

Nelson City Council

**Land Development
Manual
2010**

FOREWORD

The Nelson City Council Land Development Manual 2010 (Land Development Manual) forms the basis for design and construction of all Nelson City's roads, drains water supply and reserve areas.

The Land Development Manual is applicable to all subdivision and development where works are to be vested in the Council or works on Council infrastructure are to be undertaken.

The Land Development Manual is a revision of the Nelson City Council Engineering Standards 2003 (Engineering Standards).

The Land Development Manual is the result of an extensive review process undertaken in conjunction with Proposed Plan Change 14: Residential Subdivision, Land Development Manual and Comprehensive Housing, aimed at incorporating 'better urban design' principles affecting land development as well as up to date standards and specifications for construction.

The Land Development Manual was developed with involvement of key staff from the council and external stakeholders. The Nelson City Council acknowledges the input of surveyors, developers, consultants, network utility owners, walking/cycling groups, industry training organisation, suppliers, and contractors.

There are a number of fundamental changes to the Engineering Standards that have been incorporated into the Land Development Manual. An overview of these changes is outlined in the following table:

Section	Change
Transport	<ul style="list-style-type: none">• Key objectives include permeable, connected and attractive network that encourages walking and cycling and minimises the number of short vehicle trips• Principles of Crime Prevention Through Environmental Design (CPTED) to be incorporated• 'Place' and 'function' are key to determining the character of the road• Slower design speeds for 'non-classified' streets
Stormwater	<ul style="list-style-type: none">• Low impact design stormwater management to be incorporated where appropriate• Information regarding MfE's latest sea level rise predictions and recommendations included (awaiting outcome of NES)• Climate change predictions incorporated into design rainfall intensity curves.• Capacity requirements for secondary flow paths included
Electrical and Streetlighting	<ul style="list-style-type: none">• White light to be used in commercial areas and areas with high levels of pedestrian use.• Conventional Style luminaire to be flat-glass lens (full cut-off lamp)

Section	Change
Telecommunications	<ul style="list-style-type: none"> • Minimum performance level capability of 100Mbps downlink and 50Mbps uplink for all new reticulation
Reserves and Landscaping	<ul style="list-style-type: none"> • Design concept of neighbourhood parks to be included with the subdivision consent application • Design criteria for combining recreational open space with stormwater management.
All Sections	<p>The LDM contains two different levels of design requirements and responsibilities:</p> <p><u>Text with shading</u> (or within a table) - represents minimum standards that need to be met in relation to rules in the NRMP,</p> <p><u>Text without shading</u> - represents design requirements and guidance that are not minimum standards but are to be considered when proposing design methodologies not supported by the minimum standards.</p>

Nelson City Council encourages innovative and sustainable design and therefore welcomes alternative solutions to this Manual where this will result in better results. Please discuss this option with the relevant asset area within council. The Land Development Manual will require continuous review and amendment to reflect changes in land development practice and feedback from stakeholders.

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1. INTRODUCTION AND GENERAL PROVISIONS

1.1 INTRODUCTION

1.1.1 General

- a) This Document is called the Nelson City Council Land Development Manual 2010 (LDM)
- b) This LDM is designed to give effect to the Nelson Resource Management Plan by providing acceptable design solutions to Developers, Designers and Asset Managers within Nelson City Council area.
- c) This LDM replaces the Nelson City Council document known as the Nelson City Council Engineering Standards 2003.
- d) The LDM provides a means of compliance when designing and constructing land development and infrastructure works that are required to fulfil conditions imposed by a Resource Consent or Building Consent (or works that fall within the requirements of the District Plan, if a consent is not required ie, as a permitted activity condition.)
- e) The LDM contains two different levels of design requirements and responsibilities:
 - 1) Text with shading: The text with shading (or within a table) represents minimum standards for controlled activity subdivision and/or development in relation to rules in the Nelson Resource Management Plan (NRMP). These are specific requirements which need be met in order to achieve the objectives and performance criteria of the LDM.
 - 2) Text without shading: The text without shading represents design requirements and guidance that are not minimum standards. These are required to be considered when proposing design methodologies not supported by the minimum standards and/or those that relate to Appendix 14 Residential Subdivision Design and Information Requirements of the NRMP. Note that the construction requirements of the LDM are minimum standards and therefore shading of text has not been used in these sections.
- f) Where the design work proposed does not meet the minimum standards then additional information/preliminary engineering design must be submitted with the design substantiating how the respective objectives and performance criteria (outlined in the LDM) will be met. This additional information/preliminary engineering design may be required by council at the time of application for resource consent.
- g) It is difficult to achieve better urban design goals by imposing prescriptive resource management plan rules and minimum engineering standards. This will be particularly relevant for greenfield hillside subdivision and intensification within the existing

residential area. In recognition of this, the Council considers that a minimum standard approach will not suit all situations and therefore guidance and requirements for non-minimum standard approaches is provided.

1.1.2 Overview of Land Development Manual (LDM)

The Nelson City Council's Land Development Manual (LDM) has been organised into two key parts for ease of reference.

Part 1 (Sections 1 to 3) contains standards that relate to the administration of Council's asset infrastructure. This includes:

- a) Section 1, Introduction and General Provisions – Definitions and interpretations of words.
- b) Section 2, Process and Information Requirements – Particular information about the key steps in the process and decision points where Council approval may be required.
- c) Section 3, Legal Responsibility Associated with Council Assets – Liability and responsibility issues, training and qualifications, and the location of services.

Part 2 (Sections 4 to 12) contains the standards relating to the design, material specifications and construction and installation of all and any part of the infrastructure that will fall under Council's control. The sections covered are:

- a) Section 4, Transport – Standards for the design and construction of transport corridors and the management of road reserve.
- b) Section 5, Stormwater – Standards for the design and construction of stormwater systems. Including alternative designs such as low impact design.
- c) Section 6, Wastewater – Standards for the design and construction of wastewater collection and disposal systems.
- d) Section 7, Water – Standards for the design and construction of water supply systems.
- e) Section 8, Trenching and Reinstatement – Standards for all trenching and excavation work on underground services.
- f) Section 9, Earthworks – Standards for land disturbance activities involving the preparation of sites for development.
- g) Section 10, Electrical and Streetlighting – Standards for electricity and road/streetlighting. This section is based on the requirements of network line operators.
- h) Section 11, Telecommunications Utilities – Standards for telecommunications which are based on the requirements of line operators.

- i) Section 12, Reserves and Landscaping – Standards for parks, reserves, walkways and any public open space areas, in the context of land development.

1.1.3 Objectives

The objectives of the LDM are:

- a) The standard of service ensures the health, safety and wellbeing of people and communities;
- b) Community identified outcomes have been achieved in accordance with the Long Term Council Community Plan (LTCCP);
- c) The management of natural and physical resources, in accordance with the Resource Management Act 1991 (RMA), is sustainable;
- d) Technical guidance about the design and construction of services necessary to meet the objectives and policies of the Nelson Resource Management Plan (NRMP) has been provided;
- e) Other network utility providers have worked together with Council to deliver telecommunication, electrical and road network infrastructure works effectively and efficiently;
- f) Long-term life-cycle costs associated with all service infrastructure assets are effective and efficient;
- g) Good urban design and low impact design principles through land subdivision and development have been encouraged where they are appropriate and practicable;
- h) Innovation in the use of alternative methods for achieving design objectives has been encouraged, provided that minimum standards for safety and efficiency of infrastructure provision can be met in a cost-effective way for the Community and Council.

