3.14.2 Siting of valves

In addition to the requirements outlined in the CoP, the following requirements apply to trunkmains:

(e) Mainline isolation (line valves) are to be spaced to provide drain down time within 6 hours. Some standard spacings are shown below in Table 2.

(f) Mainline isolations are to be installed at bulk supply points to maintain continuity of water supplies and good locations for discharge of pipe drainage to stormwater or permeable ground.

(g) Isolation valves are to be installed in dry chambers or direct buried. The installation location must be demonstrated to be the best practicable option with consideration to:

- The need for ancillary equipment such as actuators.
- The type of valve being installed. Typically gate valves are best suited for buried applications.
- The whole of life cost benefit for the proposed installation method.

6.3.14.3 Gate valves
Valves 80≤ DN ≥300 shall be gate valves.

6.3.14.3.5 Valves
Butterfly or gate valves shall not be used for flow or pressure modulation. Fit for purpose control valves shall be used.

Control valves shall typically be SCADA monitored and may require to be fitted with an actuator for remote operation. All control valves shall be connected to RTU via fibre network if available.

Control valves shall be installed in an above ground building or dry chamber (dry chambers must include a drain to remove any moisture or water leaks). The installation location must be demonstrated to be the best practicable option.

Valve trains installed in sequence shall be of the same diameter, however where it may be considered that a future upgrade will require the valve train to be up-sized the isolation valves may be selected to be greater in diameter.

6.3.14.5 Pressure reducing valves
All pressure reducing valves are to have bypasses installed.

PRV bypass pipework shall be designed for the maximum ultimate flow rate in the pipeline at the projected minimum pressure differential.

6.3.14.6 Air valves

6.3.14.6.1 Installation design criteria
In addition to the requirements of the CoP, the following applies:

(a) Air valves shall be installed in dry chambers

(b) Air release valves shall be installed with eccentric reducer at the pipe soffit. The eccentric reducer shall be sized for optimal collection.

(c) Air valves shall be fitted with an isolation valve to allow the valve to be removed or replaced without isolating the main. Isolation must be below ground if the air valve is above ground.

(d) The air release valve vent shall be above the groundwater and 100 year flood levels. Direct connection to a surface vent may be required, or the valve must be vented through a flood-safe valve.

(e) Where air valves are installed underground within chambers the lid arrangement does not typically allow for adequate air flow rate. An air vent is required to be installed in the back berm and connected to the underground air valve chamber.

(f) Where the flow velocity in the pipeline is more than 2.4 ms-1 the air valve shall be fitted with an anti-slam device/feature.

6.3.14.7 Scours and pump-out branches
Change (a) to:

Scours shall drain the water main by gravity or have provision for pump-out within a period of 6 hours.

6.3.14.7.1 Scour Sizes

Scours must be sized appropriately to provide drain down time within 6 hours. Example spacings and sizes are shown below in Table 2.

Table 2. Minimum Scour Diameter for Trunk Mains

Trunk Main Diameter, mm	Minimum Scour Pipe Internal Diameter, mm	Maximum Pipe Length, m
DN $\leq$ 450	80	5000
450 < DN $\leq$ 630	100	4000
630 < DN $\leq$ 800	150	3000

Notes:
1. This table provides guidance for sizing scour points on trunk mains to comply with the maximum allowable drain time noted in clause 6.3.14.2 and 6.3.14.7.1. The table values have been calculated using an indicative initial 10 m hydraulic head above the scour point. Designers should satisfy themselves that any significant deviations from these guidance parameters in their design do not incur an exceedance of the maximum drain time. Any deviation from the guidance parameters will require validation with QLDC.
2. The calculation parameters assume pipe friction and turbulence are negligible
3. Maximum pipe length is the length of pipe that will drain through the scour should it be opened, i.e. the length between significant high points either side of the scour point.
4. Trunk main diameters are based on PE100 PN16 pipes.
5. Scour diameters based on standard DI fittings.
6. The draining pipe is assumed to operate under atmospheric pressure, noting air valves will be open when draining.

6.3.14.7.2 Scour locations
Replace (c) to (f) with:

(c) Scour design to flush mains and remove sediment shall be in a suitable location for high velocity discharge at a minimum mainline velocity of 0.8 ms^{-1}. Scour valves selected shall be suitable for the design target velocity.

(d) The scour discharge shall allow for adequate attenuation of the discharge energy such as rip-wrap or a stilling chamber. The location shall be suitable for the maximum volume to be discharged.

(e) Scour points for treated water shall consider de-chlorination requirements and provide a suitable mixing point or structure.

(d) Access to scour valves shall be off the carriageway and footpath.

(e) Scour valves are to be installed on lines greater than 300 mm.

6.3.14.8 Non Return Valves

(a) Non-return valves shall be installed as part of an isolation valve train to allow the valves to be taken out of service for maintenance.

(b) Where reverse flow in the main may occasionally be required, an unobstructed bypass around the NRV may be installed and isolated during normal flow direction.

(c) The design shall consider the need for an anti-slam device.

6.3.16 Connections

The water bulk supply point shall be located at a mainline isolation point for bi-directional feed from the bypass pipework to provide security of supply.

Where there is a take-off from the trunk main, each side of the 'T' shall have a valve installed to allow for future connections. Each take-off location shall include one hydrant in between the three-valve setup.

6.3.18 Water Meters and Backflow Prevention

All pressure zones within the network must include source totalling meters installed as appropriate to quantify the zone flows.

(a) The meter must be selected at a suitable flow velocity for optimal accuracy (to be confirmed with QLDC). This often requires that the pipeline be reduced in diameter. Reducers shall be concentric.

(b) Meters for trunkmains shall be electromagnetic type.

(c) The meter manufacturer's clear upstream and downstream diameter to length ratio shall be observed, taking into account the effect of reducers which may require greater clearance than valves and other fittings.

(d) Valve trains installed in sequence, including meters and strainers, shall be of the same diameter. However, where it may be considered that a future upgrade will require the valve train to be up-sized the isolation valves may be selected to be greater in diameter.

(e) Meters are to be installed in a dry chamber or above ground building.

6.3.19 Building over Council Infrastructure

This clause is not applicable for trunkmains.

6.5 Construction

6.5.2 Embedment

Embedment detail shall be as per Appendix A.

6.5.3 Backfilling and reinstatement

6.5.3.2 Berms

Trunkmains are not to be laid in berms.

6.5.5 Disinfection of water mains

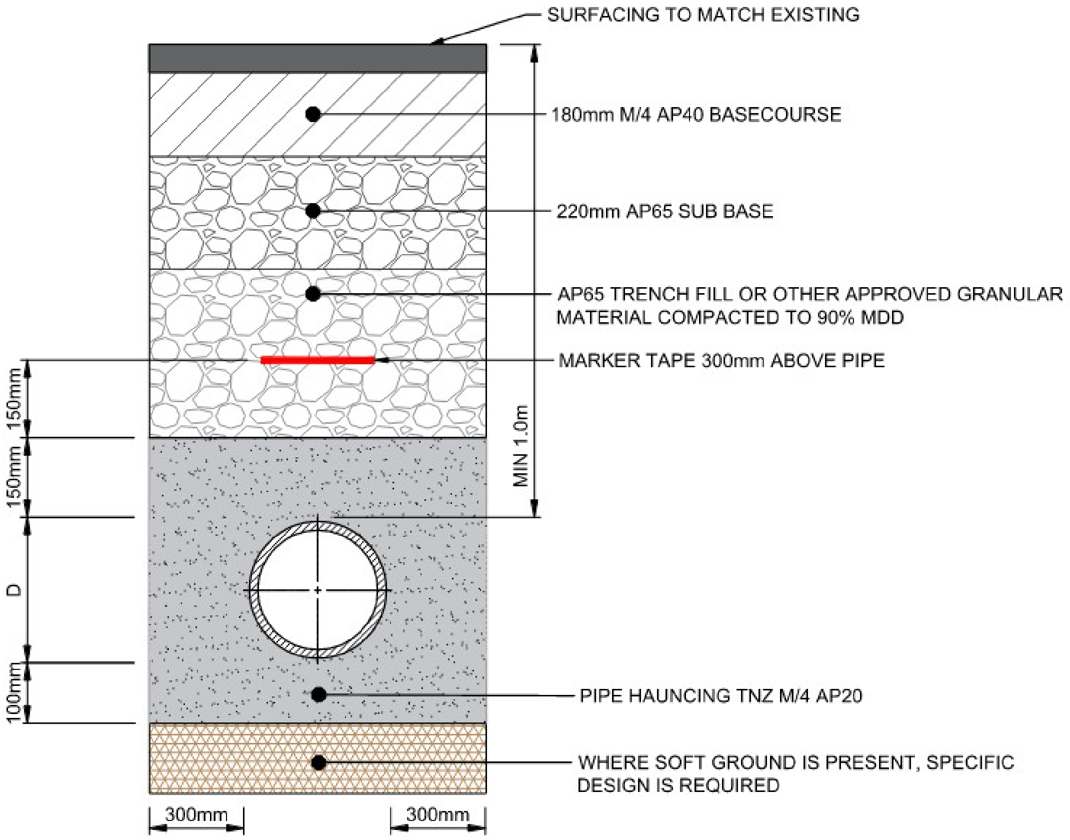
Disinfection of all trunkmains shall be in accordance with the QLDC Land Development and Subdivision Code of Practice:2018 Appendix D – Water Supply Disinfection Specification.

6.5.8 Pipe trench dewatering

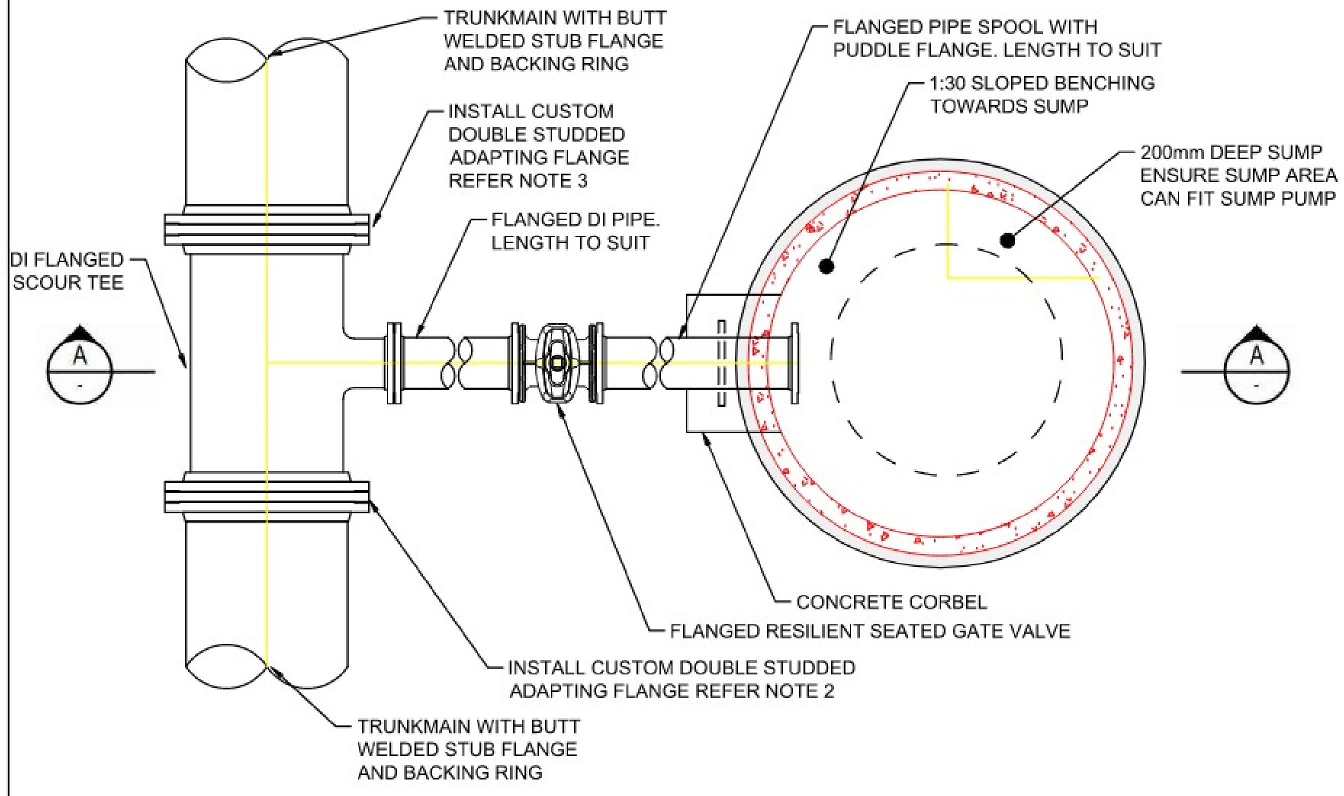
(a) Where the pipe runs along a steep slope ($\geq$15°) or where there is a high water table, the use of trench stops with suitable draining solutions must be considered.

(b) Where dewatering is not practical, alternative solutions (such as specific trench design with suitable geotextile lining or pipe anchorage) for effects of hydraulic uplift must be addressed in the design

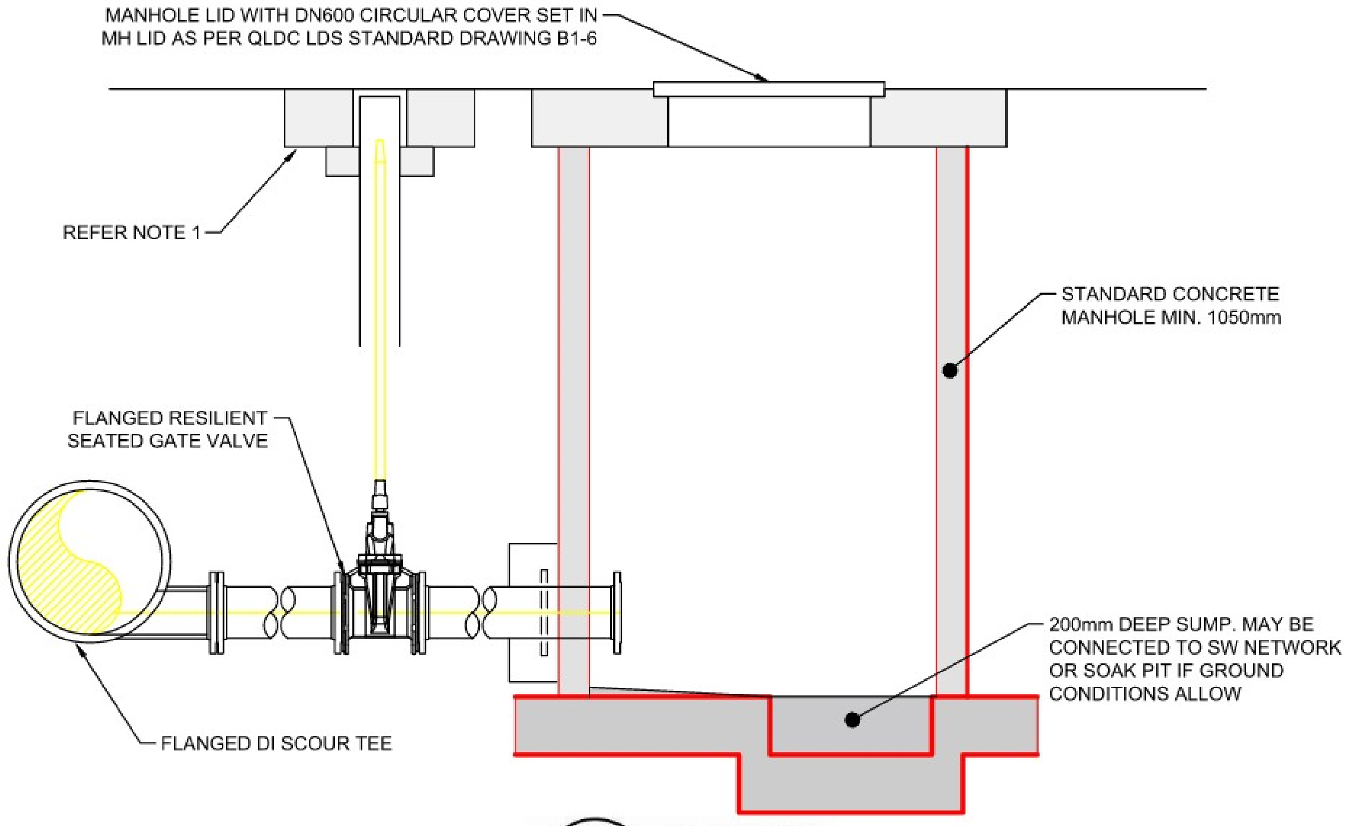
APPENDIX A. TYPICAL DETAILS



TRENCH EMBEDMENT DETAIL



TYPICAL SCOUR VALVE DETAILS



A
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SECTION

Pinnacles Civil
Design | Build | Asset Management

QUEENSTOWN LAKES DISTRICT COUNCIL

QLDC Water Supply Trunk Main
Typical Scour Valve and Trench Embedment Details

DESIGN	JS			2-0343.01	FOR APPROVAL
DRAWN	BS			DWG No.	
APRVD	JS				
PROJECT #: 2-0343	A	Initial design	21/01/2022	N.T.S	A
	REV	DETAILS	DATE	SCALE	REVISION

Attachment C: Submissions Tracker

Public Consultation Tracker and Register

Following close of 'Lets Talk' feedback process - finishing 4th October 2024

Submission							QLDC Review and Response		
Item #	**Submitter**	**COP Section**	**Related COP Clause or Appendix**	**Submitter Commenting On**	**Submitter's Proposed Amendment**	**Submitter Reasoning**	**QLDC Change**	**QLDC Reasoning**	**QLDC Ammendment**
1	Aurum	Roads	Clause 3.3.16.3		Private ways etc. Construction crossfall tolerance of +/- 0.5% seems excessive. ie +/- 15mm crossfall tolerance on on a 3m wide private access is very limiting, especially as they are often pushing maximum grade and having to blend with driveways etc		No	No change, this is tolerance for a minumum crossfall. This is a baseline, and then engineers judgement to flag where not practical and this could be accepted as a deviation	N/A
2	Aurum	Stormwater	Clause 4.3	Stormwater design	General comment is the amendment is not well written, with odd headings and random criteria placement. For example consider the headings 4.3.4.1 Primary and Secondary Systems, and then 4.3.4.2 Secondary Systems, with important design criteria for secondary systems under the first heading. It just isn't very logical. I get the impression the amendments have been rushed, or just not well considered. I understand the need for better clarity as the current version is confusing, but the amendments proposed remain ambiguous and don't go far enough to resolve the underlying problems. It is also a bit odd that it appears Council is trying to reinvent the wheel here, when there are other districts already well documented in this field. For example, there is focus around pipe capacity, but it is getting the water into the pipe that is nearly always the issue. Inlet capacity and protection is a key element that seems largely glossed over, yet that is where most blockages and issues occur. I note there is a directive (4.3.4.2) for Council to own or have easement over secondary systems, ponds, streams, swales etc. In my experience Council does not want to own difficult to maintain land, and pushes back on streamside reserves and tries to avoid maintenance costs wherever possible. This requirement therefore seems to conflict with other policy?		Yes	Removed extra secondary section, and some adjustments to formatting.	Various formatting changes for readability
3	Aurum	Stormwater	Clause 4.3.10.3		Manholes with 3 or more inlets should be 1200mm. This is excessive. Presumably an "inlet" includes a sump lead, lateral or perhaps even a subsoil? The result will be many manholes having to be 1200mm. The precast plastic manholes allow for 3 inlets in standard layout. Suggest manhole size be left for the engineer to determine if a greater size is needed.		Yes	Agree with submission. Section removed altogether, noting designer can check and smaller manhole could be used if CPAA guidelines and QLDC requirements in Appendix B able to be met	Remove - Concrete manholes with 3 or more inlets are requried to be a minimun of 1200mm in diameter
4	Aurum	Stormwater	Clause 4.3.5	Design criteria : 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	It is a confusing statement in an illogical place. It is impossible to endlessly limit discharge to a particular level. For example, how can you endlessly buffer a 100 year storm so the discharge is only ever that of a 5 year storm?		No	This is discharge to primary network. Limit the inflow, and/or provide storage/retention. If pipes are limited downstream, don't want to be adding extra flows. Minor update to structure made to make for readable (covered in other submission item)	N/A
5	Aurum	Stormwater	Clause 4.3.5.1.1	Catchment assessment.	This is another poorly written and formatted section. Catchment types remain unclear. You can always break complex catchments down into individual simple catchments, so what are you trying to say here? Total catchment complexity?		Yes	Yes, total catchment complexity. Agree clarification useful.	Minor clarification to say total
6	Aurum	Stormwater	Clause 4.3.5.1.2	Design storms	note this is a sub-part to 4.3.5.1 Design storms. Anyone confused yet?) There are numerous clauses limiting the amount of flow to certain levels, but I question how practical that is. Attenuation is not the best answer for every situation. Sometimes a bigger pipe to a safe location (lake or river) is a better solution than trying to create ponds on hillsides or in the middle of subdivisions, yet the code promotes attenuation as some sort of silver bullet. I disagree, particularly in regard to the proliferation of expensive hidden storage chambers that nobody will maintain, will fill with silt in a short enough time, and end up being ineffective. We are poor at maintaining even the slot drains and sumps we can see, let alone anything hidden away. As to comparing discharge rates, I do wonder why the historic rates are still considered relevant? Pretty clear we should be planning for the future, not wasting time looking at the old rates (since the intensity tables show the rates are increasing, not falling).		Yes	If attenuation not necessary for (i.e reasons outlined) preference would be to not have attenuation. Attenuation is a conservative default when connecting to existing infrastructure with limitations i.e secondary or primary. If limitations not existing, designer to discuss with council no attenuation for approval. Agree with naming, have adjusted title to discharge requirements.	Adjustment to title, no changes to rest.
7	Aurum	Stormwater	Clause 4.3.5.1.4		Is Council going to supply a 24-hr nested storm hyetograph so there is some consistency in modelling?		No	Good suggestion and agree would be beneficial. Intention is to work to develop these profiles, test and calibrate and provide further details and guidance as subsequent advice note. Spatial variance across the district also needs to be considered for this. Timings out of scope for this Code of Practice updates. In the interim a 24 hr nested storm profile can be created based for site specific rainfalls based on Hirds data.	N/A
8	Aurum	Stormwater	Clause 4.3.5.2	Freeboard	1% AEP section? Tauranga?		Yes	Error - working note. Have removed.	Removed

9	Aurum	Stormwater	Clause 4.3.7.12		Soak pits. Clearly a comprehensive approach here, but just wondering if that is consistent with E1 which many houses continue to be constructed to.		Yes	The soak pits we refer to in the code are for Council owned and maintained soakpits that collect water from roads and a reticulated system with a lateral from each house. If the development has onsite soakage for each individule house, that will be owned and maintained by that lot owner and is sized at the time the dwelling is built, these can be constructed to E1.	Add - Note: For soakage devices designed and approved under the building consent process the building code methodology applies.
10	Aurum	Roads	Table 3.3	Road design standards	Suggest clarifying the movement lane surfacing (sealed v unsealed). Surfacing is only mentioned in regard to the shoulder. Relevant in the rural area. Remove "total" from shoulder widths. The column is already headed with "(each side)", so any further attempt at elaboration only confuses.		No	Will review the need to include additional standards at next CoP update.	N/A
11	Aurum	Stormwater	Table 4-2		We don't have any land steeper than 30%??		No	We do have these situations, but limited data with rational coefficents on this, and best to apply a steep correction factor which is very site dependent, or adopt a different method.	N/A
12	Aurum	General			The COP is heavily biased towards greenfields and larger scale subdivision. There remains a continual conflict between the COP and the building (plumbing) standards when it comes to infill development. For example, previous versions gave flexibility for 6 dwellings to be served with a standard 100mm lateral (given appropriate grades etc), but that was removed for reasons unknown. We have ongoing confusion around when a lateral becomes a drain and when bends in those need manholes, inspection points, or nothing. We have arguments on the suitability of the capacity of small diameter water pipes, despite engineering calculations supporting the situation. We have inconsistency in pipe stiffness ratings between standard building plumbing and where that becomes a lateral. The demand for infill will only grow as land becomes scarce, and government policies push towards urban intensification. I suggest some consideration is needed in regard to the COP to facilitate that type of development and align it with the standard building methods that are set by the building code. It is counterproductive and a continual source of frustration to have conflicting standards in that space.		No	No updates to Code of Practice, but updates to a streamlined EA process in progress to better address these situations	N/A
13	Carrie Skilton	General			Developers to create a stormwater solution and implementing that solution prior to 224c. I think it is widely unfair that developers are coming up with any solution, even if it will cost tens of thousands to implement, and passing the costs down to the purchaser. There are costs for development, and this should be one of them. Deferring stormwater solutions to the time of building is inappropriate in most (acknowledging not all) circumstances.	Typically all the SW infrastructure is constructed for the full development at the time titles are issued, in some cases, typically large lot or rural properties it is more appropriate to defer the SW system for that property untill such time as the property is built, this allows flexability for where the soak pits are placed and can be sized for what is needed.	No	For communal development wide areas —such as those involving carriageways or altered catchments—a comprehensive stormwater solution will be required as part of the 224c process. However, in some cases, for individual lots within the development, stormwater management can be deferred to the building consent stage. This approach is often more pragmatic, especially for large lots or rural properties, as it allows for flexibility in determining the placement and sizing of soak pits or other stormwater devices based on the final roof and hardstand areas, which may not be known at the subdivision stage. While developers can (and often do) incorporate stormwater solutions for individual lots into the overall development plan, offering certain efficiencies, we do not intend to revise the document on this point.	N/A
14	CFMA	Roads	Clause 3.3.1	Defintion of carriageway	Carriageway should remain as per current definition - face of kerb to face of kerb as defined in Austroads and other reference documents. Within the carriageway there is/are parking lane(s) and through lanes. The through lane is the movement lane. The proposed change in definition will cause conflict between 3.4.1 "movement lane widths to avoid 7.5-9.0", and Table E2, suburban live and play movement lane 2 x 4.2. This is not the intention of NZS4404 because this Road type requires indented parking on top of the 2 x 4.2m through lanes. Also need shoulder width to be defined for all road types.		Yes	Agree confusion in widths by changing definitions, have reverted back to 4404 wording, noting this is where tables originated from. Will be reviewed in more detail in next COP update with roading focus amongst wider updates to table (to capture shoulder widths also).	Reverting back to 4404 definitions (various items changed)

15	CFMA	Stormwater	Clause 4.3.5.1.3	Clause 4.3.5.1.3-4.3.5.1.4	Requiring modelling to follow well established methods is insufficient. Parameters need to be standardised. There is insufficient data in the CoP to enable stormwater to be modelled consistently. A separate document is required similar to Wellington Water Ltd Reference Guide for Design Storm Hydrology. This document standardises precipitation methods, loss methods, and model development. Loss method is critical. This document specifies SCS curve number method and provides maps of curve numbers. Requiring pre-development catchment runoff calculations to use use HIRDS V4 historical rainfall intensities and depths requires mitigation of the effects of climate change. In general, a stormwater system introduced to service a new development must account for extra runoff created (usually courtesy of increased impermeable areas. Runoff can, due to climate change, be expected to increase from a site by a certain percentage by the year (for example 2090), whether or not development has occurred there. The development does not cause climate change. Consider a very simple scenario: A piece of land is bare in 2022, and produces runoff in a 10 year storm at 100 litres per second. Development on the land is calculated to increase the runoff to 150 l/s. Therefore, mitigation is required to collect the extra 50 l/s. A climate change scenario indicates increases in rainfall intensity by 2090 of 30% (for the sake of argument). By 2090 the anticipated runoff for the site developed in 2022 is 150 x 1.30 = 195 l/s. Mitigation of 95 l/s is required in QLDC's proposed approach. This seems excessive, regardless of the likely life of the building. Suppose instead that		No	Note standardised parameters to come in a future exercise and released as advice note following confirmation of Code of Practice stormwater requirements. The mitigating climate change point raised has been addressed through earlier ammendments of design storms (and further clarifications through this exercise)	
16	CGW consulting	Roads	Clause 3.3.19.5	Rip rap lined swales should be avoided, unless 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.	The proposed change regarding the removal of rip rap lined swales need reconsideration. Consideration should be given to erosion and scour in vegetated swales. Often rip rap lines swales are the only cost-effective option in steeper topography and this wording could lead to rip rap not being used in favour of vegetated swales when they will be prone to scouring.		No	Our aim here is to reduce the amount of riprap swales being used and the maintenance burden they present when weeds become present, we will still consider their use on a case by case basis but want designers to consider check dams or other solutions in the first instance if a scour risk is present.	N/A
17	CGW consulting	Roads	Clause 3.3.3.2	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.	CGW consulting is concerned that the proposed change is complicated . The wording of this change appears to indicate that all asphalt roads, regardless of their size or classification require mechanistic design. This concerns us, as mechanistic pavement design is a specialist discipline, requiring significant information of material properties and input parameters. It is a more onerous design requirement than we have experienced with other Council's codes of practice. If undertaken by untrained or less experienced designers this could result in wildly different pavement designs. Alternatively, the proposed change could require specialist input for something as small as an asphalt right of way pavement design resulting in design fees that are disproportionate to the project scale, complexity and risk. This will have a significant increase on the costs to design and subdivide small, low risk developments. We recommend the following: • This section is revised to provide clarity on what level of road with asphalt pavement requires this, • The size of the road is given consideration for this requirement, possibly to align with the section 1.8.4.3 b, • QLDC provide a series of standard asphalt pavement designs for small to medium sized roads, right of ways and parking areas for a range of CBR's, or a standard pavement design chart for these situations like many other codes of practice provide.		Yes	Revised - still needed for asphalt, but not mechanistic modelling required. Calculations showing meet deflections would be fine.	Yes - Various ammendments to section
18	CGW consulting	Roads	Clause 3.4.11	Table 3-5: Pavement deflection standards	We assume that the deflections highlighted columns in the table above are in mm. We recommend that (mm) is added the column headers for clarity.		Yes	Agreed	Add mm
19	CGW consulting	Roads	Clause 3.4.4.2	Hot laid asphaltic concrete surfacing	Appendix L for asphalt surface reinstatement states: "Areas greater than 20m2, one entire lane, or with a linear length exceeding 10m2 require a membrane seal..." Should this be "...linear length exceeding 10m...". Also, this doesn't seem to be reflected in 3.4.13 which states "...all carriageway areas that include asphalt must have a membrane seal..."		Yes	Agree with submission points.	Ammended typo. Membrane seal requirement in COP requirement has been clarified for greenfield.

20	CGW consulting	Stormwater	Clause 4.3.4.1 (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):	Secondary system approach seems conservative from the proposed. The approach applied in Auckland however for an urban catchment, 100% blockages in a DN600 pipe that is fed by multiple small grated intakes is highly conservative, compared to a rural catchment where there is a greater risk of large debris entering the stormwater system this seems appropriate. We recommend that discretion is applied to these pipe sizes and blockage factors based on the catchment type and risk profile. We note that for an urban road formation, the requirement of 100% blockage to the primary network will require all stormwater flows to be carried by the road formation. We have not yet investigated the effects of this, combined with the 100mm centreline maximum flow depth and the flow depth and velocity requirements of section 4.3.4.2 to determine the impacts on the overall road corridor design.		Yes	This can ideally be resolved through the design of roading profile. Understand cases where not feasible and updated to reflect this.	Add to primary and secondary flow section - When blockage factors are applied, the above requirements may be relaxed on a case-by-case basis, subject to justification and P&I approval. These requirements will still apply in an unblocked scenario.
21	CGW consulting	Stormwater	Clause 4.3.4.2	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 (dgVave) 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.	We agree with the above approach, however this mirrors our concerns from section 4.3.4.1 (b) above.		Yes	Understand concerns, ideally resolved through design of roading profile but understand may be cases where not applicable.	Add to primary and secondary flow section - When blockage factors are applied, the above requirements may be relaxed on a case-by-case basis, subject to justification and P&I approval. These requirements will still apply in an unblocked scenario.
22	CGW consulting	Stormwater	Clause 4.3.5.1.2	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 predevelopment (climate change adjusted rainfall) and shown to be no greater Further detail on the rainfall events is in Section 4.3.5.1.3.	The propose change regarding assessing the dicharges seems contracditory to section 4.3.5.1.3. In the design an attention system to meet pre-development flow rates, the post development volumes and flow rates dictate the specific outlet sizes and details. We do not see that it as practical to provide an attenuation system that is designed and sized to provide historical and climate change pre and post development neutrality at the same time. We would recommend that a more conservative and simple approach is taken to always use the historical rainfall data for pre-development flow, and climate change rainfall data for post-development flows, and required hydraulic neutrality between these reported flows. This would then be in line with the proposed changes to section 4.3.5.1.3. If the proposed change above is just a reporting requirement, then we see this requirement as unnecessary and leads to providing additional data to an already complex report. Logically, if the post-development climate change peak flows are less than the historical pre-development peak flows, then the other requirements for neutrality will also be met.		Yes	Adjust wording to remove conflict. Designers can still choose to attenuate to pre developent historical flows in a climate change scenario if easier (more conservative). The adjustment was made to allow 'apples to apples' comparisons based on other feedback.	Misc - Reformat and reword to clarify
23	CGW consulting	Stormwater	Clause 4.3.5.1.2	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.	Clarification around what is sensitive environment receiver. Particularly as this can have a substantial impact on the detention size requirements and therefore viability of development, which developers seek advice on early in a project. We would like to see this clarified or guidance provided so we know when tthis requirement is applicable. To robustly implement this requirement in a manner that will achieve the desired long-term outcomes and, it needs to be incorporated into a development from the early pre-concept feasibility stage, rather than as an resource consent or engineering approval RFI. So its vital that there is clarity as to when this is required.		Yes	This could be stream, wetland for example. Minor clarification on what a sensitive environmental receiver.	For any discharges to a watercourse or other receiving environment that is sensitive or susceptible to erosion or sediments (either directly, or further downstream)

24	CGW consulting	Stormwater	Clause 4.3.5.1.3	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.	We agree with this addition. However in practice producing and updating calculations and modelling using two sets of rainfall data is time consuming and more at risk of mistakes. It's likely that we would use HIRDS V4 RCP 8.5 for 2081-2100 rainfall intensities and depths for both primary and secondary stormwater networks, unless there was specific need on the project to minimise the primary stormwater network size. As per our comments on section 4.3.5.1.2, we would strongly recommend that pre-development flows are only assessed using historical data, to avoid confusion between multiple reported pre-development flows.		No	HIRDS V4 RCP 6.0 is minimum for a primary network, a designer can use RCP 8.5 if more suitable for their processes.	N/A
25	CGW consulting	Stormwater	Clause 4.3.5.1.4	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:	We agree with this addition. We would recommend that further work is undertaken in the region to provide standard defined SCS curve numbers that align with local soil conditions as this is often the most practical hydrologic method to apply with nested storms.		No	Agree, standardised parameters to come in a future exercise and released as advice note following confirmation of Code of Practice stormwater requirements.	N/A
26	CGW consulting	Stormwater	Clause 4.3.5.1.4	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	There is not enough guidance provided in this section. We note NZBC E1/VM1 and the CCC WWDG Part B Chapter 21 both have equal area time of concentration methods, but use different formulas to calculate these. We recommend that the LDSCoP simply refers to NZBC E1/VM1 section 2.3 for the methods of determining the time of concentration, rather that providing an undefined method of equal areas calculation and Horton n values that don't relate to NZBC E1/VM1 or the CCC WWDG Part B Chapter 21. Section 4.3.5.3 and table 4-4 refers to the use of manning's n values for the hydraulic design of stormwater system, so for cohesiveness and clarity we would recommend that maning's n values are used in the calculation of any time of concentrations.		Yes	Agree, have looked and ammendment to building code suitable. Relatively minimal difference in results via a sensitivity check.	Remove - Hortons Method Add - When undertaking Rational Method calculations, the time of concentration (Tc) may be determined following the approach outlined in NZBC E1/VM1. This includes a consideration of the transition from overland flow to shallow concentrated flow, as water begins to form small rills, channels, and tracks. Additionally, where applicable, the influence of open channels and piped networks on the flow must be considered.
27	CGW consulting	Stormwater	Clause 4.3.5.1.4		The rational runoff coefficients in table 4-2 differ significantly from the NZBC E1/VM1 rational runoff coefficients. They seem to be only representative of undeveloped natural surface types, but there is no reference to runoff coefficients for developed or impervious surfaces. We also have concerns around the accuracy of some of the coefficients, particularly the Pastural (and brownfield development), High soil permeability Flat (0-2%) coefficient. It could be argued that a new residential development in an area such as Lake Hawea with high soakage rates fits into this category. The proposed change seems to indicate that you could simply use a rational runoff coefficient of 0.20 for this development. This would lead to very different results than the standard approach of using the NZBC E1/VM1 land use type rational coefficients, or a composite runoff coefficient based on maximum impervious areas allowable under the district plan and NZBC E1/VM1 developed surfac type runoff coefficients. It will also lead to substantially different peak flows to those assessed using a nested storm with the SCS method. We recommend that additional clarity is provided as to the what the rationa runoff coefficients in table 4-2 relate to, and reference is made to NZBC E1/VM Table 1 for rational runoff coefficients for developed surface types. We also recommend comparison is carried out between the results that would b achieved with this method versus other methods that will need to be used to for the nested storm detention calculations.		No	Factors are more conservative for rational method, however designers can still look to adopt other methods and assess sensitivity etc. Building Code coefficents are also for a lower ARI event. Sensitivity check has been completed.	N/A