1.2 GENERAL PROVISIONS

1.2.1 Document Control

1.2.1.1 General

- a) The LDM is a controlled document and amendment or re-issue is the responsibility of the Council Engineering Manager with approval of the Nelson City Council Committee.
- b) Amendments/reviews are carried out three-yearly. However, an earlier individual amendment may be made if an important alteration to a standard or technology arises.
- c) Significant amendments will be reviewed and approved by Council Committee.

- d) A copy of the LDM will be available to existing copy holders and a register of these is held by the Engineering Manager.
- e) The LDM is part of the NRMP as an externally referenced document under Part 3, Clauses 30-35 of the First Schedule of the RMA 91.

1.2.1.2 Review Procedures

- a) When the LDM is reviewed on a three-yearly cycle and once the draft document is approved by the Council Committee, the document will be submitted to interest groups for comment and feedback followed by a public consultation period. A panel comprising Councillors and Council staff will review and hear written comments on suggested amendments.
- b) The review panel will confirm any further amendments, following the submissions process and subsequently approve the document for publication and for updated references in the NRMP to be notified.

1.2.2 Statutory Requirements

- a) The provisions of the LDM shall be read subject to the provisions of the Nelson Resource Management Plan (NRMP) and to any applicable statutes, regulations and bylaws.
- b) The main over arching legislative instrument that requires the necessity for the LDM is the Resource Management Act. While the Manual is also required for use in the following statutes:
 - 1) Building Act 2004;
 - 2) Local Government Act 2002;
 - 3) Land Transfer Act 1952;
 - 4) Unit Titles Act 1972; and
 - 5) Property Law Act 1952;
- c) Requirements from each legislative document provide Consent Authorities with the powers and functions to request, provide, and supply information pertaining to the land.

1.2.3 Applicability

The standards outlined in this document will apply to:

- a) All infrastructure assets that are to be vested in Council;
- b) All infrastructure assets constructed under contract for Council;
- c) Any development that may have an impact on Council's infrastructure assets;
- d) Development that requires a building consent or resource consent.

This covers:

- Subdivision development;
- Any building or construction works;
- The design, construction and/or installation of any infrastructure assets;
- Land activities that require modification of waterways and/or land disturbance; and
- Any repair or maintenance works that may affect existing infrastructure.

The intention of this document is to encourage quality land development both in the urban and rural sectors. An overview of the definition of quality urban design is provided below and in the NRMP, specifically the District Wide Objectives in Chapter 5 and Appendix 14 of the NRMP.

1.2.4 Quality Urban Design Overview

1.2.4.1 General

- a) High quality urban design is more than an engineering exercise to get the building blocks of development. It is about designing the Urban environment to get the best urban form practicable. High quality environments cannot be achieved without good subdivision.
- b) The NRMP in conjunction with the LDM describes how neighbourhoods should be structured and the layout of streets, lots, and networks designed, in ways that achieve maximum benefits to the subdivider, end-resident, and community. It is largely aimed at urban subdivision; however, most of the core design principles can also be applied to rural and rural residential subdivision. For further information on Urban design refer to Chapter 4 and of the NRMP.
- c) Council offers a pre-application design process in order to work with the subdivider to achieve high quality development that will be successful in the short term and for generations to come.

1.2.4.2 Core Design Principles

- a) There is a range of key issues that need to be addressed in the development of new neighbourhoods and subdivisions. They directly relate to the quality of environments we create:
 - 1) **Rationale** should underpin all design. Good subdivision is more focused on a clear rationale as to why and how decisions have been made about the design elements, rather than whether they strictly comply with statutory requirements.
 - 2) **Context** in which the subdivision is located must be taken into account in the design including the existing urban, landscape and social setting.

- 3) **Integrate** with surrounding neighbourhoods, through the roading and open space networks. Encourage pedestrian and cycle activity around convenient access and routes.
 - 4) **Layout** should contribute to the local identity of the Nelson City, responding to site characteristics, the surrounding environment, notable features, views, and identified region-wide strategic initiatives.
 - 5) **Reinforce** existing local focal points in the community, ensuring that residents are in walking distance of a range of amenities. Provide new nodes and focal points logically on the movement network.
 - 6) **Variety** of lot sizes and other compatible uses encourages a diverse community.
 - 7) **Connect** movement networks including street, cycle and walkways to provide accessibility and choice in the local area, reducing travel distances, vehicle emissions, and money spent on petrol that could cumulatively help the local economy and increase accessibility to public transport.
 - 8) **Convenient** designs ensure residents have convenient access to public parks, open space and community facilities.
 - 9) **Open Spaces** need to be safe, legible, cost effective to maintain and capable of providing a variety of recreation uses.
 - 10) **Safe** developments are based on lots fronting the road and public open spaces, providing informal surveillance of the public realm.
 - 11) **Low impact** approaches to managing stormwater run-off and other resource use helps maintain the long-term environmental quality of the sub region.
 - 12) **Ecological and heritage** features should be protected and enhanced. This can be achieved in a manner that adds value and uniqueness to subdivisions.
 - 13) **Consultation** should be undertaken with stakeholders and affected parties prior to the design process being initiated. In particular in discussion with Tangata Whenua cultural landscape values should be recognised and applied.
 - 14) **Strategic planning** sets the framework for the City and District. Any subdivision should be undertaken within the parameters of this planning to ensure that the overall direction for the Nelson City Council is achieved.
- b) For further guidance on Quality Urban design refer to Chapter 5 and Appendix 14 of the NRMP.

1.3 DEFINITIONS

Accessway – means a corridor with a path for pedestrians and cyclists linking between road to road or road to reserve.

Access Driveway – is any vehicular path providing access to four or more residential units, any non-residential activity or public car park.

Annual Exceedance Probability (AEP) – means the probability of exceedance in any 12-month period.

CBD – Central Business District (shall be the areas within, and roads adjoining, the Suburban Commercial, Inner City and City Fringe zones in the NRMP).

Classified Roads – roads with a hierarchical classification of Arterial, Principal and Collector. Conversely, Sub-Collector Roads, Local Roads and Residential Lanes are grouped and termed **Unclassified Roads**.

Council – shall mean the Nelson City Council or its officers.

Cycleway – means so much of any road (or other land) as is laid out or constructed by authority of the territorial authority primarily for cycles; and may include the edging, kerbing and channelling thereof.

Designer – shall mean the person responsible for producing and/or submitting the Engineering Drawings for approval and may be a Chartered Professional Engineer, Registered Professional Surveyor or authorised person experienced in the production, design and submission of plans.

Developer – means an individual or organisation having the financial responsibility for the development project and includes the owner.

Developer's Professional Advisor (DPA)¹ – means the person, appointed by the developer being a Registered Professional Surveyor or a Chartered Professional engineer, who shall be responsible for:

- 1) The investigation, design and obtaining of approvals for the works;
- 2) Contract administration and oversight of the works;
- 3) Certification upon completion of the works;
- 4) Sole point of communication with Council.