28	CGW consulting	Stormwater	Clause 4.3.7	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…. 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 the (c) current state of technical knowledge and the likelihood that the option	We agree with this approach to providing the best practical option in regard to stormwater quality management devices. Although we would like to see clear specific guidance relating to the target treatment efficiency of the common contaminants, we appreciate to onus being left to the designer, and the flexibility to provide the best practicable treatment solution for each specific situation.		No	Will look to provide further guidance in the future for target treatment efficencies	N/A
29	CGW consulting	Stormwater	Clause 4.3.7.12	Soakage Device design	We note that that proposed amendments to soakage device design differ significantly from the methods outlined in NZBC E1/VM1. We would like to see a general comment to clarify the scope of this section of the LDSCoP. Does QLDC intend this soakpit design approach to be applied to residential soakpits that are constructed under a building consent? Will the proposed changes only apply to vested infrastructure? Or also private sokapits that are constructed as part of a Resource Consent/Engineering Acceptance? There is already often a discrepancy between the design of private soakpits that are constructed as part of a Resource Consent/Engineering Acceptance to the adjacent soakpits designed by an architect or individual using QLDC's soakpit calculation under a building consent. While we welcome the additional design criteria and proposed conservative approach, we believe he proposed changes will lead to further discrepancy and confusion between the design standards for soakpits across the region. So we recommend that a clear statement is provided in the LDSCoP as to the when the proposed soakage device design and soakage testing methods outlined in section 4.3.4.12 is applicable.		Yes	Agree to add clarification	Add - Note: For soakage devices designed and approved under the building consent process the building code methodology applies.
30	CGW consulting	Stormwater	Clause 4.3.7.12.10	Equation 2 should be used to calculate the factored soil infiltration rate (K): Equation 2 K = k × (F_{total}) Where: k = unfactored soil infiltration rate (from Section 4.3.7.12.)	We generally agree with this approach regarding soakage testing, consequence levels and testing quality. However, the unfactored soil infiltration rate k, should be divided by the factor of safety that is calculated (F_{total}). Ie: if the unfactored soil infiltration rate is 1000 L/hr/m 2, and the total safety factor is 1.5 x 1.2 = 1.8, then the factored soil infiltration rate should be 1000 / 1.8 = 555 L/hr/m 2, not 1000 x 1.8 = 1800 L/hr/m 2 as equation 2 is written.		Yes	Agreed, this is an error.	Changes made to equation as per submisson
31	CGW consulting	Stormwater	Clause 4.3.7.12.11	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.	While we agree that these functions are nice to have in a soakpit, we note that the standard QLDC soakpit detail B4-4 does not provide any of these functions. We are unaware of any practical measure to remove sediment buildup from the base of the majority of common soakpit types without deconstructing the soakpit.		Yes	Changes made to drawing	As per drawing
32	CGW consulting	Stormwater	Clause 4.3.7.12.3	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.	We suggest that this section is amended to refer to a maximum drain down time of 24 hours		Yes	Agree - wording has been updated.	Update - a draindown period (to empty) within 24 hours from the end of the design storm event for which the device was sized for

33	CGW consulting	Stormwater	Clause 4.3.7.12.4	The soakage devices design area of soakage must be calculated as the base area + ½ the side area of the soakage device.	We note that is a significantly different approach to NZBC E1/VM1, and the wording that this "must" be calculated in this way appears to be contradictory to the conservative approach being taken in the remainder of the proposed changes to soakpit designs. Also, if the side area of soakage devices is being taken into account then the soakage test calculations will also need to take this into account. We would see that this is applicable is deep "Caldwell pit" style soakpits, but less applicable to traditional rock-filled soakpit. We have concerns regarding this approach for traditional soakpits where the strata on the sides of the soakpit may be significantly different from the strata underneath the soakpit. For example, in silt or glacial till layers overlaying gravels, the side soakage rates will be considerably different to the base soakage rate. We recommend that this section is reworded to as follows: If the soil strata in the proposed location of the soakpit is of uniform type, and expected to provide a uniform soakage rate, then the soakage devices design area of soakage may be calculation as the base area + ½ the side area of the soakage device.		Yes	Agreed	Update - If the soil strata in the proposed location of the soakage device are of uniform type, and expected to provide a uniform soakage rate, then ½ of the pervious side wall area of the soakage device may also be included in the area of soakage.
34	CGW consulting	Stormwater	Clause 4.3.7.12.6	A 300mm freeboard must be provided from the soakage devices design storm event TWL to the lowest invert of the upstream infrastructure outlet.	We believe that the soakage design storm event above should be altered to the 5% AEP design storm event. In the case that a soakage device provides additional capacity beyond the 5% design storm event up to a secondary event, then it is effectively getting penalised for this, over a soakage device that only provides for the 5% design storm event and sends secondary flow elsewhere. TWL is not defined anywhere in the LDSCoP. We assume this related to "top water level"? The "lowest invert of the upstream infrastructure outlet" is a very vague statement, and we are struggling to determine what this relates to. We're assuming that relates to the highlighted level of the inlet pipe on the QLDC Standard detail B4-4 below: If so, then we recommend that this detail is updated to include this note, and this section in the LDSCoP is amended to refer to the 5% design event.		Yes	Agree	Updated drawing and wording
35	CGW consulting	Stormwater	Clause 4.3.7.12.7	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	As per our previous comments relating to Section 4.3.7.12 generally, we would like to see clarification added to the LDCSoP as to when this is required. It will not be possible to design a residential soakpit in an indivdual lot, whether this is installed as part of a Resource Consent or Building Consent that provides a minimum of 5m clearance to the property boundaries or buildings. The proposed wording of this section does not appear to provide any opportunity for a reduction of the 5m minimum offset with specialist input, only an exemption from providing specialist input into deep-bored soakage devices at council discretion. There are numerous examples of infill developments where it will not be possible to comply with this proposed section. We recommend that this section is amended so that when a proposed soakpit is less than 5m of buildings, retaining walls or ground slopes in a manner that the ground below the foundations, structure or land is likely to be adversely affected, the specialist input is required to determine the effects of the proposed soakpit and determine any mitigations required to prevent adverse effects from occurring.		Yes	Agree	Add At Council's discretion

36	CGW consulting	Stormwater	Clause 4.3.7.12.9	Soakage devices at risk of sediment ingress from the contributing catchment should be provided with pretreatment 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.	We agree with this approach for small soakpits constructed in a roadside berm. However, the proposed wording of this section that soakpits "must" be designed in this manner does not allow for larger soakage basins and other devices that use alternative proprietary void chambers that are not comparable with a 160mm drain coil. We recommend that the wording of this section is modified to allow for alternative approaches where approved by council that make allowance for pre-treatment and sediment ingress.		Yes	Agree	Modification as per suggestion
37	CGW consulting	Wastewater	Clause 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.	This section appears to be out of place, and should be included in the Water chapter not the wastewater chapter.		Yes	Agreed and updated	Moved to water section under connections
38	CGW consulting	Wastewater	Clause 5.3.8.4.9	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.	This requirement is significantly above and beyond the manhole manufacturers and CPAA Loads on Circular Precast Concrete Manholes and Access Chambers guidance. Consideration should be given to manholes with small diameter pipes, such as 2x incoming DN150 pipes and one outgoing DN150 pipe. In this situation, a 1050mm diameter manhole is sufficiently sized to comply with B1-5 and the CPAA guidance. The requirement to upsize the manhole to a minimum diameter of 1200mm even if there are only 3 small diameter wastewater pipes will have a significant increase on the costs to design and subdivide small developments.		Yes	Agree with submission. Section removed altogether, noting designer can check and smaller manhole could be used if CPAA guidelines and QLDC requirements in Appendix B able to be met	Remove - Concrete manholes with 3 or more inlets are requried to be a minimun of 1200mm in diameter
39	Civil Construction Limited	Roads		Proposing Ethical Ground Improvement	1.This feedback is on behalf of Civil Construction Ltd (CCL), in respect of the Ethical Ground Improvement Methodology (EGIM) it has developed as described in the site specific example methodology attached. The EGIM is a commercially and environmentally sustainable solution using a binder to stabilise liquefiable ground conditions to meet earthworks and pavement subgrade specifications. Council's infrastructure staff will be familiar with it, as it has most recently been approved for use at the Classic Development Site (EIC) on Woolshed Road, RM200615 This feedback on the Draft Land Development and Subdivision Code of Practice (CoP) is relevant to the following sections of the CoP: a.References to Low Impact Design approaches. CCL seeks to ensure the EGIM is recognised as a Low Impact Design Approach. b.References to earthworks and geotechnical requirements c.References to 'special soil types' and liquefaction d.References to the requirement for a geo-professional's report on suitability of land for subdivision and development e.Section 2 as a whole (Earthworks and Geotechnical Requirements) f.Section 3 (Roads), specifically section 3.3 Design and 3.4.2 Materials for flexible pavements. In particular, in addition to the general efficiencies provided by EGIM, it is consistent with QLDC's own policy around emissions and reductions. https://www.qldc.govt.nz/2022/june/22-06-30-qldc-launches-climate-and-biodiversity-plan The EGIM process of ground improvement adheres to that policy, unlike other current methodologies used in this district for ground improvement. CCL can provide further information on this point.	CCL wishes to ensure the CoP contemplates and provides for this methodology as a standard methodology to stabilise liquefiable ground to appropriate specifications. See attached CCL representatives wish to meet with Council experts to explain it further to them and answer any questions, provide further information etc, leading up to Infrastructure Committee Meeting in November.	No	Outside of scope of this review, can be looked at in next stage.	N/A
40	Edward Radcliffe	Appendix B	Appendix B Dwg B2-3	EF couplers for private connections and remove the mechanal fittings	Jason recommendation on PE rider mains to have PE saddles and not mechanical fittings which is shown in the drawing B2-3 and submitter suggests on adding a sentence in the section 6.3.16.2, " EF multiseal tapping saddle must be used for service connections <nominal internal diameter of 50mm" or similar and have the Mechanical Tapping options removed from the drawing B7-4		Yes	Agree with suggestion	Refer to change in Drawing B2-3
41	Edward Radcliffe	Water	Clause 6.3.5.10	Design pressure	A question to why the design pressure was reduced to 750kpa , it was 900kpa orginally ?		No	Set max pressure at 750 kPa to align with the QLDC Level of Service document. If needed, we can adjust it to 900 kPa for instances raised, as the current wording allows. Keeping the pressure lower is generally safer in new subdivisions, where connections are added over time, and it helps reduce wear on pipes and water loss. Greater consideration is required for hilly sites, especially where houses are located below the lateral connection point.	N/A
42	EZED - Paul Jaquin	General	Clause 2.2		You should define Geo-professional for the geotechnical work, either CPEng or Chartered Engineering Geologist?		Yes	Agree	Updated as per submission

43	EZED - Paul Jaquin	General	Clause 2.3.10		The usual requirement for Permanent cut-fill batters is 3H:1V, for temporary 2H:1V seems reasonable. But you're introducing a bit of risk to QLDC by allowing 2H:1V cut-fill batters in the permanent case.		No	This is not a propsed amendment to the code therefore requiring more will need to go through consultation process, we will not be able to make the change during this round of updates however we will keep your submission on this point and consider the risks and any possible change in the next review.	N/A
44	EZED - Paul Jaquin	General	Clause 2.3.7	Erosion and sediment control	This section is weak, and could be made so much better. Either reference the Auckland Council stuff, or make your own one. Force every development to have an erosion and sediment control plan.		No	This is covered under QLDC Guidelines for Environmental Management Plans (which generally resource consent condition) and under ORC guidance also when an ORC consent applicable.	N/A
45	EZED - Paul Jaquin	General	Clause 2.3.9		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. Comment - There is always the potential for surcharge, and the usual NZ practice is for a building consent for over 1m retained. Maybe say something like, don't need one for 500mm retained, and also reference flat sites. Retaining walls on slopes over 30 degrees require a building consent. Stacked retaining walls require a building consent.		Yes	Ammended the wording to ensure a check against the building code to see if BC is required.	Add - Any retaining wall should be checked against the Building Code to confirm if a Building Consent is required. Satisfying the requirements of this code does not exempt the retaining structure from requiring a building consent.
46	EZED - Paul Jaquin	Roads	Clause 3.3.3.2		CBR to Scala comparison charts - this is textbook graph, and as such isn't usually included in a Code of Practice. It's useful, but does potentially allow inexperienced people to do the design, without appreciation of the local conditions etc. [for example the micaceous silts in Frankton can give a reasonable Scala, and therefore CBR result, but designing a pavement using these values doesn't necessarily work.		No	In this case it would need approval from Council therefore checks will be in place to ensure the scala to CBR comparison is appropriate.	N/A
47	EZED - Paul Jaquin	Water	Clause 6.3.9.2	Clearance from sturcutres	Please define 'zone of influence' a bit better, otherwise you might get into all sorts of trouble. Auckland council have some guidelines, but its causing Engineers headaches. But something just like 45 degrees in soil, and 60 degrees in intact schist. - Similar to 6.3.19, but call it 'zone of influence'		No	Defined in 1.2.2 as 45 degrees from 150mm below pipe invert	N/A
48	EZED - Paul Jaquin	Appendix J		Cycle Trails	references its own appendices A and B. Please include and update		Yes	Error, this was an omission when reprinting document	Added Appendices
49	EZED - Paul Jaquin	Appendix I		Street Tree Planting Guidelines	The word Native does not occur anywhere within the document. There should surely be a reference to a preference for native trees within the street tree planting guidelines.		No	Good suggestion. Outside of scope of this review, can be looked at in next stage.	N/A
50	Florence Micloud	Other		Do we need Land Development ?	Go back to email and go through it		No	Many of the changes suggested would need to be addressed at a higher District Plan level to ensure developers incorporate these elements into their developments. The Code of Practice sets a minimum standard for designing and constructing physical works. While there is flexibility within the Code to achieve these goals, the key decisions need to happen at the consent stage, which falls outside the scope of this work. Our next update to the Code will have a stronger focus on transport. We'll keep this submission on file and consider any appropriate changes in the next update, particularly regarding connectivity and ease of transport.	N/A
51	Fluent	General	Clause 1.8.4.3	SQEP - Stormwater	Would something more similar to Auckland's definitions of a Suitably Qualified and Experienced Person be more appropriate	We are concerned that professionals with a Survey and Spatial certificate may not necessarily have sufficient skills to manage flood mitigation, catchment analysis and stormwater system design, especially for complex catchments. We also note that stormwater is not a specific discipline under the CPEng accreditation scheme.	Yes	Reviewed and CPENG provides a well-established statutory certification and standards regime. The Chartered Professional Engineers of New Zealand Act 2002 provides the legislative foundation for the certification of CPENG in New Zealand, which is legally recognized and has enforceable standards and requirements for engineers in New Zealand, ensuring that specialised works and projects are managed by professionals against an industry recognised standard. The Survey and Spatial Certified Professional Land Development Engineer is not specified under any current legislation, with this considered the section has been updated accordingly. As a result of feedback and information provided through the consultation process, officers consider that for the purposes of land development works, a person with a Survey and Spatial Qualification could be deemed a Suitably Qualified and Experienced Person (SQEP) for certain small-scale civil design works only. However, for large scale civil design, complex civil design or civil design related to specific areas, a CPENG will be required, as per the current operative 2020 Code of Practice.	Various updates in accordance with reasoning in section

52	Fluent	Stormwater	Clause 4.3.4.1 (b)	Blockage Factors	Can the conditions for culvert blockage please be further clarified? As it currently reads, culverts d < DN1500 should have a secondary system / flowpath to accommodate 100% blockage of culvert. Thus high water levels can be expected over roadway, and upstream of culvert. Do the design freeboard requirements for levels of properties need to be based on the water level assuming 100% culvert blockage (for culvert <DN1500)? Can you please provide further clarification on how this clause should be applied.		Yes	Additional clarification given. Freeboard requirements apply, velocity and depth requirements may be relaxed on case by case basis. Note - Blockage flactors can be refined due to site specific conditions.	Add to freeboard section - (including blockage factors in Section 4.3.4.1 if applicable) Add to primary and secondary flow section - When blockage factors are applied, the above requirements may be relaxed on a case-by-case basis, subject to justification and P&I approval. These requirements will still apply in an unblocked scenario.
53	Fluent	Stormwater	Clause 4.3.5.1.2	Rainfall events	Reference is made to "hydrological regime for all storm events through onsite attenuation". Could clarification please be provided regarding which storm events should be modelled to meet this condition?		Yes	Agree, needs clarification. 2 year event detailed to be checked in conjucntion with 20 year and 100 year	Reformat for clarity Add - These are to be checked and shown for a 50% AEP, 5% AEP and 1% AEP event at a minimum
54	Fluent	Stormwater	Clause 4.3.5.1.2 and 4.3.5.1.3 (contradiction)	Rainfall events	The discharge comparison in 4.3.5.1.2 indicates pre- and post-development should use historical and climate change adjusted rainfall on parity. The Rainfall section indicates pre-development should only use historical rainfall data. Can clarification be provided regarding which would be applicable?		Yes	Agree - contradictory information. Reviewed and reformatted to say pre-development can use climate change rainfall also (depending on scenario comparision)	Misc - Reformat and reword to clarify
55	Fluent	Stormwater	Clause 4.3.5.1.4	Time of Concentration	The Horton method (Friend's equation – see equation to the left) is usually used for sheet flow / overland flow estimation of Tc. Please clarify if this should this be used for the entire catchment, or as part of a component of parts? $Tc\ (component\ parts) = overland\ flow + shallow\ concentrated\ flow + open\ channel\ flow + pipe\ flow$		Yes	Agree, incomplete method was listed. Have reviewed and ammendment to building code suitable. Relatively minimal difference in results via a sensitivity check.	Remove - Hortons Method Add - When undertaking Rational Method calculations, the time of concentration (Tc) may be determined following the approach outlined in NZBC E1/VM1. This includes a consideration of the transition from overland flow to shallow concentrated flow, as water begins to form small rills, channels, and tracks. Additionally, where applicable, the influence of open channels and piped networks on the flow must be considered.
56	Fluent	Stormwater	Clause 4.3.5.1.4	Nested Storms	We recommend providing further guidance on how nested storms should be developed. We note other Councils provide further clarification on the 'shape' of nested storms		No	Good suggestion and agree would be beneficial. Intention is to work to develop these profiles, test and calibrate and provide further details and guidance as subsequent advice note. Spatial variance across the district also needs to be considered for this. Timings out of scope for this Code of Practice updates. In the interim a 24 hr nested storm profile can be created based for site specific rainfalls based on Hirds data.	N/A
57	Fluent	Stormwater	Clause 4.3.5.2	Inset section about 1% AEP – also check Tauranga guidance	Seems to be missing content		Yes	Error here, was a previous working note	Removed
58	Fluent	Stormwater	Clause 4.3.7.12	Soakage Device design	Section 4.3.7.10 seems to be an incorrect reference here.		Yes	Yes, agreed. However upon review, found this section not necessary and have removed.	Removed
59	Fluent	Wastewater	Clause 5.3.10.8	Flow Metering	Doesn't seem to fit in the wastewater section.		Yes	Error in location	Moved to water section under connections
60	Fluent	Wastewater	Clause 5.3.12	Low pressure sewer guidelines	Will these documents be included in the Appendices of the CoP now? This would make them easier to find.		No	These are to be uploaded - no change from 2022 Consultation Documents	N/A
61	Fluent	Water	Clause 6.3.16.1	Lot connections 150mm DN and above	We note that this change will significantly increase the number of pipes/rider mains required in QLDC's networks for QLDC to maintain. We query why this has reduced from the previous standard of DN200 or greater, given DN150 is often required for FW2 fire flows.		Yes	Reviewed and agreed, ammend wording	Updated - to nominal internal diameter greater than 150 mm
62	Fluent	Water	Clause 6.3.5.10	Design pressure bands	We note this change will result in an increase in the number of PRVs and reservoirs in QLDC's networks given the topography of the area. We also note we have recently had feedback from QLDC Engineers that QLDC do not want to see PRVs in their networks.		No	Set max pressure at 750 kPa to align with the QLDC Level of Service document. If needed, we can adjust it to 900 kPa for instances raised, as the current wording allows. Keeping the pressure lower is generally safer in new subdivisions, where connections are added over time, and it helps reduce wear on pipes and water loss. Greater consideration is required for hilly sites, especially where houses are located below the lateral connection point.	N/A
63	Fluent	Water	Clause 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.	Drinking water standards for New Zealand reference needs to be updated		Yes	Agreed	Updated to Water Services Act 2021
64	Fluent	Other		Draft Reservoir Standard	Is the Draft Reservoir Standard going to be included as an Appendix?		No	These are to be uploaded - no change from 2022 Consultation Documents	N/A

65	Fluent	Other		Draft Trunk Main Standard	Is the Draft Trunk Main Standard going to be included as an Appendix?		No	These are to be uploaded - no change from 2022 Consultation Documents	N/A
66	Fluent	Water		Headloss for firefighting flows	We have seen a references to maximum headloss for firefighting flows of 10 m/km. Is this going to be included in the CoP?		No	Not included as COP design requirement at this stage, hasn't been causing issues.	N/A
67	Fluent	Other		Formatting	The document would be much easier to navigate if there were different coloured headings or bars down the side of the page for each section.		Yes	Agreed and have updated main COP document	Added as per request
68	Hadley Consultants	General	Clause 1.8.4.3	SQEP	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. For small scale general civil design work Council will except CPEng and Survey and Spatial New Zealand Certified Professional Land Development Engineer, however this will not apply to the specific situations referenced below. 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 in addition to the above mentioned are outlined below that are required for any person to be deemed suitably qualified in these work areas. a. Traffic and transportation assessment, barrier design, Safe System audits, and Safe System audits exemptions – Suitably Qualified and Experienced Person is required to sign off design, assessment or audit and that person shall be a CPEng with a practice area in Traffic Engineering or Traffic Safety; b. Road Pavement Design for pavements designed for a medium load or above (5 x 105 to 5 x 106 ESA / ONRC Primary Collector or above) - Suitably Qualified and Experienced Person is required to sign off design and that person shall be a CPEng with a practice area in Pavement Design;	We are concerned about the liability that QLDC are opening themselves up to with the amendment to 1.8.4.3 in the draft CoP, this amendment is inconsistent with other councils such as Auckland Council. Upon inspection of the brand-new Survey and Spatial New Zealand Annual Practising Certificate for Land Surveyors it appears that it is a largely untested assessment run by Land Surveyors and not governed by Engineering New Zealand the governing body for Engineers in New Zealand. Relaxing the Council CoP in this way seems inappropriate. However, we do see merit in surveyors completing land development work as has been occurring within the District. I have drafted an amended 1.8.5.3 below for your consideration which I believe this will ensure that Council have suitably qualified persons completing design work in the district. I have taken the liberty of adding both Geotechnical Engineering and Civil Structures as they are clearly omitted from the previous version of the Council CoP.	Yes	Reviewed and CPENG provides a well-established statutory certification and standards regime. The Chartered Professional Engineers of New Zealand Act 2002 provides the legislative foundation for the certification of CPENG in New Zealand, which is legally recognized and has enforceable standards and requirements for engineers in New Zealand, ensuring that specialised works and projects are managed by professionals against an industry recognised standard. The Survey and Spatial Certified Professional Land Development Engineer is not specified under any current legislation, with this considered the section has been updated accordingly. As a result of feedback and information provided through the consultation process, officers consider that for the purposes of land development works, a person with a Survey and Spatial Qualification could be deemed a Suitably Qualified and Experienced Person (SQEP) for certain small-scale civil design works only. However, for large scale civil design, complex civil design or civil design related to specific areas, a CPENG will be required, as per the current operative 2020 Code of Practice.	Various updates in accordance with reasoning in section - some suggestions adopted
69	Hadley Consultants	Stormwater	Clause 4.3.4.1 (b)	Blockage factors	We believe that the blockage factors proposed are too aggressive and the focus should be on inlets and their risk profile and potential impacts on reticulation rather than being broadly applied to all pipes irrespective of the catchment characteristics. E.g an inlet from a rural catchment has a much higher chance of blockage or letting debris enter reticulation than a fully urban network reliant solely on lateral connections and roadside sumps. However, if the pipe blockage factors are to be retained then it should be made clear that this is to be considered as a separate secondary flow "super design" type event with velocity/depth limitations not applying as opposed to a standard secondary flow scenario.		Yes	Additional clarification given. Freeboard requirements apply, velocity and depth requirements may be relaxed on case by case basis. Note - Blockage flactors can be refined due to site specific conditions.	Add to freeboard section - (including blockage factors in Section 4.3.4.1 if applicable) Add to primary and secondary flow section - When blockage factors are applied, the above requirements may be relaxed on a case-by-case basis, subject to justification and P&I approval. These requirements will still apply in an unblocked scenario. Add - These blockage factors serve as a default unless demonstrated with suitable justification to Council approval that a lower blockage factor can be applied. Australian Rainfall Runoff – Book 6 (Flood Hydraulics) / Chapter 6 (Blockage of Hydraulic Structures) provides specific guidance on a risk-based approach for determining blockage factors.
70	Hadley Consultants	Stormwater	Clause 4.3.5.1.4	Stormwater Catchment Analysis	We generally support the distinction between simple and complex catchments although there are a number of potential issues with actual application. However, the requirement to utilise a nested storm is on our view outdated and a full assessment of a range of storm durations would be more appropriate. It is our understanding that nested storms were a concept that was created to simplify modelling when computational power was significantly less than it currently is to avoid the need for time consuming model runs with different storm durations – this is obviously not the case now with modern computing.		No	Alternative well established methods like detailed in submission could still be used subject to justification, 24-hr nested storm has been selected as default for simplicity and consistency with many other councils.	N/A
71	Hadley Consultants	Stormwater	Clause 4.3.7.12.10	Soakage Device FOS	The factors of safety will make it nigh on impossible to cost effectively provide soakage devices in many instances even though the LID aspirations/requirements seem to require them E.g requiring groundwater monitoring within 100m may be relevant in some areas but for many areas such as Frankton flats where depth to groundwater is known to be significant it is unwarranted and costly to undertake.		Yes	Have removed consequence level 4, agree appropriate that FOS over 7 is not appropriate and would be best to look at on case by case basis (noting this would be soakpits that failure will cause significant damage). Most of F0S largely sit between 2 - 2.7, max at 6 (unlikely and this could be avoided). Absolute minimum factor of safety of 2 use as well (as per previous versions)	Remove - Consequence Level 4 Add - Minimum Factor of Safety of 2 Reformatting and clarifications made
72	Hadley Consultants	Stormwater	Clause 4.3.7.12.3	Soakage Device Drainage	Drain to empty within 24 hours of first rainfall. If soakage devices are properly designed the critical storm duration will be assessed (separately to that of the catchment), it is usually significantly longer than the catchment critical storm duration and at tiems can exceed 24hours. In effect this approach already considers long duration design storms		Yes	Agree - wording has been updated.	Update - a draindown period (to empty) within 24 hours from the end of the design storm event for which the device was sized for
73	Hadley Consultants	Other	N/A		While there is a lot of information included, we have kept this fairly brief as we have become increasingly pessimistic by the QLDC 'feedback' process on the CoP. There is no formal process followed to consider the 'feedback', unlike standard resource management and local government procedures and it would appear that many of the changes and decisions are being put forward and made with limited real world design and construction experience. Our view is that the key failure with the CoP is it simply leaves engineering matters open for QLDC 'sole discretion'. The primary purpose of such a document should be to remove ambiguity for the developer and designer and to specify what QLDC's requirements are, not to leave a multitude of key elements to their subjective discretion.		No	To discuss and review consultation and general approach moving forward	N/A

74	Hadley Consultants	Roads	Table 3-5	Deflection and Curvature Limits	Table 3-5 Identifies deflection and curvature limits which are similar to those suggested by NZTA and other standards. We believe that these curvature limits should only apply to AC and do not need to be met for chipseal surfaces as it is able to withstand much higher curvature whereas asphalt can't.		Yes	Reviewed and agreed. Ammended curvature requirement (to only for higher volume asphalt)	Various wording and table updates
75	Mt Iron Geodrill	General	Clause 1.8.4.3	SQEP - Catchments	Note that catchment analysis can also be done by others that are not CPEng or those that hold Survey and Spatial New Zealand Annual Practising Certificate in the discipline of Land Development Engineering, i.e. hydrologists. It may be worth separating out catchment analysis from the engineering here.		Yes	Slight adjustment, to sign off on design. Within this catchment analysis could be done by hydrologist, providing the person signing off design reviews/accepts this and takes on liability.	Update as per suggestion and QLDC reasoning
76	Mt Iron Geodrill	General	Clause 2.3.2		There is a reference in Section 2.3.2 c to GNS Landslide Planning Guidance 2024, however, I don't see this listed in the references list		Yes	Error	Added to list
77	Mt Iron Geodrill	Stormwater	Clause 4.3.5.1.1	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.).	Could this be changed to better delineate the two different catchment areas? -		Yes	As per suggestion	Refer to change in revised document.
78	Mt Iron Geodrill	Stormwater	Clause 4.3.5.1.4	Table 4.2&4.3	it should be noted that the infiltration rate is determine by the surface conditions and should be tested by single of double ring (preferred) permeameter testing through the surface to account for grass and other ground covering. See ASTM 3385 - Standard Test Method for Infiltration Rate of Soils in Field Using Double-Ring Infiltrometer for test method. Permeation rates should not be based on testing in borehole or test pit testing below the surface		Yes	Have adjusted to note this is surface permeability. Testing not always required.	Add - based on surface permeability.
79	Mt Iron Geodrill	Stormwater	Clause 4.3.5.12.14		The definition of coarse and fine grain soils needs to be better defined. A fine grained soil is one that has greater than 35% retained on a 63micron sieve a coarse grained soils has less than 35% retained on the same sieve as per NZGS field description of soil and rock. It should be noted that fines content lower than 35% can still have a major impact on permeability and thus the test method used.		Yes	Agree	Adjusted and adopted NZGS guidance
80	Mt Iron Geodrill	Stormwater	Clause 4.3.5.12.15 (vii)		the standard should be AS/NZS1547. I suggest that the reference to this AS/NZS standard is removed as it refers to only one type of test (constant head in a borehole). I recommend that the test method used is given in the report along with the equations used for calculations.		Yes	Agree	Added in descriptions for both falling and constant head test
81	Mt Iron Geodrill	Stormwater	Clause 4.3.7.12.1		the reference to another section here is wrong (refers back to Rain gardens). Should it not be 4.3.7.12.10?		Yes	Yes, agreed. However upon review, found this section not necessary and have removed.	Removed
82	Mt Iron Geodrill	Stormwater	Clause 4.3.7.12.12		Having an IANZ person test the ground when below 50L/hr/m2 is ridiculous as there is on one accredited to do this work in the district or south of Christchurch maybe even the south island (to the best of my knowledge). Personally, I can using the constant head method of AS/NZS1547:2012, Appendix G, get down to values of 2mm per hour (this being the same as 2L/hr/m2). I suggest that the person doing the testing should be competent in doing the work and use an established test method that can be repeated by someone else.		Yes	Agreed, and not practical in district currently. Methods and calculations commonly used, but have adjusted for clarity.	Ammendment to recognised competent geo-professional, and added requirement to detail methods and calculations used
83	Mt Iron Geodrill	Stormwater	Clause 4.3.7.12.12		the minimum rates for infiltration are to high. There should be way of being able to provide design for soakage devices when the rate is lower than 25L/hour/m2 in consultant with QLDC. Furthermore, The maximum rate of 2000L/hr/m2 may be to low. There are free draining gravels in this area that can take a lot more than this. I understand that we don't want to overload a soil but I suggest that a max rate of 4000L/hr/m2 would be more reasonable with the possibly of going higher under certain conditions in consultant with QLDC and sound justification from a geoprofessional that doing so is ok.		Yes	Agree - and should allow some flexibility based on local environment	The maximum unfactored infiltration rate of 2000 L/hr/m2 will be accepted by Council. Should higher infiltration rates be proposed these will require further justification from a recognised SQEP and specific agreement from Council." Where testing shows an unfactored soil infiltration rate of less than 25 l/hr/m2, soakage is not appropriate and will not be accepted by Council as a stormwater disposal option unless further justification from a recognised competent geo-professional is provided, with specific agreement from Council."
84	Mt Iron Geodrill	Stormwater	Clause 4.3.7.12.13 v		all test pits and bores left open for the purposes of water level testing shall be left and a safe state such that people are unable to accidently enter. An egress for animals shall be put in place, e.g. a board with rungs to allow the animal to climb out. Test pits shall not be left open without suitable support if there is a risk of side wall collapse. Installation of standpipes is preferable.		Yes	Agree with these points	If test pit collapse is considered a risk then the side walls shall be supported. A geo professional shall need ot design a suitable test methodology. If test pits are to be left open then the pit shall be fenced off to prevent public access. Where test pits are left open for a time period greater than 4 hrs then appropriate means of animal egress must be considered or alternative means of completing the test shall be implemented, ie standpipes and piezometers.
85	Mt Iron Geodrill	Stormwater	Clause 4.3.7.12.14		The standard should be AS/NZS1547. I suggest that the reference to AS/NZS is removed as this standard refers to only one type of test (constant head in a borehole). I recommend that the test method used is given in the report along with the equations used for calculations		Yes	Agree	Added in descriptions for both falling and constant head test
86	Mt Iron Geodrill	Stormwater	Clause 4.3.7.12.14		this could be a recommended method and the calculation that should be used for this method. It shall be noted that other methods could be used. The single and double ring methods can be used in a laid back test pit base as can the constant head borehole.		Yes	Agree	Adopted to allow more flexibility in methods, based on geo-professional and specific cases