DI – ductile iron pipes – generally socket jointed with Tyton elastometric seal rings.

¹ The DPA may nominate in writing to the Engineering Manager a DPA Representative for the construction phase of the project. The DPA's Representative must be a suitably qualified and competent person and not being a body corporate or firm. The Council will not unreasonably withhold the nomination of the DPA's Representative.

DN – nominal pipe bore diameter in millimetres. For polyethylene pipes, this relates to the pipes' outside diameter. For other pipes this relates to the internal diameter.

Domestic Driveway – is any vehicular path providing access to three or fewer residential units.

DP (Design Pressure) – the maximum operating pressure that the designer expects to act on the pipeline in service.

Drainage – means wastewater drainage or stormwater drainage, and "drain" has a corresponding meaning.

Easement In Gross – An easement in gross is an easement that, unlike a normal easement, does not attach to any dominant tenement; examples are the right of public utilities, such as power, gas, phone, water and sewerage, to use part of the land.

Earthworks – means any alteration to the contours, including the excavation and backfilling or recompaction of existing natural ground and the stripping of vegetation and topsoil.

Electrical Reticulation – means all "Electric Lines" that are owned by the "Line Owner" and form part of the Line Owner's electrical Reticulation System or "Network".

Engineering Manager – shall mean the Senior Executive Infrastructure of the Council.

Exclusive Fittings – means those fittings used or intended to be used for the purpose of supplying electricity exclusively to that property.

Footpath – means so much of any road as is laid out or constructed by authority of the territorial authority primarily for pedestrians; and may include the edging, kerbing and channelling thereof.

Geotechnical Engineer – means a Chartered Professional Engineer (CPEng) or an engineering geologist with recognised qualifications and experience in geotechnical engineering and experience related to the development.

Ground – is used to describe the material in the vicinity of the surface of the earth whether soil or rock.

GRP – means glass reinforced plastic pipes, eg Hobas. This type of pipe is generally only used for major transfer or transmission mains since pipe diameters of less than DN 300mm are rare.

Hillside Environment – is considered to be where the road is formed on ground that has an average slope of greater than 10 degrees.

Household Unit or Dwelling Unit – means 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.

HCV – means a Heavy Commercial Vehicle.

Independent Qualified Person (IQP) – means a specialist approved by the territorial authority and having the appropriate skills and qualification to carry out specific procedures.

Installation – shall include excavation, the laying or thrusting of the pipe, ducting or cabling service, backfilling and reinstatement of surface.

Land Drainage System – refers to the flow of surface and ground water but concentrates mainly on peak surface discharges and their regulation under urban conditions.

Landowner – shall mean the consent holder or persons responsible for, or authorised persons subdividing or developing the land.

LDM – means the Nelson City Council Land Development Manual 2010.

LGA – means the Local Government Act 2002.

LGOIMA – means the Local Government Official Information and Meetings Act 1987.

Line Owner – means a person or company that owns electrical reticulation (works) that are used or intended to be used for the conveyance of electricity.

LINZ – means Land Information New Zealand.

Low Impact Design (LID) – an alternative stormwater management system that utilises natural drainage features in the landscape such as infiltration, filtering, storing, detaining and evapotranspiration rather than piped systems.

LTCCP – means Long Term Council Community Plan.

Maximum Design Pressure (MDP) – the maximum instantaneous pressure that may be created within a pipeline, including for pressure surge effects.

Means of Compliance – means a method by which the requirements of the standard may be complied with. It implies that there may be other methods which may meet the requirement subject to specific consideration or approval.

MHWS – means Mean High Water Springs.

Network Connection Point – means the position where a service connects to a Line Owner's network.

Network utility operator – has the same meaning given to it by Section 166 of the Resource Management Act 1991.

Nominal Pressure Rating (PN) – the pressure marked on the pipe or component and the maximum pressure that it can operate at throughout its design life.

NRMP – the Nelson Resource Management Plan.

NZTA – the New Zealand Transport Agency.

Operating Pressure – means the internal pressure which occurs at a particular time and that on average will likely be experienced at a particular point in a water reticulation system on a typical day. For a gravity system, the operating pressure will depend on the water level of the reservoir, the ground level at the point on the pipeline under consideration, and the head loss due to demand in the system.

Operator – shall mean the party or parties either as approved by the Council or as approved as a network operator under the Telecommunications Act 2001 or as approved under any other service supply Act to carry out excavation, backfilling or reinstatement works within the road reserve under the control of the Nelson City Council.

Owner – the owner of the land that has the power to make decisions about the land and the power to sell the land. Includes the Crown, the Public Trustee, and any person, local authority, board, or other body or authority however designated, constituted or appointed.

PE – polyethylene, generally pipes for water supply networks, for example PE 80B or PE 100. PE 80C is not recommended for long-term water reticulation networks.

PN8 – indicates the nominal pressure rating of the pipe (the higher the number the higher the strength and quality).

Point of Supply – means the point at which the supply authority responsibility ends.

Primary Design Flow – Is the estimated run-off selected to provide a reasonable degree of protection to the surrounding land and buildings. In most cases this flow will be piped or contained within relatively narrow confines under public control by reserve or easement.

Private Road – means any roadway, place or arcade laid out within a district on private land by the owner thereof intended for the use of the public generally.

Private Way – means any way or passage whatsoever 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 open or intended to be open to the use of the public generally and includes any shared access or right of way.

PVC – (Polyvinyl Chloride) – material from which the pipe or fitting is produced; has a similar meaning for uPVC, mPVC, PVC-O.

RMA – means the Resource Management Act 1991.

Road – has the same meaning given to it by section 315 of the Local Government Act 1974.

Road Reserve – means the whole parcel/s of land designated as road reserve.

ROW – means Right-of-Way.

Runoff cover – means extension of insurance cover if a company ceases trading.

SD – refers to a Nelson City Council standard drawing detail.

Secondary Flow Path – refers to the path taken by run-off in excess of the primary design flow.

Service or Service Main – is the term for the cable (fitting), owned by the owner of premises and connecting premises to the electrical reticulation at an agreed network connection point.

STP – means System Test Pressure.

Street – has the same meaning as “road” as defined by section 315 of the local Government Act 1974.

Stormwater – is rain water 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.

Surface Water – means all naturally occurring water, other than sub-surface water, which results from rainfall on the site or water flowing onto the site, including that flowing from a drain, stream, river or sea.

Survey Plan – means a survey plan in terms of section 2 of the Resource Management Act 1991.

Swale – means a constructed watercourse shaped or graded in earth materials and stabilised with site-suitable vegetation, for the safe conveyance and water quality improvement of storm run-off.

System Test Pressure (STP) – the hydrostatic pressure to be applied to a newly laid pipeline (measured at the lowest point) to ensure its integrity and water tightness.

Territorial Authority (TA) – means a territorial authority defined in the Local Government Act 2002.

TMP – means Traffic Management Plan.

NRMP – means the Nelson Resource Management Plan.