87	Mt Iron Geodrill	Stormwater	Clause 4.3.7.12.15 (viii)		not sure where this equation came from but it doesn't look like it is for a constant head test. The equations in either AS/NZS1547:2012 Appendix G or GD07 Appendix B Worksheet 2 may be better suited here.		Yes	Agreed. However, have removed this and added reference to GD07 as more complete methodology	Remove formula and add reference to GD07
88	Mt Iron Geodrill	General			Geoprofessional should be reworded to be "A chartered professional engineer (CPEng) or a chartered engineering geologist (PEngGeol) with recognised qualifications and experience in geotechnical engineering, and experience related to land development		Yes	Agree	Clarification made
89	Mt Iron Geodrill	General			SQEP should be added to abbreviations		No	Already in abbreviations	Yes
90	Mt Iron Geodrill	General			It should be noted in the CoP that the building code requirements for soakage to ground (soak pits) is a lot less then for the CoP and as such there should be some consideration given to the potential overflow from these devices with flows that could go the system being designed for the subdivision. It regards to test methods used for infiltration rate. Could it not be that there is a list of suitable methods given or that the test method has to be given along with the calculations used. The method has to have a standard test method so that it is repeatable. I'm aware that different methods can give different results but they should be similar in the provided values. the rate should in terms of hydraulic conductivity (k).		No	Merit to this but can't enforce different soakage requirements for soakage devices in building consent process following building code.	N/A
91	NZTA	Roads	Clause 3.2.4.2	Exclusion of Arterial and Motorways	NZTA supports the retention of this advice however some revisions may be appropriate given changes to processes that have occurred since its establishment. The following amendments to this advice to bring it up to date and make sure users understand early the need to engage with NZTA on proposals that may impact the state highway are suggested: 'Where a development may affect the state highway network or require a connection to the state highway, NZTA's agreement and/or written approval may be required. The types of proposals typically requiring NZTA approval include: • creating, upgrading, moving or otherwise changing an accessway onto a state highway. • changes to intensification of existing land use activities on properties accessed from the state highway (ie from residential to commercial, or increased residential density). • subdivisions or new activities (including building new structures or undertaking works) in land designated by Waka Kotahi – our land use designations may be for state highways, cycleways or shared paths. • subdivisions or new businesses requiring access to the state highway. • subdivisions or new businesses not requiring access to the state highway but generating potential traffic impacts on the state highway network.	NZTA supports the retention of advice regarding the need to consult with NZTA when undertaking developments and subdivision that may impact on the operation or assets of the state highway network in the Queenstown Lakes District. (ii) NZTA requests updated wording to be agreed with the Agency prior to finalisation of the code of practice to support users in gaining correct information early and identifying where NZTA approvals and design considerations may be relevant.	Yes	Reviewed and in agreement	Ammended as per submission
92	Patersons	Appendix B	Appendix B Dwg B1-1	Omissions	Combined service trench detail missing specifications for bedding/hauncing materials for service sharing same cross section. We request the district to provide some guidance for appropriate materials to use in these trenches		No	This detail is focused on layout rather then trench materials. We can revisit this in the next round of code of practice updates if needed.	N/A
93	Patersons	Appendix B	Appendix B Dwg B1-10	Omissions	Detail refers to granular bedding, but does not provide an appropriate specification of the materials mentioned.		No	Have left as is for now, as the current wording avoids being overly prescriptive. We can revisit this in the next round of code of practice updates if needed.	N/A
94	Patersons	Appendix B	Appendix B Dwg B1-11	Omissions	Detail refers to compacted sand fill or granular bedding, but does not provide an appropriate specification of the materials mentioned.		No	Have left as is for now, as the current wording avoids being overly prescriptive. We can revisit this in the next round of code of practice updates if needed.	N/A
95	Patersons	Appendix B	Appendix B Dwg B1-2	Omissions	Standard pipe embedment detail refers to "Granular Material as Specified". There is no specification in the notes nor reference in the body of the CoP. We request the district confirm the materials and appropriate specification of those materials including but not limited to gradation, PI, ect.		No	Have left as is for now, as the current wording avoids being overly prescriptive. We can revisit this in the next round of code of practice updates if needed.	N/A
96	Patersons	Appendix B	Appendix B Dwg B1-3	Omissions	Detail refers to compacted AP20 Granular Bed and Sorrund, but does not provide an appropriate specification of the AP20 materials mentioned.		No	Outside of scope of these revision. To review and confirm in next stage of updates, in conjuntion with the M/4 2024 updated guidelines.	N/A
97	Patersons	Appendix B	Appendix B Dwg B1-4	Omissions	Detail refers to compacted AP20 Granular Bed and Sorrund, but does not provide an appropriate specification of the AP20 materials mentioned.		No	Outside of scope of these revision. To review and confirm in next stage of updates, in conjuntion with the M/4 2024 updated guidelines.	N/A

98	Patersons	Appendix B	Appendix B Dwg B1-5	Omissions	Detail refers to corbels as blocks of concrete at pipe entrances, but does not advise the appropriate reinforcing for those connections. Pre-cast manholes have a specification and standard to work to, so should the connection detail as shown with limited advise from the district. We request that QLDC provides further advice for reinforcement at those pipe connections as a baseline for construction of this standard connection. Many councils have detailed this and the district can refer to those details to inform their design.		No	Reinforcing tie in of corbel to precast manhole not required, provided suitable scabbling done as per drawing.	N/A
99	Patersons	Appendix B	Appendix B Dwg B1-8	Omissions	Missing corbel details. We request that QLDC provides further advice for corbels and reinforcement at those pipe connections as a baseline for construction of this standard connection. Many councils have detailed this and the district can refer to those details to inform their design.		No	Reinforcing tie in of corbel to precast manhole not required, provided suitable scabbling done as per drawing.	N/A
100	Patersons	Appendix B	Appendix B Dwg B1-9	Omissions	Detail refers to compacted drainage metal (AP20), but does not provide an appropriate specification of the AP20 materials mentioned.		No	Outside of scope of these revision. To review and confirm in next stage of updates, in conjuntion with the M/4 2024 updated guidelines.	N/A
101	Patersons	Appendix B	Appendix B Dwg B3-5	Omissions	Missing corbel details. We request that QLDC provides further advice for corbels and reinforcement at those pipe connections as a baseline for construction of this standard connection. Many councils have detailed this and the district can refer to those details to inform their design.		No	Reinforcing tie in of corbel to precast manhole not required, provided suitable scabbling done as per drawing.	N/A
102	Patersons	Appendix B	Appendix B Dwg B3-6	Omissions	Missing corbel details. We request that QLDC provides further advice for corbels and reinforcement at those pipe connections as a baseline for construction of this standard connection. Many councils have detailed this and the district can refer to those details to inform their design.		No	Reinforcing tie in of corbel to precast manhole not required, provided suitable scabbling done as per drawing.	N/A
103	Patersons	Appendix B	Appendix B Dwg B4-2	Note 4. PIPES IN TRAFFICABLE AREAS WITH LESS THAN 1.0 m COVER SHALL BE CONCRETE CAPPED, AND PIPES WITH LESS 0.6 m COVER SHALL BE CONCRETE ENCASED. THE CONCRETE ENCASEMENT SHALL BE REINFORCED CONCRETE AND STRUCTURALLY DESIGNED FOR REQUIRED DESIGN LOAD BY A STRUCTURAL ENGINEER.	This is a standard detail that most councils provide advice for (refer to CCC CSS SD342) standard roading conditions HN-HO-72. Conditions beyond this standard would be expected to have a specific design by a structural engineer. We request that QLDC engage a structural engineer to confirm as standard concrete capping detail with the required reinforcing for HN-HO-72 loads.		Yes	Good suggestion. Have adopted a detail for some cases and will be looked at further next stage of Code of Practice updates which will have a primary roading focus.	As per updated drawing
104	Patersons	Appendix B	Appendix B Dwg B5-18	NOTES: 1. DESIGN OF ALL RESIDENTIAL CROSSINGS TO COMPLY WITH DISTRICT PLAN REQUIREMENTS. 2. CROSSING CONCRETE TO BE 125mm THICK REINFORCED WITH STRUCTURAL MESH, CENTRALLY PLACED. 3. SURFACING TO BE CONCRETE WITH A MINIMUM CRUSHING STRENGTH OF 20MPa AT 28 DAYS, OR 30mm DG7 ASPHALT (NZTA M10 Notes TABLE N3.3), OR 2 COAT SEAL.	Note 2 No specification for Mesh. Recommend 665 as minimum placed in the top third per Branz and CCANZ specifications. Also note reinforcement is only to control shrinkage cracks from developing. Note 3 30MPa concrete mentioned elsewhere. Recommend this is the minimum crushing strength. Can QLDC advise on spacing of Sawcuts, tied joints, control joints and free joints inline with advice from CCANZ? No slip surface on base of concrete, CCANZ recommends either 2 layers damp proof membrane (DPM) or membrane surface to reduce friction at base.		No	Mesh outside of scope of these revision. To review and confirm any changes in next stage of updates. Concrete left as 20 Mpa.	N/A
105	Patersons	Appendix B	Appendix B Dwg B5-19	Vehicle Crossing - Commercial/Industrial	As per requirements of other councils these details are typically specifically designed as pavement depends on specification of actual traffic. Note 2 No specification for Mesh. Recommend 664 as minimum placed in the top third per Branz and CCANZ specifications. Also note reinforcement is only to control shrinkage cracks from developing. Note 3 30MPa concrete mentioned elsewhere. Recommend this is the minimum crushing strength. Can QLDC advise on spacing of Sawcuts, tied joints, control joints and free joints inline with advice from CCANZ? No slip surface on base of concrete, CCANZ recommends either 2 layers damp proof membrane (DPM) or membrane surface to reduce friction at base. Scope of this detail should expand to multi-unit developments and private		Yes	Mesh outside of scope of these revision. To review and confirm any changes in next stage of updates. Concrete changed to 30 Mpa.	As per updated drawing

106	Patersons	Appendix B	Appendix B Dwg B5-22	Regular/Heavy Duty Concrete Footpath	Mesh shall be in the upper third of slab. Mesh should be 50mm away from edges of slab. Heavy Duty concrete shall have 664 mesh. Regular concrete footpath shall have 665 mesh. Transverse Saw cut joints shall be specified as every 3m.		No	Outside of scope of these revision. To review and confirm any changes in next stage of updates.	N/A
107	Patersons	Appendix B	Appendix B Dwg B5-8	No. 2A Commercial Crossing	Missing size of stirrups holding D12 bars in place. Stirrups need to end 50mm from edges of the kerb.		Yes	Agree, have updated for clarity. Stirrups are to be R6 at 600mm centres as default and this updated in drawing. It is possible that some designers may look at other alternatives for greater reinforcing or construction methodology purpose.	As per updated drawing
108	Patersons	Roads	Clause 3.2.7	Safe system audits	Why team consisting of minimum of two people. The latest guidance form NZTA includes allowance for RSA's to be completed by a one-person team if the person is sufficiently experienced and capable of the audit requirements for the project. Wording is not clear "Safe System audits should be completed by suitably qualified persons are is independent from the project" QLDC often confuse that the two people undertaking the inspection are independent of each other – not independent of the project.		No	No change, default minimum of two people for the audit team, one person appoved by exception if project is small/simple.	N/A
109	Patersons	Roads	Clause 3.3.2.5	Design vehicles	The design vehicle for a 5.7m road should not be an 8m rigid truck. Allowing for clearance lines, it doesn't physically fit within a 5.7m carriageway. 8m rigid Truck width = 2.5m. Assuming 5.7m IOK to IOK which is our current standard, two trucks passing consists of: - 0.5m clearance to IOK - 2.5m truck - 0.5m clearance between vehicles - 2.5m truck - 0.5m clearance to IOK 6.5m total width in a 5.7m movement lane. No issues on larger roads.		No	Agree likely appropriate, however this will be looked at in next stage of COP review which will have a roading focus. Exemptions will likely continue to be in place and approved, as current process in reality.	N/A
110	Patersons	Roads	Clause 3.3.3	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	Change design "life" to design "period" -Austroads AGPT02-24 "Guide to Pavement Technology Part 2:Pavement Structural Design" should be used along with the NZ supplement.		Yes	Added reference and updated other Austroads guides dates/revisions. Change to design life not updated. NZ document refers to life, Austroads refers to period generally, but interchanges sometimes with life. Not seen as an issue, and leaving as is to keep consistent with COP document.	Add - and Austroads Guide to Pavement Technology Part 2: Pavement Structural Design
111	Patersons	Roads	Clause 3.3.3.2	Omissions	Add to last paragraph "In the case of roads with concrete surfacing, designers must submit design modelling using CCANZ or AustroadsAGPT02-24 Part 2."		No	Defer to next COP review with roading focus. Noting this is what designers typically are using and we are not seeing issues with this currently. Item about deflections is more in relation to design deflections not being considered in past, and issues coming when testing during construction and considerable cost and outlay already in place. Same deflection issues not being seen with Concrete.	N/A
112	Patersons	Roads	Clause 3.4.11	Omissions	Add a maximum deflection for values outside the 90th percentile, such as 2.5mm for ROW, 2.0 for Local Road, 1.5 for minor collector, 1.2 for collector		No	Already states maximum deviation in section. Factor can be simply added. Not necessary to add extra items to table.	N/A
113	Patersons	Roads	Clause 3.4.4.4	Omissions	Wire Mesh Shall be minimum 664 and placed in the top third of the concrete pavement. -Concrete shall be underlain with two layers of Damp Proof Membrane (DPM) or membrane seal to provide a slip layer and reduce shrinkage friction. -Sawcuts, longitudinal joints, transverse joints and free joints shall be		No	Defer to next stage - capture in advice note or subsequent COP update	N/A
114	Patersons	Stormwater	Clause 4.3.10.3	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.	There is no mention in any of the manhole details as to design requirements for corbels. Pre-cast manholes are standard product for drainage infastructure and QLDC's guidance of what is necessary for corbels at pipeline connections would be an important detail to have. Most major council have guidance to support a design for QLDC to consider and we request they set a baseline for this connection detail.		No	Reinforcing tie in of corbel to precast manhole not required, provided suitable scabbling done as per drawing.	N/A
115	Patersons	Stormwater	Clause 4.3.5.1.1	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.	Homogeneous surface conditions' could be interpreted to excludes all urban catchments with impermeable surfaces. Something like 'Standardised surface conditions' would be more suitable word choice. What is an external catchment – a catchment off site? if interpreted wrong there would be almost zero catchment assessments defined as simple. They would need to be located on the crest of a knoll not to have any external catchments		Yes	Homogeneous removed as requirement based on feedback. External changed to significant external.	Remove - Homogenoeous Add - "significant" external

116	Patersons	Stormwater	Clause 4.3.5.1.3	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.	This new requirement for rainfall estimates will greatly increase the demand on SW attenuation beyond the standard practice of matching pre to post. We request the RCP6.0 for 2081-2100 be used for both pre and post for design of primary/secondary stormwater systems. The historic rainfalls can be used as a check to confirm there would not be and additional risks from storms in the current estimates. RCP8.5 for 2081-2100 can be reserved for high risk facilities meeting the importance level 4 or higher as this rainfall is an extreme limit of what IPCC have determined.		No	This has been looked at, and we proposed to keep as per consultation document in line with other council standards across New Zealand. RCP8.5 is not an new requirement, and is consistent with previous revisions.	N/A
117	Patersons	Stormwater	Clause 4.3.5.1.4	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.	It is widely acknowledge from SW modelling experts that applying this method to determine runoff volumes have been found to be "difficult to make use of the Rational Method results to estimate detention storage". Althought a triangular hydrograph has been specified it is known that "it is difficult to concluse that a single shaep should be representative of all catchments.". Should QLDC insist on this approach it would be recommended to limit its application to developments of 0.5ha or less to reduce the risk of an undersized attenuation system effecting the over all SW network. Refer to paper by M. Pennington "Rational method frequently used, often misused".		Yes	Adopted change to limit at 0.5ha	Add - with an area of 0.5 ha or less
118	Patersons	Stormwater	Clause 4.3.5.1.4	software modelling must be used with a 24-hour Nested Storm Hyetograph created for the design storms in Section 4.3.5.1.2	QLDC should identify the temporal design storm/pattern to be used as this can effect results greatly. In previous experience the Auckland Region 24hr Design storm has been applied in the district. This pattern greatly over estimates the peak runoff due to it matching the tropical climate of Auckland. We request that the HIRDS temporal design storm for the West of SI be used as this was based on rainfall data analysis carried out by NIWA and is more representative of the Alpine environment present in the district		No	Good suggestion and agree would be beneficial. Intention is to work to develop these profiles, test and calibrate and provide further details and guidance as subsequent advice note. Spatial variance across the district also needs to be considered for this. Timings out of scope for this Code of Practice updates. In the interim a 24 hr nested storm profile can be created based for site specific rainfalls based on Hirds data (this would incorporate West SI analysis)	N/A
119	Patersons	Stormwater	Clause 4.3.5.1.4	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 app	The method provided in the code above is not fit for the purpose of a complex catchment. As per SW modelling experts, rational method or modified rational method as its sometimes called is "difficult to make use of the Rational Method results to estimate detention storage". We request that methods such as the SCS or others used to determine runoff volumes be listed as approved approach with out prior verification by council. Refer to paper by M. Pennington "Rational method frequently used, often misused".		No	Modified rational method not to apply for complex catchments, and SCS or others would apply.	N/A
120	Patersons	Stormwater	Clause 4.3.5.1.4	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.	QLDC should identify softwares that are approved for use as a baseline for stormwater modelling. There are many free modelling softwares availible from USACE and the requirement to provide a specialist PC with modelling license should only be reserved for applicants who chose to use other paid programmes.		Yes	Limiting software too restrictive, however have provided another alternative option to providing PC with license	Add - or be prepared to present and explain the model in detail with a suitably qualified person if requested.
121	Patersons	Stormwater	Clause 4.3.7.1	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.	Please clarify if the 5mm reserved for ground water recharge is included in the first 20mm for treatment or if this is on top of the first 20mm and therefore 25mm overall treatment/GW recharge.		Yes	Clarified the 5mm is included	Add - Of this, a minimum of 5mm rainfall should be discharged to ground through soakage where feasible.
122	Patersons	Stormwater	Clause 4.3.7.1	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	Please specify the method for calculating the water quality or first flush volume for the initial 20mm of rainfall. CCC WWDG part B Eqn 6-2 provides a method for determining this volume, which is appropriate to New Zealand South Island conditions. Alternative approaches from other parts of New Zealand may over estimate this volume.		Yes	CCC is essentially runoff from the impervious area. QLDC adopting similar approach (i.e grass not considered), have clarified this further. Runoff is run off from impervious area, this can be calculated in several different ways (i.e. taken from a hydraulic model if applicable) so this not specified. 2.5mm ponding on hardstand not considered, however worth noting total rainfall amount provided is less than CCC specified 25mm rainfall.	Added clarification - Stormwater quality management devices should treat the runoff from the first 20mm of rainfall from the post-development catchment impervious area.