Unclassified Roads – roads with a hierarchical classification of Sub-Collector Roads, Local Roads and Residential Lanes. Conversely, Arterial, Principal and Collector are grouped and termed **Classified Roads**.

Urban Design – means the design of buildings, places and networks that make up our towns and cities, and the ways people use them. It ranges in scale from a metropolitan region, city or town down to a street, public space or even a single building.

Vehicle Access Point – is the point where a Domestic Driveway or Access Driveway connects to the formed carriageway of a Road.

Wastewater – is water that has been used and contains unwanted dissolved and/or suspended substances from communities, including homes, businesses and industries.

Water Supply Authority – (WSA) – is the operational unit of the TA responsible for the supply of water, including its authorised agents.

Works – can be any type of construction or infrastructure and includes earthworks. Works can also be in the form of “money” as defined by the RMA.

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2. PROCESS AND INFORMATION REQUIREMENTS

2.1 INTRODUCTION

- a) This section sets out the information that Council requires in order to authorise construction of and vest new infrastructure assets within the Nelson City Council. This information typically comprises:
- Design drawings and details;
 - Supporting calculations;
 - Producer statements and certificates;
 - Specifications, and
 - As-built information.
- b) Prior to approval to commence work, Council requires the submission of fully detailed Engineering Drawings covering the design of all new roads, rights-of-way, access lots and service utilities. These drawings and associated information will be reviewed against these standards by Council.
- c) Appendix A sets out the scope of these Engineering Standards in the context of an urban development and consenting process.

2.2 REQUIREMENTS OF THE DESIGNER

- a) Council requires all design, construction and construction supervision of infrastructural assets and subdivisional works to be performed by suitably qualified and experienced individuals. Council standards, as set out in this document, are intended to reflect the minimum standard required by Council, and should not be seen as a replacement for professional engineering design.
- b) The responsibility for site-specific design relies solely on the Designer of the work and this may include investigation of unusual site conditions and exceptional circumstances. In particular the Designer shall consider all risks to lifeline systems (significant infrastructure) in the event of a major earthquake, flood, tsunami, slope failure and climate change.
- c) At the Engineering Drawing approval stage the Designer is required to complete and submit a Designer's Certificate and Check Sheet with the Engineering Drawings (see Appendix B and Appendix C of this section) together with the Designer's details on the plan title block.
- d) At the Engineering Drawing as-built stage the DPA is required to certify that the work has been completed in accordance with sound engineering practice and as shown in the as-built information supplied.

2.3 REVIEW AND APPROVAL PROCESS

2.3.1 Preliminary Discussion and Design

- a) Council encourages Designers and the Developer's Professional Advisor (DPA) to meet with Council in the early stages of design to discuss any proposed works and how these will meet Council's standards and integrate with existing services and infrastructure.
- b) Council has set up a Major Projects Team which is a group of inter departmental Council staff who provide pre application advice to applicants on proposed major development projects. This is a free service. Further information on the Major Projects Team can be obtained from the Nelson City Council website at www.nelsoncitycouncil.co.nz.
- c) Normally, detailed engineering drawings will not be required at the resource consent application stage. In the case of larger subdivision development where Council's future infrastructure, low impact stormwater, and/or streets with a reduced speed design is involved, Council may require preliminary Engineering Drawings prior to the approval of subdivision consent

2.3.2 Review and Approval of Engineering Design Drawings and Supporting Information

- a) Engineering Drawings and supporting information must be submitted to and approved by Council prior to the commencement of physical works, and prior to the pre-construction meeting. The requirements of the Engineering Drawings and supporting information are described in section 2.4.
- b) Council will review the Engineering Drawings and supporting information and advise the applicant in writing of either:
 - 1) approval of the Engineering Drawings, and supporting information; or
 - 2) a request to modify the design and/or provide further information.
- c) Approval of the Engineering Drawings and supporting information will consist of a single copy of each of the Drawings, endorsed with the signature of the Engineering Manager or his/her approved representative.

2.3.3 Construction by Stages

- a) Where the landowner proposes to proceed with construction of a subdivision in more than one stage, the Engineering Drawings shall cover the whole scheme in the first instance.
- b) In the case of major staged subdivisions where Council's infrastructure is involved, Council, at its sole discretion, may relax this requirement to the extent that preliminary service layout drawings for the total project may be submitted for initial approval.

- c) Fully detailed drawings required for each particular stage shall subsequently be submitted for final approval.
- d) Engineering Drawings for each stage shall comply with the Land Development Manual at the time of the subdivision consent approval; however should an extension of time for the consent be granted, compliance with the current Land Development Manual at the time of extension may be required.

2.3.4 Neighbours' Consent

- a) Where any construction work is required on another property, the owners' consent shall be endorsed on the original drawing in opaque black ink that will permit satisfactory reproduction. Note that biro may not reproduce satisfactorily.

2.3.5 Notification of Contracts and Phases of Work

- a) At least five (5) days prior to the commencement of work the consent holder or their agent shall advise the Engineering Manager in writing of the following information:
 - the name(s), addresses and contact telephone numbers of contractor(s) to whom it is proposed to award the work;
 - the nature of the work to be awarded in each case; and
 - the date that work will commence.

2.3.6 Pre-construction Meeting

- a) The Developer shall arrange a formal pre-construction meeting (with a written agenda) at Council's offices with the DPA, contractor's site representative, the Engineering Manager or representative and the Manager Resource Consents or representative. This meeting shall occur prior to the commencement of any work and after approval of the Engineering Drawings and will include discussion of the programme of works, the inspections required by Council or their agents and any other relevant matters.
- b) Specifically, matters to be discussed at this meeting will include:
 - Type/size of work contemplated and methodology;
 - Soil types, ground, environmental and weather conditions;
 - Erosion and sediment control requirements;
 - Locality of site;
 - Consent conditions;
 - Hold points and inspections required by Council;
 - Traffic effects, corridor access requests and effects to neighbours;
 - Risk to adjacent services;
 - Health and Safety;

- Relevant experience/training of the Contractor(s);
- Relevant experience of the Designer(s) and the DPA and level of construction supervision.

c) The Designer/DPA shall bring to the pre-construction meeting:

- A construction programme;
- A set of A1 size Engineering Drawings (approved). A2 or A3 drawings may be permitted depending on clarity of the drawing;
- The construction specification;
- An outline of the proposed construction supervision approach;
- Any relevant information on how risks, environmental compliance and consent compliance are going to be managed; and

d) A letter outlining minutes of the meeting, agreed hold points, and the inspection regime will be prepared and distributed by the Council within 2 working days after the meeting.

e) There are four levels of monitoring carried out by Council. The appropriate level will be based on the list in Section 2.3.6 above and determined at the sole discretion of Council. Council reserves the right to review the level of monitoring at any stage of the construction activity.

Level 1	One visit per two weeks and at hold points
Level 2	One visit per week and at hold points
Level 3	Two visits per week and at hold points
Level 4	Random visits and at hold points

2.3.7 Commencement of Development Works

a) Work shall not commence on the engineering construction of the subdivision or development unless:

- 1) The Council has granted an appropriate resource consent; and
- 2) There are no outstanding appeals or rights of appeal to the Environment Court; and
- 3) The Engineering Manager has approved the Engineering Drawings, specifications and calculations for the specific work that is required; and
- 4) The Engineering Manager has approved the Traffic Management Plan (TMP) (if required);
- 5) All other necessary consents or permits (e.g. corridor access request, building consent) have been obtained; and
- 6) The pre-construction meeting has been held.