123	Patersons	Stormwater	Clause 4.3.7.12.10	Table 4-7 Test undertaken at a time when groundwater is at an annual high.	This would restrict all consultants to undertaking test at only one time each year, which would be difficult to predict. Each project would be put on hold until tests could be undertaken... A more effective approach would be to allow for testing at any time and then confirm proximity of GWL near test site to confirm a certin degree of freeboard such as 500mm above seasonal high GWL.		No	No change, if one was to verify with new testing that would mean lower quality factor could be used. If no groundwater to consider (well below surface at all times) would be considered that testing is at all time relevant high (i.e frankton flats)	N/A
124	Patersons	Stormwater	Clause 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.	This standard is complex to implement and potentially could yield FoS over 7, which is over the top. We understand this requirement was taken from Auckland Council document GD-07, which accomdates the dense developments types and variable geology that forms New Zealands most populated region. The Queenstown Lakes district is still a mostly rural region with small pockets of urban development. The geology of the district is not variable and largely consists of Mesozoic shists and fluvioglacial deposits. We request the district consider a standard FoS such as recommended by CCC WWDG, which indicates a reduction factor of 3.33. This factor is more than appropriate for south island conditions and is generally lower than the minimums set by NZS4404:2010 (FoS min 2).		Yes	Have removed consequence level 4, agree appropriate that FOS over 7 is not appropriate and would be best to look at on case by case basis (noting this would be soakpits that failure will cause significant damage). Most of F0S largely sit between 2 - 2.7, max at 6 (unlikely and this could be avoided). Absolute minimum factor of safety of 2 use as well (as per previous versions)	Remove - Consequence Level 4 Add - Minimum Factor of Safety of 2 Reformatting and clarifications made
125	Patersons	Stormwater	Clause 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).	The method described in this section would be difficult to achieve a reliable test due to the accuracy required to dig a test hole at depth, while meeting requirements of Health and Safety. A more reliable method would be to dig a test pit to desired test level and install a 150mm open bottom PVC pipeline and backfill the base with either on-site silts/clay or bentonite clay to a depth of 300mm min. Then back fill pit with dug spoil. Due to anticipated rate of drain down measurement via data logger may be required. This would require much less water to pre-soak hole and test multiple times if required. Pipe can be left for futher measurements of GWL and testing.		Yes	Agree, have reformatted section, and made less prescriptive for soil types, permitting one to use a borehole method if appropriate	Misc - Reformat and reword to clarify and make less prescriptive
126	Patersons	Stormwater	Clause 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.	This method refers to an Auckland Council test method, which matches the geology fo the Auckland Region. A more reliable test method would be to follow CCC WWDG Appendix App6, which provide multiple methods for measuring shallow (double ring inflitrometer) and deep permeabilities in the south island.		Yes	Double ring infiltrometer methodology added, referring to CCC	Add - Alternatively, a double ring infiltrometer may be used instead of the Talsma-Hallam permeameter detailed in Appendix A1.5. Use of a double ring infiltrometer is to follow the methodology prescribed in Christchurch City Councils WWDG Appendix 6.2.
127	Patersons	Stormwater	Clause 4.3.7.12.7	Soakage pits on individual lots must provide an Operation and Maintenance manual with body corporate agreement to maintain the soakage pit in perpetuity	Not all soak pits on individual lots are maintained by privately and not all individual lot owners are part of a body cooperate. Can the district clarify when it is to be applied.		Yes	Agree, clarification needed. Soakpits in individual lots would be building consent and wouldn't fall under this. Communal soakpits privately owned would have body corporate or similar structure and need O&M manuals and agreement to maintain generally. Exceptions to this to be looked at on case by case basis	Update - Any privately owned soakage pits covered under this Code of Practice must provide an Operation and Maintenance manual and an agreement to maintain the soakage pit in perpetuity from body corporation or other ownership structure.
128	Patersons	Stormwater	Clause 4.3.7.12.9	A removable 160mm draincoil pipe in a filter cloth sleeve.	Not all soakage devices will have a drain coil pipe on filter cloth sleeve – too prescriptive. We request this is removed from the requirement and let it be the designers choice wither it is allowed for in the design.		Yes	Have been numerous cases around district we where filter socks useful and have prevented systems being clocked and expensive repairs. If being vested operations want it like this generall, so no major change. Note added however about alternative options.	Add - Alternatives approaches to the above for vested soakage devices may be approved at the discretion of Council. Pre-treatment, sediment ingress, design life and maintenance will be key considerations of this.
129	Patersons	Stormwater	Clause 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.	Please specify the guideline values or trigger levels for Water quality monitoring and any other treatment objectives to be carried out by developer.		No	These are based on current requirements of stormwater discharge in accordance with integrated three waters bylaw	N/A
130	Patersons	Stormwater	Clause 4.3.7.3	Proprietary systems Unless specified in the LDCSoP approved materials specification, proprietary BPO systems will be accepted by QLDC	There are no appoved proprietary systems noted in the approved materials list although there are a number of BPO systems in use in the district. Can the district update materials list to be inclusive of these devices and the applicablity of them for use?		No	Please submit any approved material list requests as per portal. Approved materials list sits outside COP (so have adjusted according). Currently wording is for proprietary BPO systems will be accepted by QLDC on the provision of third-party performance verification and prior approval from QLDC Operations and Maintenance.	N/A

131	Patersons	Wastewater	Clause 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.	unless the connection is replacing an existing connection		No	O&M identified several examples where we need. Want to have where possible as default, and if not required/possible applicant justifies and council reviews as outlined in current code.	N/A
132	Patersons	Wastewater	Clause 5.3.5.5	Self-cleansing velocities can be demonstrated by: • Adopting the minimum pipe grades in Table 5-4 and Table 5-5; and	Revisions to absolute minimum gradients in table 5-4 are in line with Watercare waste water code of practice, which represents the conditions in the Auckland Region. These minimum are much higher than the previous minimums and those contained in NZS4404:2010, which has been used reliably in NZ by many districts outside of Auckland. We request the district maintain the minimum grades as setout in NZS4404:2010 as it is more representative of the region/conditions the district operates in.		Yes	Agree based on reviewed impacts, flow velocities of different grades pipe, implications and other standards across country.	Revert back to 2020 COP/grades. Comment on self cleansing changed to 'or' from 'and'
133	Patersons	Wastewater	Clause 5.3.8.4.9	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.	Un-necessary cost increase. Surely manhole size should be dictated by CPAA guidelines? For example, a Ø1050 manhole with 4 x Ø150 pipes @ 90° easily complies with CPAA clearances. -There are certain circumstances where a larger manhole is justified – e.g. internal drop structure.		Yes	Agree with submission. Section removed altogether, noting designer can check and smaller manhole could be used if CPAA guidelines and QLDC requirements in Appendix B able to be met	Remove - Concrete manholes with 3 or more inlets are requried to be a minimun of 1200mm in diameter
134	Patersons		Clause 8.4.6	Omissions	There is no mention of the standard backfill requirements for common service trenches. We request the district to provide some guidance for appropriate materials to use in these trenches.		No	Outside of scope of this review, can be looked at in next stage.	N/A
135	QLDC - Alison Tomlinson		Clause 1.1.1	Traffic Signal Data Submission	Specify better data required for signals in the signals guidance	1.1.1Provision of RAMM Data The data for all assets installed and specified in the detailed design must be provided and must be compliant with the Asset Management Data Standard. This includes all assets related to the signals, and any additions or amendments to (but not limited by) e.g. drainage kerb and channel, catchpits, footpaths, lighting, lines, signs, surface, pavements. Submission of data can be via two options: Utising the RAMM sheets found on the QLDC Webite – or available on request from **assetmanagement@qldc.govt.nz**. Entered directly into the QLDC RAMM database, please contact **assetmanagement@qldc.govt.nz** to request access. This includes attaching relevant multimedia into RAMM. Practical completion will not be issued until data submission is approved.	Yes	Adopted suggestions	As per submission
136	QLDC - Gina Schmitz			Street lighting	Include Warranties for luminaires, warranties for poles, street light location plan with marked up pole numbers		Yes	Minor update	As per suggestion
137	QLDC - Gina Schmitz				the requirements for us to take on any work for 2nd coat seals (pre-paid by developer) will have to be updated please. Council will only take any 2nd coat seals into their sealing programme if all of the following requirements are fulfilled: NOT private roads, driveways or private accessway Minimum 2nd coat seal width: 5.5m Minimum 2nd coat seal length: 100m There might be certain circumstances where QLDC will be able to offer the pre-paid option even though the required min. dimensions are not fulfilled (e.g. multiple slightly shorted stretches in the same area), however, written pre-approval must be obtained by P&I beforehand.		No	Outside of scope of this review, can be looked at in next stage.	N/A
138	QLDC - Gina Schmitz				Regarding the road naming stage, it could be quite handy for us to get at least a draft plan of the planned project at road naming stage which includes chainages of the roads to be constructed. This would help us being able to match the directions of our RAMM centrelines to the ones from the plans.		No	Will be requested during road naming application form	N/A
139	QLDC - Hayden Bed	General	Clause 1.9	Bond and charges	Bonds currently too lenient – it should state they are at TA discretion, and we have right to decline.		No	Outside of original consultation scope, to address in next stage.	N/A
140	QLDC - Hayden Bed	Roads	Clause 3.3	Shoulder upgrade	We need enhanced criteria to ensure that more than just the shoulder is upgraded for access into larger developments (20+ Lots? e.g. hogans gully). I.e. testing/inspection of the exiting road and ensure adequate for new development. And how far each way (not just for sight distance/safety but for protection of our asset!?).		No	Outside of original consultation scope, to address in next stage.	N/A
141	QLDC - Hayden Bed	Roads	Clause 3.4.3	Failed Road surfacing and sealing	Rework of failed surfacing and sealing (based on test results) – when to local patch repair and when to rip up and remake full width? – testing criteria for rework? – this has been a significant issue last season for failed AC.		No	Outside of original consultation scope, to address in next stage.	N/A

142	QLDC - Hayden Bed	Stormwater	Clause 4.3.5	Design criteria	Should we add criteria for frequent storms (+50%AEP) as these also seem to be causing some issues around network (e.g. Wanaka)?		Yes	Adding 2 year as elaboration on the 'all events to be maintained' for overland flow discharges	Reformat for clarity Add - These are to be checked and shown for a 50% AEP, 5% AEP and 1% AEP event at a minimum
143	QLDC - Hayden Bed	Stormwater	Clause 4.3.5	Design criteria	Should we include a criteria to take account of chanellisation (intensification) of flows – i.e. we have issues where post-development flow is less than pre-development but because it's been changed from sheet flow to channelised, it's causing problems. (many examples!)		No	Covered under 4.3.5.1.2. '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.'	N/A
144	QLDC - Hayden Bed	General		Requirements of Inspection and Test Plan	I think we should require an Inspection and test plan be submitted as part of design – to enable council to audit and inspect during construction. And provide as good evidence for 224c.		No	Outside of original consultation scope, to address in next stage.	N/A
145	QLDC - Hayden Bed	General		Schedule/indemnity	I think we need a hold point or extra requirements when the supervising SQEP is different to designer SQEP (or any change of designer/engineering/surveyor) to ensure competency, consistency and indemnity not impacted.		No	Outside of original consultation scope, to address in next stage.	N/A
146	QLDC - Sarah Thompson	General			Add requirement to notify QLDC for classifiable dams	Make the acceptance of future water storage areas notify us if they are a classifiable dam in the next code of practice document?	Yes	Agree	Designers are to check if any future storage areas are classifiable dams. All relevant ORC requirements and guidelines are to be followed. QLDC Property and Infrastructure department must be notified on the classification status if found to be a dam.
147	RDA Consulting	Stormwater	Clause 4.3.7.12.1		Wrong section stated for consequence levels, should be 4.3.7.12.10		Yes	Yes, agreed. However upon review, found this section not necessary and have removed.	Removed
148	RDA Consulting	Stormwater	Clause 4.3.7.12.15		Equation shown is for a falling head test, constant head equation from Auckland Council GD07 Appendix B1.2 is appropriate		Yes	Agreed. However, have removed this and added reference to GD07 as more complete methodology	Remove formula and add reference to GD07
149	Remarkables Park Limited	Other	Clause 1.8.7.3		RPL continues to have a major concern with the departure from NZS4404:2010 that is made at 1.8.7.3. 1.8.7.3 states: "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." The New Zealand Standard requires a developer to give 5 working days' notice of an intention to connect to existing services. RPL submits that Council should be embarrassed that it has set itself a performance standard that is three times worse than a national standard. Council should be aspiring to provide better than average performance to its ratepayers. It would be far better to accept the benchmark set in the New Zealand and fail occasionally than to indicate that Council is prepared to accept such low standards for itself. This is especially so when the other changes that Council has made to NZS4404:2010 over the years are all aimed at raising the standards that developers should meet.		Yes	Agree, should aim for less. Talks with Veolia have reduced to notification period to 10 working days, looking to reassess and further reduce in future.	Update - to 10 working days
150	Remarkables Park Limited	Roads	Clause 3.3.11.2	Cycle Facilities	There is a proposed insertion at 3.3.11.2 that includes the following statement: "Cycle facilities may be required as part of a subdivision resource consent at Council's sole discretion." RPL has a problem with this proposal; not because RPL is against cycle facilities (indeed there are more cycle lanes in Remarkables Park than in other parts of the district), but because this statement is factually incorrect. In its current form, there is an inference that the above statement applies to all subdivisions. Most urban subdivisions are Restricted Discretionary Activities (RD). Rule 25.5.7 of the District Plan lists the matters over which Council has reserved discretion for those subdivisions and cycle facilities are not listed there. If, in respect of an RD activity, Council has not reserved discretion over a matter (such as cycle facilities), then it does not have discretion to require it in a subdivision consent. Nor can such a requirement be introduced by way of the QLDC LDSC 2024. Council has reserved discretion to require cycle facilities in respect of a very limited number of RD subdivisions (see 27.5.9, 27.7.9, and 27.7.14 for example) and could be argued to have such a discretion in respect of Discretionary and Non-Complying subdivision consents. The statement: "Cycle facilities may be required as part of a subdivision resource consent at Council's sole discretion", should be deleted or should be amended to apply only to the very few zones and subdivision consents where Council actually has such a discretion.	Additionally - The final paragraph in this section is worded too broadly, and would exceed council's powers as written. The following alternative is proposed. If there are conflicts between the Code and other documents referenced in this section with regards to cycling facilities, the Code supersedes the direction provided in all the other relevant documentation	Yes	Agree	Updated as per submission

151	Remarkables Park Limited	Roads	Clause 3.3.6	Car Parks	In the following statement, "Public parking and loading can be provided either on-street including indented, or off-street in vested public car parks", the underlined words are proposed to be added. The suggestion is problematic. It is not at all clear what a vested public car park is. • Is the suggestion that all public parking provided off street must be vested in Council? • Is this intended to be mandatory or at the developer's option or at Council's option? • Has Council considered the implications of Council owning the land on which the parking spaces would be situated? • Would it be intended for the land to be held as fee simple or local purpose reserve parking or have some other status. • Would Council wish to take over the maintenance (sealing and line marking and landscaping) responsibilities for numerous pockets of parking dotted around the district? • Will it likewise wish to take over the monitoring, policing of time restrictions and removal of abandoned vehicles from such parking areas? • Can a developer choose to call a parking area "public parking" and vest it in Council as a means of avoiding responsibility for all future commitments related to the land, including payment of rates? In RPL's submission, this proposed insertion should be deleted. It is noted that C3.3.6 still purports to impose parking minimums. Council will be aware that it has been required by statute to remove parking minimums from its District Plan and can no longer impose such minimum parking requirements. The old minimums have been removed from the District Plan and the purported parking minimums should be removed from QLDC LDSC		Yes	Agree	Updated as per submission
152	Remarkables Park Limited	Roads	Clause 3.3.9	Bus stops	There is a statement included in 3.3.9 that: "Bus Stops may be required as part of a subdivision resource consent at Council's sole discretion"; Similar to the comments above related to 3.4.11.2, the District Plan does not appear to have reserved a discretion to require bus stops in respect of RD subdivisions. If this statement is intended to apply to all subdivisions, then it is factually incorrect. This statement should be removed or amended to refer only to the subdivision resource consents to which it might apply		Yes	Agree	Updated as per submission
153	Remarkables Park Limited	Other		Format of the document	There is one very valuable change that should be made to the format of the document. It would be a simple change to effect because QLDC LDSC 2024 is a digital document. There is no complex printing cost associated with this change. QLDC LDSC 2024 is based on the New Zealand Standard NZS 4404:2010 that applies throughout New Zealand. It is valid for QLDC to make its own amendments to the New Zealand Standard so that it better applies to the Queenstown Lakes environment. However, recognising the drive to have more National Environmental Standards under the RMA and recognising the intention to standardise the format and language of district plans throughout New Zealand, it is important to illustrate the places where QLDC LDSC 2024 differs from NZS 4404:2010. To date there have been thirteen different sets of amendments to QLDC LDSC 2024. The proposed amendment will be the fourteenth. It is submitted that, when the current review of QLDC LDSC 2024 is complete, all current and past insertions and amendments made by QLDC should be readily identifiable. This could be simply achieved using coloured text and strikethrough (strikethrough). The original text of the New Zealand Standard could be shown in black and all amendments that have been made by QLDC to date could be shown in a single coloured text. One argument for doing this is that it would enable professionals, who use NZS 4404:2010 in other districts, to easily identify where different standards apply in the Queenstown Lakes District. More importantly, it would allow all users of the QLDC LDSC 2024 to better understand the matters that are important to consider when working in the Queenstown Lakes District and gain an appreciation of the environmental	Please Note: If the above suggestions do not resonate with those drafting the document, RPL requests the opportunity to discuss any concerns before the document is finalised. As we have said in the past, the three minutes given to parties to speak at a Full Council meeting about technical matters such as these makes a mockery of the concept of consultation and engagement. A brief, two way conversation, over the phone or across a table, between parties who understand the issues, before the document is finalised, would do much to allay this concern.	No	Have discussed with submitter. Outside of original consultation scope, will look at resource to do this in future. At present best would be to look at documents in conjuction if wanting to see where differences are.	N/A
154	Southern Land #2	Appendix B	B4-2	Requires all concrete capping and concrete encasement of pipes to be structurally designed by a structural engineer which is over the top.	**Proposed change :** Provide standard detail with reinforcing specified for different loading scenarios similar to what Christchurch City Council has done i.e commercial crossing, residential crossing	Standardises design so QLDC know exactly what they are getting.	Yes	Good suggestion. Have adopted a detail for some cases and will be looked at further next stage of Code of Practice updates which will have a primary roading focus.	As per updated drawing
155	Southern Land #2	General	Clause 1.3.3	Building Act	The current clause is silent on private infrastructure on private property and doesn't prevent designs from having to be submitted for both EA and BC approval which often leads to conflicts between design standards and confusion regarding who will be doing the QLDC inspections (subdivision inspector or building inspector, or both?). **Proposed change :** Amend clause to state that public infrastructure must be designed to the QLDC LDSCP but private infrastructure on private land may be designed to NZBC. Private infrastructure = NZBC Public infrastructure = EA **.**	Provides clarity on the required design standard, which legislation the design is being approved under and who will be doing the compliance inspections from QLDC	No	Too complex to differentiate for every scenario, and want to have the higher standard in place in case. Particularly complex in the case of stormwater. Will have some additional information sessions/training between EA team and building team, with P&I involvement to ensure a consistent approach	N/A