- b) The Engineering Manager may grant staged approval to allow earthworks to commence prior to approval of other works at his/her sole discretion.
- c) The consent holder should be aware that in some cases, the Environment Court has ruled that works must not proceed without the Court's consent in cases where an appeal is lodged against consent conditions and has not been heard, or a right of appeal to the Court still exists, such as in the case of an objection lodged with the Council and still unheard.

2.3.8 Documentation to be Held

- a) Throughout the construction period, the contractor's site representative shall have the following material on site at all times:
 - 1) signed copies of the approved Engineering Drawings and the initial letter from Council setting out hold points, the inspection regime and engineering administration matters;
 - 2) a verified Health and Safety Plan and the letter of verification;
 - 3) copies of the resource consent;
 - 4) copies of any Nelson City Council consents or permits necessary for the works;
 - 5) signed copies of all consents to enter land for construction for works on land not owned by the Developer; and
 - 6) plans and details of sedimentation and erosion control measures to be implemented.

2.3.9 Variations

- a) No variations from the approved Engineering Drawings shall be made without the proposed amendments being first submitted to, and approved by, the Engineering Manager or his approved representative.
- b) The Designer shall identify and fully document the nature and position of the amendments.
- c) In the case of emergencies where immediate action is required to safeguard safety and health, property and infrastructure assets, such action shall be taken. At the earliest opportunity after the event, the Council shall be notified for approval.

2.3.10 Council Inspections and Construction Hold Points

a) The DPA shall notify the Engineering Manager, or representative at least five (5) working days (or as mutually agreed) before any of the following phases of the work are reached (and such other phases as have been determined) to enable inspection to be carried out by the Engineering Manager or representative:

- 1) Earthworks starting, (for checking of erosion and sediment control measures).
- 2) Street Works
 - i) Subgrade preparation and subsoil drains;
 - ii) basecourse prior to sealing;
 - iii) footpath and kerbside prior to sealing or concreting.
- 3) Stormwater and Wastewater
 - i) Inspection of laying first pipes of pipeline in sub-division while there is work in progress;
 - ii) inspections at a series of hold points determined by the Engineering Manager or representative to suit the particular situation and level of monitoring (refer Section 2.3.7).
- 4) Water Supply
 - i) Inspection of each line prior to backfill and trench reinstatement, including pressure testing;
 - ii) chlorination; and
 - iii) connection by Council required.
- 5) Final
 - i) After completion of all works including sweeping of roads and channels, clearing all drains, manholes and sumps, checking all valve and hydrant operations, planting riparian areas and appropriate inspections, eg CCTV, gauging or any other testing as required by Council as appropriate.

Note:

1. The certification by the DPA of the works at the various stages identified in section 2.3.10 should be done in accordance with section 2.3.11.
2. Council reserves the right to determine the inspection/monitoring regime on each project and the testing method of services/infrastructure which is appropriate.

2.3.11 Completion Certificate and Supply of As-built Drawings

- a) On completion of the construction of a subdivision or development the DPA being a Chartered Professional Engineer or Registered Professional Surveyor, shall submit to Council a Completion Certificate that the work has been constructed in accordance with:
- this Land Development Manual;
 - the approved Engineering Drawings and specifications;
 - any approved amendments; and
 - manufacturer's instructions.
- b) The "certifier" may be required to provide sufficient evidence at the written request of Council to demonstrate to Council's satisfaction that they have experience and competence in the work they are certifying, that they have sufficient professional indemnity insurance and run-off cover, and they have sufficient documented observation and testing records to adequately certify the works.
- c) The Work Completion Certificate shall be accompanied by as-built drawings, showing all works as actually constructed and drawn to the standards specified by Council.
- d) The Certificate shall be in the form as shown in Appendix D and must be received by the Council before it decides whether to issue a certificate under Section 224(c) of the Resource Management Act.

2.3.12 Approval of Engineering As-Built Drawings

- a) When the as-built Engineering Drawings are ready for approval and signing by the Engineering Manager, the DPA shall submit them along with electronic copies of the drawings and electronic coordinate files.
- b) The DPA is responsible for collecting and documenting information set out in the as-built plans. Disclaimers or endorsement negating responsibility will render the plans unacceptable and the 224 Certificate will be withheld. Further, if underground asset locations are found to be inaccurate on excavation or otherwise, the Developer may be liable for rectifying the situation.

2.3.13 Maintenance Certificate

- a) On expiry of the twenty four (24) month maintenance period, the DPA shall issue a maintenance certificate confirming that all outstanding maintenance has been completed.
- b) The performance bond for maintenance will not be released by Council until the work covered by the maintenance certificate is verified by Council.

2.4 GENERAL DRAWING STANDARDS AND DETAILS SUPPORTING INFORMATION REQUIREMENTS

- a) This section sets out Council's requirements for the preparation and submission of engineering design and as-built drawings and supporting design details and information.
- b) Engineering design and as-built drawings are required by Council in all instances where works involve any or all of the following: - roading, right of ways, public drains and watermains, and drains of 150mm equivalent diameter or greater.
- c) Each and every plan must be signed by the Designer of the work. The Designer's signature is taken as evidence that the plans have been checked against and comply with Council's current Land Development Manual. Unsigned plans will not be accepted.
- d) Approval of engineering design drawings and as-built plans¹ together with specifications and supporting calculations where requested by Council, is required prior to approval of the survey plan of the subdivision pursuant to Section 223 of the Resource Management Act. This is to show that practical pipeline alignments and legal easements are consistent with each other. For large subdivisions, full Engineering Drawings may be required by Council prior to subdivision consent being granted.
- e) Table 2-1 sets out Council's requirements for any proposed works at the Engineering Plan approval and as-built stages.

Table 2-1 Council's Requirements

	Design Engineering Plan submission	Section 223 and 224 As-Built Engineering Plan submission
Engineering Drawings and As-Builts - hard copies - electronic copies	2 copies If requested	Required If requested
Electronic coordinate and attribute information		1 copy required
Specifications (electronic or hard copies)	2 copies	Changes only
Supporting calculations (electronic or hard copies)	Required	Changes only
Certificates	Design Design Review	Construction Construction Review

¹ As an alternative to as-built plans the Council will accept a letter of confirmation from the DPA confirming that the services covered by easements are installed and completed and are positioned central within the easements shown on the 223 survey plan.

2.4.1 General Format Requirements

- a) The symbols and arrangements shown on SD 201 and 202 shall be used.
- b) The standard approval signature block (SD 201) shall be placed on the bottom right hand side of all plans, with the resource consent number where applicable.
- c) A site location, in the form of a locality plan, including major street names and site identification shall be shown.
- d) Where more than five sheets are involved a title sheet shall be included showing sheet numbers, individual sheet titles and site location plan.
- e) Existing property boundary lines that abut the work and a north point shall be shown as a reference.