156	Southern Land #2	Roads	Clause 3.3.16.3	Requiring pavement design of private pavements and entrances to the same level as public roads introduces significant time and cost for most simple developments, where standard pavement details are appropriate for most applications.	**Propose change**: Amend clause as follows: "Private pavements shall be designed as for public roads but [adequate to carry the expected load over its design life, with] no residential or rural pavement shall have [having] a minimum formation thickness of less than 150mm for flexible pavements or 100mm for concrete pavements. [For typical details of appropriate pavements see Appendix B Drawing ###]" (Refer Hamilton City Council RITS Clause 3.3.19.2, and drawing D3.3.5)	Standard pavement designs are appropriate for the majority of footpaths and vehicle crossings, and including acceptable typical details for these applications will simplify and streamline the preparation and processing of most simple development EA applications.	No	Good suggestion. Will be looked at in the next stage of Code of Practice updates which will have a primary roading focus or a future advice note.	N/A
157	Southern Land #2	Stormwater	Clause 4.3.5.1.3	Clause 4.3.5.1.2 which requires historic pre and post development and rainfall adjusted pre and post development flows to be compare conflicts with clause 4.3.5.1.3 which requires pre-development flows to be calculated using historic rainfall intensities	Amend clause 4.3.5.1.3 to match the intention clause 4.3.5.1.2	Removes confusion regarding which rainfall intensities need to be used. Based on 4.3.5.1.2 it sounds like QLDC's intention is that the post development flow shouldn't exceed the predevelopment flow both in the current case as well as the future case which we agree is a sensible approach which compares existing with existing and future with future flows	Yes	Agree - contradictory information. Reviewed and reformatted to say pre-development can use climate change rainfall also (depending on scenario comparision)	Misc - Reformat and reword to clarify
158	Southern Land #2	Stormwater	Clause 4.3.5.2	Freeboard Requirements	**Issue with clause** : The current clause is confusing and could be misinterpreted. Our understanding is that the freeboard requirements apply to sites where pluvial and fluvial flooding occurs and causing ponding on site, and that the 500mm offset from the bottom of the slab to the top computed water level doesn't apply where there is no likelihood of ponding or flooding occurring on site. **Proposed change**: Reword to clarify what the 'computed top water flood level for the 1% AEP storm' means and provide a diagram.	Provides clarify on freeboard offsets to be used for design.	No	No catch all definition appropriate, adding risk and/or potential problems to specify. Common sense with be for small surface ponding, small flows and/or catchments to be considered as could be relaxed from this as required but to look at on a case by case basis.	N/A
159	Southern Land #2	Wastewater	Clause 5.3.10.8		This clause relates to water supply – we assume that this has been included by mistake.		Yes	Error in location	Moved to water section under connections
160	Southern Land #2	Water	Clause 6.3.14.1(g)		**Issue with clause** : This states that valves should be located on all legs of a junction – its unclear if this relates to public mains and commercial connections only or also to residential development connections? We don't think that the intention is to have two valves installed on the public for every connection (i.e. right of way main connection to public main when it services a small number of properties/lots . **Proposed Change :** Amend to clarify in which scenarios a way valve configuration should be provided.	Provides clarity of when three-way valve configurations are required.	Yes	Discussed with operations an ammended to add clarity - is in line with submission	Add - For a connection of a less than 100mm internal diameter pipe to an existing line, only a valve is required for the new connection.
161	Southern Land #2	Stormwater			Provide worked examples for attenuation calculation so all designers are following the same process. Provides consistency between designers and makes it easier for QLDC to review if everyone is presenting the information in the same manner		No	Good suggestion. Intention is to provide worked examples as a subsequent advice note, following confirmation of Code of Practice stormwater requirements.	N/A
162	Stantec	Roads	Clause 3.2.7	Safe systems designs	This Update to the COP requries SSA to be done at resourse consent stage, but also states that Safe System Auditors shall provide confirmation of the design's compliance with relevant resource consent conditions or identify any deviations from those conditions. this can't be acheived if there is no consent. Although an SSA can be completed on an preliminary design at consent stage the benefits are unlikely to be as much as they will be on a detailed design at EA stage therefore suggest amending the COP to require the SSA to only be done at EA stage at Council's discretion	If the SSA will be completed and closed out at resourse consent, how can one provide confirmation on the compliance with a resourse consent? It will mean that any changes to the road design from that point (i.e during EA) will not be assestsed from the safe systems point of view. Also it is likely the lighting, landscaping and detail design is incompelete at the time of resource consent, meaning the SSA is not assessing all aspect of the road corridor that have an influence of safety outcomes. It is better to have it as part of the detialed design review and Engineering approval to ensure all is captured and reviewed.	Yes	Agree, there wouldn't be RC conditions if SSA at this stage and generally SSAs should not assess compliance with any standards or guidelines (or RC requirements) . The only purpose of a SSA is to assess alignment with Safe System principles. Safe system audits have the most influence at early stages and can steer the project in the right direction early on. The earlier we get a SSA, the better to avoid unecessary design changes later on so the inclusion at RC stage should remain.	Remove - Safe System Auditors shall also provide confirmation of the design's compliance with relevant resource consent conditions or identify any deviations from those conditions Add - Additional Safe System audits may be required at later design and implementation stages at Council's discretion
163	Stantec	Roads	Clause 3.3.2.5	Design and check vehicle requirements	Add speeds at which the tracking for each vehicle type is supposed to be untertaken at	Speeds influence the shape of vehicle tracking when using software.	No	Appropriate speed of tracking will be assessed on a case by case basis. We can look at minimum requirements at the next roading focussed update.	N/A
164	Stantec	Roads	Clause 3.3.2.5	Design and check vehicle requirements	500 mm clearance to apply to design vehicle only	clearance for the check vehicle seems generous and could lead to wider intersections than are appropriate and/or increased speeds leading to safety risks	No	Check vehicles will not be assessed on the 500mm clearance as design vehicles are but the clearance envelope should still be shown. More detailed clearance requirements will be assessed during the next CoP update.	N/A
165	Stantec	Other	Clause 3.4.2	NZTA M/4:2006	A recent 2024 version of M/4 has been released so QLDC may wish to reference this, although if using the updated version then clarity should be made in the COP around whether QLDC is accepting of the new classes of material in the specification and that lower class material can be used on lower volume roads.	Reason: Latest version is appropriate to use but consideration needs to be given to acceptance of lower class material on lower volume roads	No	Further investigation needed on the material change impacts and new grading, particularly in regards to frosts.	N/A
166	Stantec	Stormwater	Clause 4.3.10.3	Any MH with 3 or more inlets is required to be a minimum of 1200mm diameter	Concrete manholes with 3 or more inlets are requried to be a minimun of 1200mm in diameter.	This is only applicable to concrete manholes, the spacing around the outside of the manholes comes from CPAA for concrete structures. PE manholes are different and are an approved material available in smaller sizes with multiple connection fabricated into the manhole	Yes	Agree with submission. Section removed altogether, noting designer can check and smaller manhole could be used if CPAA guidelines and QLDC requirements in Appendix B able to be met	Remove - Concrete manholes with 3 or more inlets are requried to be a minimun of 1200mm in diameter

167	Stantec	Stormwater	Clause 4.3.10.5	Deep Manholes	amend wording to: "Where manholes deeper than 4m are unavoidable council will be required unless an approved product is used and installed in accordance with manufacturers guidelines"	The comment around specific design is ambigious and in general there is not an issue with either the structural integrity or ongoing performance of a manhole deeper than 4m therefore why would specific design be required. There are also already the likes of PE manoles on the approved materials list which can be made deeper than 4m therefore these should already be acceptable and not require separate council approval.	No	Specific design would be checking manhole depth is within manufacturers guidelines. Council approval is predominantly looking at in from an operations and maintenance perspective.	N/A
168	Stantec	Stormwater	Clause 4.3.4.1 (b)	Blockage - The secondary system design shall apply the following assumptions to culverts based on culvert size (d - diameter or smaller side if rectangle):	For culverts d ≥ DN1500 should be assessed following the NZTA Bridge Manual. The Bridge Manual refers to Institution of Engineers, Australia (2013) Blockage of hydraulic structures. Australian Rainfall and Runoff project 11. Barton, ACT, Australia.	A blanket 50% blockage does not seem appropriate for culverts ≥ DN1500. Following the recommended guidance takes a risk based approach which determines the appropriate level of blockage that should be allowed for	Yes	Agree. However refererred to ARR Guidance 2019 Book 6 (as more current)	Add - These blockage factors serve as a default unless demonstrated with suitable justification to Council approval that a lower blockage factor can be applied. Australian Rainfall Runoff – Book 6 (Flood Hydraulics) / Chapter 6 (Blockage of Hydraulic Structures) provides specific guidance on a risk-based approach for determining blockage factors.
169	Stantec	Stormwater	Clause 4.3.5.1.3	Rainfall	suggest moving this section before section 4.3.5.1.2	Rainfall is a parameter used as part of the design storm. For readability it would make sense to specify the rainfall event (s) before the design storm	Yes	Agree - contradictory information. Reviewed and reformatted to say pre-development can use climate change rainfall also (depending on scenario comparision)	Misc - Reformat and reword to clarify
170	Stantec	Stormwater	Clause 4.3.5.1.3	Rainfall - Pre-development catchment runoff calculations must use HIRDS V4 historical rainfall intensities and depths.	Pre-development catchment runoff calculations must use HIRDS V4 historical rainfall intensities and depths. Should be changed to - Pre-development catchment runoff calculations must use HIRDS V4 historical rainfall depth and climate adjusted rainfall for rainfall intensities and depth.	This aligns section 4.3.5.1.2 with the assessment required. I.e. there is a requirement to: 1) Post-development (historical rainfall) to be compared with pre-development (historic rainfall) and shown to be no greater and 2) Post-development (climate change adjusted rainfall) to be compared with predevelopment (climate change adjusted rainfall) and shown to be no greater	Yes	Agree - contradictory information. Reviewed and reformatted to say pre-development can use climate change rainfall also (depending on scenario comparision)	Misc - Reformat and reword to clarify
171	Stantec	Stormwater	Clause 4.3.5.1.4	All complex catchment modelling must follow a well-established stormwater hydrology, hydraulic and modelling methods.	All complex catchment modelling must follow a well-established stormwater hydrology, hydraulic and modelling methods. The determination of a well-established method can be determined by a suitably qualified person.	This statement is ambiguous and may lead to a magnitude of work being completed for it to not be accepted by QLDC. This should also limit the requirement for so many projects being peer reviewed.	Yes	Agree, have ammended wording	Add - The determination of a well-established method can be determined by a suitably qualified person.
172	Stantec	Stormwater	Clause 4.3.5.1.4	Applicants should provide access to a PC with modelling license and the stormwater model if needed.	Applicants should provide the model if needed alternatively a suitably qualified person shall confirm the modelling is correct.	Providing a PC for use is not suitable for the following reasons 1) Privacy concerns 2) Security Risks 3) Data Integrity 4) If something happens to the PC who is responsible.	Yes	Have provided another alternative option to providing PC with license	Add - or be prepared to present and explain the model in detail with a suitably qualified person if requested.
173	Stantec	Stormwater	Clause 4.3.7.1	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.	remove "and should attempt to direct a minimum 5mm rainfall to ground through soakage"	This would be challenging to achieve for most cases and may lead to puddles of water around developments.	No	If poor soakage and not feasible, this can be identified and not done.	N/A
174	Stantec	Stormwater	Clause 4.3.7.1	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	Remove this requirement for a DA	This seems unnecessary and is introducing extra paperwork. The efficiency and maintainability of the stormwater system should be able to be assessed through the EA process and during construction so that it is accetable prior to 224c without the need for a DA	No	Reviewed with and this is best mechanism for now. Can look at improving the process making more efficent for developers and council in future exercise	N/A
175	Stantec	Stormwater	Clause 4.3.7.2	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	Remove this requirement	What is the purpose of this and why is it being held over the Developer? It seems ambiguous as to what should be recorded and would likely lead to unhelpful information being provided. If the purpose is to get a better understanding of the actual results from different types of treatments then this should be a QLDC or ORC driven testing and monitoring excercise	No	Developer and engineer to ensure designed system operating effectively, and records important component of this. Extent of different developments would mean monitoring all devices unfeasible for QLDC and/or ORC. Important that devices are operating effectively and as per design prior to QLDC taking ownership and putting costs on ratepayers.	N/A
176	Stantec	Stormwater	Clause 4.3.7.4		Remove this statement	One of the fundamental approach's to LID is using a treatment train approach. The specification of an end of line LID system goes against LID principles.	Yes	End of line devices refer to ponds, soakpits etc at the end of train, reducing maintenance requirement. This wouldn't be applicable in cases, for example a site with a big ridge up it.	Add - Unless topographical constraints or other reasoning acceptable to council preclude this.
177	Stantec	Wastewater	Clause 5.3.10.8		Move this clause to the water section under "6.3.16 Connections", and create a new clause titled "6.3.16.5 Flow Metering".	This clause is inappropriately included in the wastewater section and is best included in the water section.	Yes	Error in location	Moved to water section under connections
178	Stantec	Wastewater	Clause 5.3.7.3	EF couplers	couplers should be limited to where butt welding is impractical or unsafe, to be agreed with designer prior to installation	the use of EF couplers are critical in some applcations and therefore the designer should be the one specifing where they can and can't be used, not QLDC who has not been invloved in the design works, valve layouts etc.	No	This has been discussed with operations. Wording as to be maintained, ideally EF identified in design. If not possible and comes in construction to be agreed with QLDC engineer. Any issues with this in practise please notify P&I.	N/A
179	Stantec	Wastewater	Clause 5.3.8.4.10	Deep Manholes	amend wording to: "Where manholes deeper than 4m are unavoidable council will be required unless an approved product is used and installed in accordance with manufacturers guidelines"	The comment around specific design is ambigious and in general there is not an issue with either the structural integrity or ongoing performance of a manhole deeper than 4m therefore why would specific design be required. There are also already the likes of PE manoles on the approved materials list which can be made deeper than 4m therefore these should already be acceptable and not require separate council approval.	No	Specific design would be checking manhole depth is within manufacturers guidelines. Council approval is predominantly looking at in from an operations and maintenance perspective.	N/A
180	Stantec	Wastewater	Clause 5.3.8.4.9	Any MH with 3 or more inlets is required to be a minimum of 1200mm diameter	Concrete manholes with 3 or more inlets are requried to be a minimun of 1200mm in diameter.	This is only applicable to concrete manholes, the spacing around the outside of the manholes comes from CPAA for concrete structures. PE manholes are different and are an approved material available in smaller sizes with multiple connection fabricated into the manhole	Yes	Agree with submission. Section removed altogether, noting designer can check and smaller manhole could be used if CPAA guidelines and QLDC requirements in Appendix B able to be met	Remove - Concrete manholes with 3 or more inlets are requried to be a minimun of 1200mm in diameter
181	Stantec	Roads	Table 3-2	Medium ridge truck radius of 10m	This should be 8m rigid truck with a 10m radius	there is inconstancy between recent consent conditions and the COP requriements, have it clear that its 10m radius for an 8m ridge truck.	Yes	Adjusted to 8.8m as per PDP	Medium rigid truck (8.8m) Radius: 10m and An 8.8m rigid truck (10m radius) shall be catered for in any areas where rubbish collection will occur
182	Stantec- Mike Smith	Roads		AS/NZS 2890.1	AS/NZS 2890.1 will be renewed to 2024/25 version in first part of next year. NZ has dropped from AS/NZS 2890.6 (Disability parking. We can still reference a AS standard if that is appropriate		No	Will review the need to include additional standards at next CoP update.	N/A