2.4.2 Hard Copy Format Requirements

- a) Hard copies of Engineering Drawings are retained by Council as a permanent record of the proposed and as-built assets. The following is required to facilitate scanning of drawings and to ensure that a durable record of the works remains:
 - 1) Two sets of Engineering Drawings shall be submitted on standard A1- or A2- (or A3- with the approval of the Engineering Manager) sized sheets of high quality paper (80 gsm or greater).
 - 2) Final sheets submitted to Council for signing must not be folded or creased.
 - 3) All drawing shall be in opaque black ink (not pencil).
 - 4) All lettering shall be ISOCP, Arial or similar approved font style.
 - 5) Minimum line thickness shall be 0.25mm.
 - 6) A minimum letter height of 2.5mm (including the actual height of lower case text) is required for all data specified by the LDM, in accordance with the relevant section of AS/NZS1100.101.

2.4.3 Electronic Drawing Format Requirements

- a) At the submission of hard copy as built plans the submission of supporting electronic drawing files will be required. Drawing formats for submitted plans shall be one of the following, in order of preference:
 - 1) AutoCAD drawing files along with any other required electronic files;
 - 2) 'DXF' files (dependent on compatibility with the Council system) along with any other required electronic files;
 - 3) Nelson City Council approved LandXml files along with any other required electronic files.
- b) No OLE (Object Linked or Embedded) entities are acceptable, e.g. EXCEL spread sheets "copy and pasted" into the drawing file.
- c) External referencing to image and other DWG files is acceptable as long as the referenced file is supplied with the data.
- d) When requested by the Nelson City Council any support files required by the drawing file (e.g. Text Shape files) shall be provided BEFORE the plans are approved.
- e) Data provided as a drawing file for the purposes of generating contour data, shall be provided as 3D lines and 3D points, to the Nelson City Council datum and one of the Nelson City Council accepted standard coordinate systems.

2.4.4 Electronic Coordinate and Attribute Data Requirements

- a) The supply to Council of electronic coordinate and attribute data is essential for the maintenance of Council's asset management system. The correct supply of this data for all new or modified assets is compulsory. This electronic data shall be submitted at the same time as the hard copy plans. Plans will not be processed until electronic data is supplied. Electronic data should be in the form specified by the template available from Council.
- b) The data supplied must be a complete and accurate representation of the same information shown on the physical Engineering As-built Drawings.
- c) A separate tabulation of all the point coordinates and levels specified in these standards shall be shown on the drawing set as a cross-referenced table. This table will be used to assist in the distribution of the data in hard copy format.

d) Where an electronic file of coordinates is required or supplied the order of preference for the format of the file is as follows:

- 1) Spreadsheet file e.g. Microsoft Excel or similar
- 2) Text file e.g. Tab or Comma (CSV) Delimited Text file
- 3) Document "Table" e.g. Microsoft Word "Table" or similar
- 4) Database file e.g. Microsoft Access or similar

e) The file must be capable of being processed with one of Council's current Microsoft compatible systems and each point (coordinated location) shall appear on a separate line.

f) Each point (EXCLUDING contouring spot heights) will be cross referenced to a point on the HARD COPY plans to clearly indicate the one that it represents.

g) The following format for each point (coordinated location) shall apply:

- 1) Cross reference to location as shown on the plan;
- 2) Easting;
- 3) Northing;
- 4) Level (0.0 if not supplied);
- 5) Invert (0.0 if not supplied);
- 6) Description as applicable.

h) E.g. for a simple text "comma" separated file:

MH3a,2530000.58,5930000.64,14.53,10.25,Sewer Manhole
 SMP3,2530010.63,5930005.62,15.98,10.25,Sump
 MH4a,2530020.58,5930015.24,14.89,10.55,Sewer Manhole

i) E.g. for a simple table or spread sheet file:

MH3a	2530000.58	5930000.64	14.53	10.25	Sewer Manhole
SMP3	2530010.63	5930005.62	15.98	10.25	Sump
MH4a	2530020.58	5930015.24	14.89	10.55	Sewer Manhole

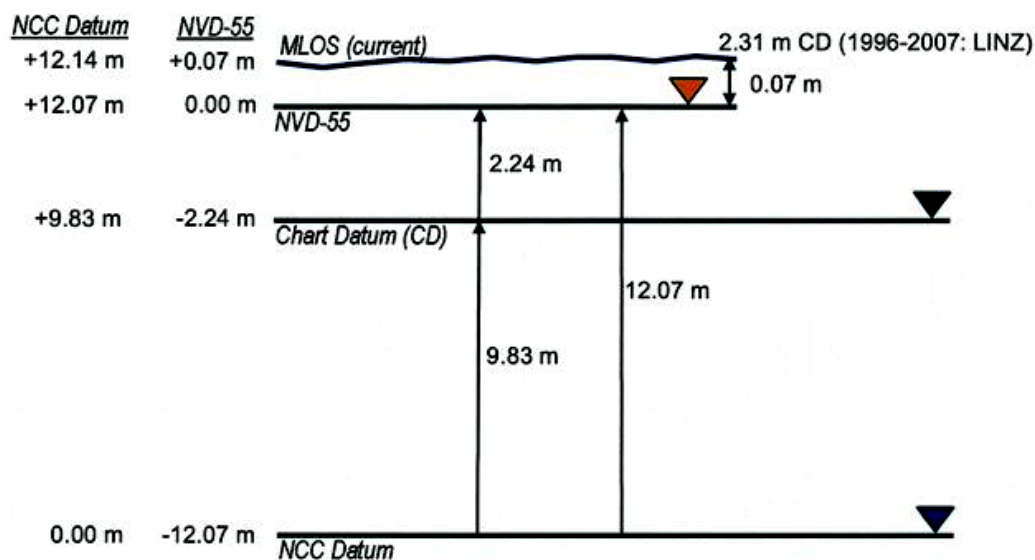
2.4.5 Coordinate and Elevation Standards

a) Easting and Northing coordinates shall be accurate to two decimal places and in terms of the following (in preference):

- NZMG
- Local Circuit (NZGD) 2000
- Local Circuit (NZGD) 1949

- b) The local circuit origin shall be stated on all plans.
- c) The origin of levels and height shall be recorded and accurate to two decimal places, for example "Origin of levels BP11 SO12345 = 4.26 AMSL".
- d) Known benchmarks and survey levels are recorded by Council and are available during office hours.
- e) The NCC Datum, of 9.83 m below the Chart Datum, shall be used. See Figure 2-1.
- f) Nelson City historically defined a drainage datum that was set well below low tide to ensure Reduced Levels were always positive values even for pipe networks in the ground. In recent years (1996-2007), the actual mean level of the sea (MLOS) has been at an average of 12.14 m above NCC Datum or 2.31 m above Chart Datum (CD) as determined by Land Information NZ (LINZ).²
- g) The LINZ local vertical datum, Nelson Vertical Datum-1955 (NVD-55), was set up in 1955 based on sea level measurements from 1939 to 1942. Since that time, sea levels have risen, with MLOS now at 0.07 m relative to NVD-55.

Figure 2-1 Nelson City: conversions between the various local vertical datums.