183	Stantec- Mike Smith	Roads		Road safery Auditing	suggest that reference is made to both RSA, and SSA as directed by Council		No	Safe System Audits (SSA's) have replaced Road Safety Audits in New Zealand. If applicable in cases where RSA's a condition of consent, consent woul dalso refer to an earlier COP version with RSA reference.	N/A
184	Terry Drayton	General			I have read through the appendix and see no mandate to ensure existing trees on subdivision are protected and integrated into a subdivision. (NB: the removal of all historic tree orchard on Orchard Rd)Also, and essential, there is no provision to include at least 30% of land use to park or green space as per UICN international plan as endorsed by the United Nation convention on biodiversity.		No	The district plan is the legislative framework that protects trees within the district and additional to this, there is the QLDC Tree Policy. It is these documents that you can request a change to cover you rconcerns however it is outside of the scope of the Code of Practice.	N/A
185	Warren David Ladbrook	Stormwater	Clause 4.3.4.1 (b)	Primary and Secondary systems	N/A	Agreement with the COP's assumptions on blockages within the primary system.	No	No change from this comment. However other comments adding a risk based approach adopted, submitter also notified on this.	N/A
186	Warren David Ladbrook	Stormwater	Clause 4.3.4.2	Secondary systems	N/A	Agreement with clarifications about the location of secondary systems on public land and the consideration of pedestrian access/egress from adjoining properties.	No	N/A	N/A
187	Warren David Ladbrook	Stormwater	Clause 4.3.5.1.1	Catchment Assessment	Remove "Homogenous surface conditions" and "Has no external catchment overland runoff onto the development" from the definition of 'simple' catchments.	The 'simple' definition to include "Homogenous surface conditions" is unreasonable, as no normal site will ever meet that criteria except for empty paddocks ... and there's virtually no empty paddocks in Queenstown that are up for development. Any property that has more that one type of surface or slope would not qualify, meaning that no property will qualify. This phrase should be removed. Further, the limitation of "Has no external catchment overland runoff onto the development" means that only property at the very upstream of every catchment can qualify as 'Simple' - meaning that truly simple downstream sites are ineligible. This phrasing would not allow any site, with even a tiny bit of overland flow from offsite as being treated as a simple site. As such this phrase should be removed. I have no objection to the remaining two points regarding the definition of a 'simple' catchment. Regarding both simple and complex catchments, I am not a lawyer, but I understand that there is legal precedence with respect to the definition of Pre-Development Catchments, and I would strongly request that QLDC adopt the New Zealand standard, and not create a definition that is inconsistent in any way.	Yes	Agreed, homegeneous adds confusion and has been removed. External, changed to significant external. Catchment definitions queried with legal in regards to national definitions, and no changes required.	Remove - Homogenoeous Add - "significant" external
188	Warren David Ladbrook	Stormwater	Clause 4.3.5.1.2	Design storms	Revise the stormwater design approach to account for significant differences in rainfall characteristics between Auckland and Queenstown Lakes areas. Consider adopting a front-loaded design storm approach specific to Queenstown Lakes, based on peak rainfall amounts for intervals from 5 minutes to 24 hours. Design storm selection should reflect local rainfall patterns and exclude Auckland's nested storm approach, which is more suitable for cyclonic storms. Additionally, only catchments with a time of concentration (Tc) ≤ 60 minutes and 10 Ha or smaller should be classified as 'simple'; catchments with Tc > 60 minutes should be treated as 'complex.'	The High Intensity Rainfall Design System (HIRDS) v4 data shows median annual maximum rainfall is significantly different in Queenstown Lakes compared to Auckland. Queenstown's rainfall is characterized by frontal-type storms, unlike Auckland's cyclonic storms, which require distinct stormwater solutions. The current approach, which relies on Auckland-based models and nested storm methods, may be suboptimal or inappropriate for Queenstown. Additionally, adopting a front-loaded design storm method would ensure the system accounts for peak runoff over various durations, including intense short-duration rain events. The proposed classification of simple and complex catchments aligns with appropriate design complexity for Queenstown Lakes conditions.	No	Good suggestion. Intention is to work to develop this, following confirmation of Code of Practice stormwater requirements. Requires time, QA, calibration etc in process. Front loaded storms and impact would be reviewed in this process. Sensitivity check shows very unlikely for a 10ha catchment to have a Tc over an our (even well grassed, soil type A, long flow path)	N/A
189	Warren David Ladbrook	Stormwater	Clause 4.3.5.1.3	Rainfall	N/A	No comments	No	N/A	N/A
190	Warren David Ladbrook	Stormwater	Clause 4.3.5.1.4	Runoff	Use locally adapted rainfall models. Engineer should be able to be able to determine when triangle unit hydrograph (or other methods) should be used for attenuation,. Expand table 4-1 and 4-2 Allow other methods of stormwater modelling which have been previously approved. Look at new methods without prejudice from methods currently in COP	As noted in Section 4.3.5.1.2 the Auckland standard of nested storms aligns with the cyclonic rainfall that is appropriate for Auckland, and is wholly inconsistent with the frontal rainfall that is appropriate for Queenstown Lakes District. Given it's 2024, I would further recommend that we move beyond simplistic triangle unit hydrographs, and use actual rainfall projections for the range of possibilities. I further note that there is inconsistency between the Tc referenced here (10 min) and the Tc previously referenced in Section 4.3.5.1.2 (60 min). It could be argued that the Engineer should be able to exercise sound judgment based on the specific catchment and site, subject to approval by QLDC P&I Engineer (notwithstanding the Tc = 60 min limit for 'simple' catchment approach). Tables 4-1 and 4-2 do not provide an adequate breadth of surface conditions that should be considered, and I would recommend that these are expanded accordingly. I applaud the differentiation for soil permeability and slope, both of which have a significant bearing on runoff. For complex catchment modelling, I would argue that there are perfectly sound and alternative ways to conduct stormwater modelling, and that Council should not be prejudiced in the 'preapproval' of models that use different methods. Further, that 'preapproval' is not required for modelled approaches that have been previously approved by Council, except where extenuating circumstances warrant a 'case-by-case' approach.	No	Time of concentration is specifically for the modified rational method, and due to limitations only to be applied for small catchments with minimal change in time of concentrations. Other methods, i.e. running multiple storm events would be applicable for longer duration events/significant changes in Tc - alternative methods would not be prejudiced, and can be discussed with council.	N/A
191	Warren David Ladbrook	Stormwater	Clause 4.3.5.2	Freeboard	Re-evaluate the Tauranga-based freeboard requirements for the Queenstown Lakes District.	The reference to Tauranga guidance w.r.t. 1% AEP is another example of potential 'cut and paste' from other Councils, without due consideration of what is most appropriate within the Queenstown Lakes District.	Yes	Error here, was a previous working note	Removed

192	Warren David Ladbrook	Stormwater	Clause 4.3.7.1	Water Quality Design objectives	N/A	I note the requirement to treat the first 20mm of rainfall, unless it can be shown to not be possible, with a preference for the first 5mm routed to ground for treatment & disposal.	No	N/A	N/A
193	Warren David Ladbrook	Stormwater	Clause 4.3.7.1	Water Quality Design objectives	Consider alternative methods to the separate Stormwater Developer Agreement to ensure stormwater effectiveness without extra administrative burden.	The requirement for a separate Stormwater Developer Agreement could be considered onerous, where there are other methods for ensuring the stormwater system operates effectively, and can be maintained. I am not a lawyer, but would strongly recommend that Council adopt an approach that is generally consistent with common legal practice within New Zealand, not not necessarily create additional administrative burden and cost	No	Reviewed with and this is best mechanism for now. Can look at improving the process making more efficent for developers and council in future exercise	N/A
194	Warren David Ladbrook	Stormwater	Clause 4.3.7.12	Soakage Device design	Broaden applicability to allow site stormwater disposal, considering Queenstown's soil suitability for land disposal	This introductory paragraph does not include "sites", but rather appears to limit these devices to treatment of roof runoff, parking areas, and roads. The disposal of site stormwater to land is culturally important, and preferred, and should be included as a viable approach for Queenstown Lakes District, particularly due to many locations with ideal soil conditions (sands and gravels) for land disposal.	Yes	Agree	Add - lots
195	Warren David Ladbrook	Stormwater	Clause 4.3.7.12.10	Factory of Safety	Rewrite Factor of Safety section to remove ambiguities and over-conservativeness; reassess max Factor of Safety (FoS) of 12.	I concur with the sentiment of including adequate factors of safety for any soakage device. However, the proposed adaptation and modification from CIRIA SuDS Manual C753 includes many ambiguous references that are subject to interpretation, abuse, and consequential inefficiencies and cost increases. The consequences of failure appear somewhat arbitrary, and neglect well defined Operation and Maintenance Requirements for soakaways (Tables 13.1 and 13.2 in CIRIA SuDS) – which will have a significantly greater bearing on the effectiveness and life of any soakage device than just the presence of pre-treatment and access. I would propose that this entire section is rewritten. Further, proposing a worst-case Factor of Safety of 12.0 seems somewhat extreme. In saying that, I by no means intend to diminish reasonable efforts to determine appropriate safety factors for various levels of consequence and data quality. For example: Consequence levels use terms like "easy" access, and "high" maintenance, but without any quantifiable reference to what these mean. Further, Consequence Levels 3 & 4 require speculation about the extent of prospective damage from secondary flows, which cannot be accomplished by any person who is constrained by space and time. Quality levels change based on seasonal groundwater depths, but these are completely irrelevant if the groundwater is many, many meters below ground in highly porous soils (as are common around Queenstown Lakes District). As written, this introduces additional Factors of Safety which are not warranted.	Yes	Have removed consequence level 4, agree appropriate that FOS over 7 is not appropriate and would be best to look at on case by case basis (noting this would be soakpits that failure will cause significant damage). Most of F0S largely sit between 2 - 2.7, max at 6 (unlikely and this could be avoided). Absolute minimum factor of safety of 2 use as well (as per previous versions)	Remove - Consequence Level 4 Add - Minimum Factor of Safety of 2 Reformatting and clarifications made
196	Warren David Ladbrook	Stormwater	Clause 4.3.7.12.12	Soakage Testing	Define testing requirements at both consenting and detailed design stages, focusing only on locations relevant to soakage devices.	Shouldn't this be included in Section 4.3.7.12.8 Geotechnical Investigations, or that text should be included here. As noted above, Council is requiring an excessive amount of testing on a project that I'm involved in, so this would be a good place to define what is an acceptable level of testing? The excessive testing required by Council (on the project I'm referencing) has not changed the design in any material way, and is only adding to the increased cost of development (and therefore has increased the cost of housing). I would propose that the infiltration rates for Detailed Design should be a determined at the locations described by the testing methods within Section 4.3.7.12.13. At the Consenting stage, while concept designs are still being developed, testing should only be required in the estimated locations for soakage devices. Additional testing after earthworks are completed, should only apply to cases where the horizontal and/or vertical locations for soakage devices have moved from the original design location, or if there has been fill material added in the proposed location of the soakage device(s). Otherwise, Council is only adding additional cost forno material benefit. The text about seasonal factors is noted. However, Council should also note that areas with deepgravels and very deep water tables are unlikely to be impacted by seasonal factors. The reference to "three soakpit test results" is ambiguous and misleading. The site of each soakpshould be treated on the merits of the soils and infiltration rates at that location. Any geotechnicaengineer will tell you that soils are highly variable, and limiting the infiltration rate at one location because another site wasn't as good is unreasonably conservative, and totally neglects the fact that any site can have areas with high infiltration, and also areas with low infiltration ... and the smart	Yes	Could be improved for clarifity, intention is for soakage capacity not to be lowered during construction and design doesn't take this into account. 3 tests requirement reviewed, geo-professional would look at what appropriate based on specific site and testing	Add - If, during construction, flows from disturbed soil areas have entered the soakage device location or the area has been compacted, soakage rates must be reconfirmed afterward Remove -Three soakpit test results used
197	Warren David Ladbrook	Stormwater	Clause 4.3.7.12.3	Draindown	I suggest adding the words "no more than" before "24 hours"	Faster draindown would be preferred.	Yes	Agreed	Update - a draindown period (to empty) within 24 hours from the end of the design storm event for which the device was sized for
198	Warren David Ladbrook	Stormwater	Clause 4.3.7.12.4	Area of Soakage	TBC - unsure	The definition given is perfectly fine for pond systems. However, for underground storage chambers the definition would describe this as the footprint area of the proprietary system being employed	Yes	Agree with clarification to pervious.	Update - If the soil strata in the proposed location of the soakage device are of uniform type, and expected to provide a uniform soakage rate, then ½ of the pervious side wall area of the soakage device may also be included in the area of soakage.
199	Warren David Ladbrook	Stormwater	Clause 4.3.7.12.5	Secondary flow paths	Require secondary flow paths for events exceeding the 1% AEP threshold.	I do not agree with the notion that secondary flow paths are not required for storm events over 1% AEP. I have been working with Council on a project where this is required, and which I strongly agree is appropriate, that secondary flow paths need to exist for unexpected events that exceed the capacity of the stormwater system as designed.	No	Agree that this is still a hazard, but we are remaining consistent with NZ and international criteria. Noting freeboard, climate change factors and blockage factors in practice would give a higher storm capacity in practice	N/A
200	Warren David Ladbrook	Stormwater	Clause 4.3.7.12.6	Freeboard	N/A	No comment. That said, I would have expected a requirement that no building floor level is within 500 mm of the TWL.	No	Keeping consistent with NZ criteria. Noting blockage factors may give a higher freeboard in practice	N/A

201	Warren David Ladbrook	Stormwater	Clause 4.3.7.12.8	Geotechnical Investigations	Specify acceptable testing levels in the COP to balance effectiveness and cost. Move to an early element of Section 4.3.7.12.12	I'm not sure why Council would ever allow any systems that don't require some level of infiltration testing? Shouldn't this be required? That said, Council is requiring an excessive amount of testing on a project that I'm involved in, so this would be a good place to define what is an acceptable level of testing? The excessive testing required by Council (on the project I'm referencing) has not changed the design in any material way, and is only adding to the increased cost of development (and subsequently the cost of housing). Further, this section should likely be moved to an early element of proposed Section 4.3.7.12.12 – Soakage Testing.	No	This relates to overall suitability, i.e. are there wider land instabilities on a hillside that would prohibit soakage (not necessarily infiltration rates)	N/A
202	Warren David Ladbrook	Stormwater	Clause 4.3.7.12.9	Pre-Treatment	Broaden pre-treatment options to include all viable systems. Emphasize proactive sediment and erosion control during construction.	This section states that the soakage device "must provide design elements compliant with the Appendix B Drawing B4.4". However, this drawing is of a soak pit for a road connection, and does not account for sites with a broader approach. As noted in the last paragraph of this section, there are numerous other methods which can be employed, and none of these methods would comply with Drawing B4.4 as they're completely different systems. Further, this section should be expanded to include reference to the importance of proactive sediment and erosion control during construction. The greatest threat to any soakage device is the 'blinding' of soils from poor construction management. If Council wants trouble-free systems, it is best to start with very good sediment and erosion control practices.	Yes	Ammended. During construction Environmental Management Plans a separate process and application, with different reference documents (required with QLDC, and sometimes ORC)	Add - Potential ingress of sediments into devices during the construction process should be both considered and avoided. All soakage devices to be vested with Council must provide design elements compliant with the Appendix B Drawing B4-4 if applicable.
203	Warren David Ladbrook	Stormwater	Clause 4.3.7.2	Water Quality Monitoring	Include specific inspection requirements in this section rather than referencing them within the DA document.	There are no details about what the developer is supposed to inspect for two years (other than ambiguous "visual discharge and sediment retention inspections"), with these details supposedly being incorporated into the Stormwater DA. It would be better to incorporate the detailed requirements in this Section, rather than have a host of separate documents with no assurance of consistency. As noted above, Stormwater DA's are a heavy handed approach, where other alternatives are known to exist - and are commonly employed.	No	These are based on current requirements of stormwater discharge in accordance with integrated three waters bylaw	N/A
204	Warren David Ladbrook	Stormwater	Clause 4.3.7.4	Low Impact Design	Rephrase to clarify that Council prefers LID but does not require a centralized end-of-line system for LID.	This section includes the text that "Council's preferred method of stormwater control is a low impact design solution" with I agree with. However, the following paragraph includes the contradictory text "QLDC require centralised end of line LID systems ... ", which should be rephrased to avoid ambiguity. You prefer in one paragraph, and then require it in the next. I agree with the preference, but do not agree with the requirement.	Yes	Updated wording	Add - Prefer
205	Warren David Ladbrook	Stormwater	Clause 4.3.7.5(d)	Low Impact Design Process, Design for Maintenance	State TMP-free access as a preference rather than a requirement. Allow variations based on road classifications.	It is common for road corridors to be utilised for infrastructure, including stormwater collection and disposal. The requirement that they do not require a TMP for access or maintenance is an overly restrictive requirement, and inconsistent with the majority of standard access or maintenance for other infrastructure within road corridors. Instead, I would recommend that this is stated as a Council preference, and include a requirement to coordinate with P&I O&M about the placement of all such stormwater devices. Further, perhaps there could be consideration of the road classification with different levels of permission for stormwater systems - such that regional roads or arterials are more restricted than primary or secondary collectors, and with no such limit on access roads.	No	This is requirement as default, deviations looked at as appropriate and discussed with O&M etc. Consideration of road type would be a factor if deviating.	N/A
206	Warren David Ladbrook	Stormwater	Clause 4.3.7.8	Wetlands	N/A	I don't disagree with this section, but would note that it looks like it was pulled out of Auckland - and there are not many locations where I expect that this would apply.	No	Not many, but there are some in area and potential for further. To remain.	N/A
207	Warren David Ladbrook	Stormwater	Clause 4.3.7.9	Vegetated Swales	Provide more detail	I agree with considering the safety concerns associated with check dams adjacent to roadways. However, does Council have anything specific that should be included, or avoided? This appears to be lip service with ample ambiguity.	No	Case by case, flagging to designer to consider and use judgement. Typically thinks like speed environment, distance from carriageway.	N/A
208	Warren David Ladbrook	Stormwater	General	Alignment with the Handbook of Hydrology (David R Maidment - Editor)	Simplify procedures in line with Handbook's 9.3.2 recommendation for reproducibility, simplicity, and locally observed data.	Complex models and procedures adopted from other regions may lead to outcomes unsuitable for the Council or landowners. The Handbook emphasizes that methods should be simple, physically sound, and regionally appropriate.	No	Understand sentiment, this to be considered in future stormwater guidance.	N/A
209	Warren David Ladbrook	Stormwater	Pages 10 & 14	Stormwater solutions based on Auckland's methods	Reassess the suitability of Auckland's stormwater design solutions for Queenstown; avoid over-reliance on Auckland's methods like nested storms. Further details on 4.3.5.1.2	Auckland's rainfall patterns and storm types differ significantly from those in Queenstown. Solutions and approaches suitable for Auckland may not be optimal or appropriate for Queenstown's unique rainfall and stormwater conditions. Further details on 4.3.5.1.2	No	Good suggestion. Intention is to work to develop this, following confirmation of Code of Practice stormwater requirements. Requires time, QA, calibration etc in process.	N/A
210	Waste Management - Sean Cronin	Roads			Check vehicle updated to reflect the 10.5m vehicles used in fleet. COP has rubbish trucks as being a 8m rigid truck with a 10m turning radius. The Proposed District Plan and Austroads has a 8.8m rigid truck with 10m turning radius.		No	This is significant change in criteria, and has been flagged during consultation process. Will defer to next stage of Code of Practice updates and consultation which will have a roading focus.	N/A