Not to scale

² <http://www.linz.govt.nz/hydro/tidal-info/tide-tables/tidal-levels/index.aspx>

2.4.6 Orientation of Plans and Sections

- a) Plans shall be orientated with either north or west to the top of the sheet. North point shall always be shown.
- b) In the case where a layout plan and longitudinal section appear on one sheet, the layout plan is to be orientated to suit the longitudinal section.
- c) Plans and longitudinal sections shall have the lowest distance on the left hand side of the sheet. In drainage longitudinal sections, the lowest end of the drain shall be at the lower distance and the plan should be orientated correspondingly.
- d) Cross-sections of a street shall commence at the bottom left hand corner of the sheet and proceed upwards where this is possible.

2.4.7 Scales

Table 2-2 Scales to be used for all Engineering Drawings

1	Consent applications	At recognised scales
2	Location plan	Not less than 1 in 20,000 Not larger than 1 in 5,000
3	Site contours	1:1000 or 1:500 or 1:250 or 1:200
4	Road/Streetworks plan	1:500 or 1:250 or 1:200
5	Longitudinal sections of channels - Horizontal - Vertical	1:500 or 1:250 or 1:200 1:50 or 1:25 or 1:20
6	Cross Sections - Horizontal - Vertical	1:50 1:50 or 1:20
7	Sewer, stormwater and water plans	1:500 or 1:250 or 1:200
8	Longitudinal section - Horizontal - Vertical	1:500 or 1:250 or 1:200 1:100 or 1:50
9	Details	1:20 or 1:10 or 1:5
10	Other services (e.g. streetlights) - Plans - Cross section	1:500 or 1:250 or 1:200 1:50

Note: Longitudinal and cross sections should be drawn at appropriate exaggerated vertical to horizontal scale ratio.

2.4.8 Special Scales

- a) Special scales (other than the above) may be approved by the Engineering Manager for rural areas and special cases, but only on prior application.

2.5 ENGINEERING DESIGN DETAILS REQUIRED

- a) The following plans and drawings of each street are required showing:

- proposed and existing survey lots and Land Transfer (LT) numbers (if known);
- street numbers;
- names of new streets; and
- the location of services, including the necessary manholes, fittings and similar features (on separate plans for each service).

- b) New services shall be located as shown on SD 201, generally along with bench marks and survey mark levels.
- c) The Designer shall make every endeavour to locate existing power and telecommunication services. Where proposed pipes cross under or over existing or proposed services, these services shall be shown on the plan and section with reduced levels.
- d) Plans shall show the location of services in existing streets which abut the subdivisions.
- e) A Traffic Management Plan is required by Council for any work on or immediately adjacent to a public road for works that will or may pose a risk to road users. Council requires demonstration that the consent holder and agents are in compliance with requirements of the Health and Safety in Employment Act 1992.

2.5.1 Earthworks Design Drawings

- a) Earthworks drawings shall be provided and show:

- original and finished contours;
- proposed earthworks (cut and fill);
- erosion and sedimentation control;
- geotechnical engineers input; and
- property boundaries, kerb lines and street names.

- b) A contour plan of the site at an appropriate interval in terms of NCC datum shall be provided for all subdivisions and developments of 0.25 hectares or greater.
- c) Erosion and sediment control must be shown in detail at the Engineering Drawing approval stage.

2.5.2 Road/Street Works Design Drawings

a) A road/street works plan shall be provided and show:

- property boundaries;
- kerbs and channels;
- road/street names;
- footpaths;
- longitudinal and cross sections of the existing ground;
- proposed road/street levels with batters;
- existing and proposed survey bench marks;
- road marking; and
- signs (where relevant).

b) Left-hand and right-hand top of kerb shall be shown separately unless they are identical, in which case this shall be stated.

c) The levels of the proposed services shall also be shown on sections. Longitudinal sections shall extend 40.0m beyond the extent of the works.

2.5.3 Wastewater Design Drawings

a) Wastewater services drawings shall be provided and show:

- wastewater pipes and manholes (in plan and long-section);
- pipe size, length and gradient in long section;
- pump stations;
- stormwater pipes and manholes (for proximity purposes, with a thick line for wastewater and thin line for stormwater); and
- property boundaries, kerb lines and road/street names.

b) Wastewater discharge calculations complying with Council's LDM shall be submitted.

2.5.4 Stormwater Design Drawings

a) Stormwater services drawings will be provided and show:

- property boundaries;
- stormwater pipes, channels, subsoil drains, manholes and structures (in plan and long-section), pipe size, length and gradient in long section;
- secondary flow paths and proposed easements;
- wastewater pipes and manholes (for proximity purposes, with a thick line for stormwater and thin line for wastewater); and
- property boundaries, kerb lines and road/street names.

b) Stormwater drawings submitted for checking shall be accompanied by:

- catchment plans showing all the catchment areas to be served; and
- stormwater discharge calculations for each and every proposed pipe and channel.

2.5.5 Water Supply Design Drawings

a) Water supply services drawings shall be provided and show:

- Water main and fittings;
- pump stations, and
- property boundaries, kerb lines and road/street names.

2.5.6 Streetlighting, Power and Telecommunication Utilities Design Drawings

a) Streetlighting, power and telecommunication utilities drawings shall be provided and show:

- Cables ducts, boxes, pillars, cabinets and substations;
- street lighting; and
- property boundaries, kerb lines, vehicle and pedestrian entrances and road/street names.

b) Power, streetlighting plans may be submitted separately to Council as these are designed by specialists other than the DPA.

2.6 ENGINEERING AS-BUILT DETAILS REQUIRED

a) As-built drawings shall be provided and approved before the 223 certificate pursuant to the RMA is issued. For Council's physical works contracts, as-built drawings are required within 2 weeks of the issuing of the Practical Completion certificate or within an agreed timeframe with the Engineering Manager's approval.

2.6.1 Separate Plans to be Submitted for Each Infrastructural Asset

a) All non-standard structures (eg pump stations, reservoirs, bridges, low impact stormwater devices) shall be shown as an outline and all lids and surface openings shall be shown and separately located. The position of all pipe connections to a structure shall also be located with coordinates and invert.

2.6.2 Earthworks As-built Drawings

a) Where bulk earthworks have been carried out, sufficient additional levels, coordinates and break lines to regenerate contours on earthworks plans at 1.0m intervals shall be provided. The contours are to be shown on an appropriate as-built plan.

- b) Ground level in terms of the NCC datum shall be shown on an appropriate plan at all boundary pegs for all subdivisions regardless of size.

2.6.3 Road/Street Works As-built Drawings

- a) In addition to the road/street works design drawing requirements, as-built plans shall show:

- 1) All kerbing (including traffic islands/traffic calming), channels where separate from kerb, or edge of seal or formed carriageway in the absence of kerbing. Points shall be located at top of kerb, centre of channel or edge of seal and in terms of coordinates and level at changes of type, direction or grade. All curves are to be located using the tangent points and at least one central point on each curve.
- 2) The location and width of footpaths. Locations in terms of coordinates are preferred but are acceptable in terms of offset from boundaries or kerb.
- 3) Road signs in terms of sign type and coordinates.
- 4) Road markings in terms of colour, width, symbol type or text and coordinates. Coordinates shall be positioned at ends and changes of type and/or direction. All curves are to be positioned using the tangent points and at least one central point on each curve. Offsets from the front face of kerb and channel will be acceptable. Road marking symbols need only be positioned to their centres.
- 5) Bridge abutments, piers, carriageway, kerbing and footpaths in terms of outline coordinates and level, as per above specifications.
- 6) New or altered benchmarks and survey standards in terms of coordinates and level in terms of NCC datum. The points shall be clearly defined as either an NCC bench mark (NCC Ownership) or survey standard (LINZ ownership) and shall be levelled/coordinated back to known benchmarks or reference points. The work must be undertaken in accordance with LINZ requirements.
- 7) Any road/street works removed or relocated shall be noted on the plans to the same level of detail as new assets.

Note: Further road construction information, such as the Road Assessment and Maintenance Management System (RAMM) data, as required on the standard form (see Section 4, Transport, Appendix A) and the Streetlight Data Collection Form (see Section 10, Electrical and Streetlight, Appendix E) shall be provided where applicable.

2.6.4 Wastewater As-built Drawings

a) In addition to the wastewater design drawing requirements, as-built plans shall show:

- 1) Material, class and size (diameter, or height and width) and date installed for all assets.
- 2) Manholes, roding points and formed bends in terms of coordinates, lid level, invert level and size and dimensions to lot boundaries where structures are not within a road or ROW pavement area.
- 3) Pump stations, non-standard manholes, underground chambers, storage tanks, intake structures and outlet structures in terms of outline and pipe connection coordinates. Invert levels on all chambers, storage tanks, wet wells, intakes and outlet points.
- 4) Upstream and downstream invert levels on each length of pipeline. At drop manholes the invert is required for both the upper and the lower level entry point.
- 5) Any change in direction, grade or type not located by the above information is to be defined in terms of coordinates and invert level.
- 6) The blank end of pipe laterals or connection point to existing house drains. These shall be in terms of coordinates and reduced level, depth to the blank end from the final ground level and distance from two readily defined permanent points (usually boundary pegs).
- 7) Junction of laterals to mains in terms of coordinates or running distances along mains between surface features.

b) Details of any pump, automated valve, or motor components and electrical control equipment shall be incorporated into four sets of operations and maintenance instruction manuals enclosed in a hard-copy A4 bound folder. The folder shall include as-built plans of the pump station including electrical wiring, operational schematic diagrams, valves, flow meters and the like.

2.6.5 Stormwater As-built Drawings

a) In addition to the stormwater design drawing requirements, as-built plans shall show:

- 1) Material, class and size (diameter, or height and width) and date installed for all assets.
- 2) Manholes, sumps and roding points in terms of coordinates, lid level, invert level and size and dimensions to lot boundaries where structures are not within a road or ROW pavement area.

- 3) Low impact stormwater devices, including detention basins, detention ponds, detention tanks, rain gardens, vegetated swales, soakage structures, filter strips, sand filters in terms of outline.
 - 4) Pump stations, non standard manholes, underground chambers, storage tanks, intake structures and outlet structures in terms of outline and pipe connection coordinates. Invert levels on all chambers, storage tanks, wet wells and intake and outlet points.
 - 5) Upstream and downstream invert levels of each length of pipeline (at node points). At drop manholes the invert is required for both the upper and the lower level entry point.
 - 6) Any change in direction, grade or type not located by the above information is to be defined in terms of coordinates and invert level.
 - 7) The blank end of pipe laterals or connection point to existing house drains in terms of depth to the blank end from the final ground level and measurements from two readily defined permanent points, usually boundary pegs, and as coordinates and reduced level.
 - 8) Junction of laterals to mains in terms of coordinates or running distances along mains between surface features.
 - 9) Subsoil drains in terms of coordinates and invert level at all changes in direction and grade.
 - 10) Watercourses, streams, rivers and secondary flow paths are to be defined by coordinates and levels at the centre line of water course and the top and bottom of both banks.
 - 11) Detention structures (inlet, outlet, spillway, dam crest) are to be specifically surveyed in terms of coordinates and level. Reservoir areas are to be defined by 0.2m contour data to maximum operating level.
- b) Details of any pump, automated valve, or motor components and electrical control equipment shall be incorporated into four sets of operations and maintenance instruction manuals enclosed in a hard copy A4 bound folder. The folder shall include as-built plans of the pump station including electrical wiring, operational schematic diagrams, valves, flow meters together with all other relevant components of the pump station. The plans shall be in a form that can be electronically scanned.
 - c) An operation and maintenance manual is required for all detention dam structures. This manual shall include key design parameters (such as reservoir catchment areas, inflows and reservoir and spillway operation) and ongoing maintenance and dam safety inspection requirements.

- d) Operation and maintenance information may be required for non-standard stormwater components (such as water treatment devices, ponds, wetlands or swales). This information would include any special maintenance or servicing requirements.

2.6.6 Water Supply As-built Drawings

- a) In addition to the water supply design drawing requirements, as-built plans shall show:

- 1) Material, class, type and size (diameter, or height and width) and date installed for all assets.
- 2) Valves and hydrants in terms of coordinates and lid level size and dimensions to lot boundaries.
- 3) Meter boxes in terms of coordinates and lid level and by distance to two adjoining boundary pegs. In addition the meter number and meter reading information is required. Refer to Section 7 Water, Appendix A.
- 4) Manholes in terms of coordinates, lid level size, invert level and dimensions to lot boundaries.
- 5) Water mains and rider mains, in terms of coordinates at any change in horizontal direction or material or type or diameter. Curves are to be located either using the tangent points and at least one central point on each curve or points at regular intervals.
- 6) Pump stations, storage tanks, reservoirs, chambers and non-standard manholes in terms of outline, pipe connection and lid coordinates, lid level and pipe connection tank/wet well inverts as well as floor and overflow levels.
- 7) Any horizontal change in direction or type not covered by the above information is to be defined in terms of coordinates. Curves are to be located using the tangent points and at least one central point on each curve. Offsets from the front face of kerb and channel maybe acceptable.
- 8) Junctions of laterals to mains in terms of coordinates or running distances along mains between surface features.

- b) Details of any reservoir, pump, motor components, automated valve or electrical control equipment shall be incorporated in four sets of operation and maintenance instruction manuals enclosed in a hard-copy A4 bound folder. The folder shall include as-builts, plans of the pump station including electrical wiring and operational schematic diagrams. The plans shall be in a form that can be scanned.

2.6.7 Telecommunication and Power Utilities

- a) Electrical, telephone and other reticulation drawings shall be supplied to the relevant network line operator(s). Council may require evidence from the relevant network line operators that the as-built plans have been received and are fit-for-purpose.

2.6.8 Road/Streetlights

- a) Council will require an as-built plan of all road/streetlights installed and completion of the data collection form (see Section 10, Appendix E) which shall include:

- 1) Location in terms of coordinates.
- 2) Light type, dimensions, wattage and date installed.

2.6.9 Redundant Assets

- a) In addition to new assets, as-built information shall show all existing assets that have been made redundant. The assets shall be marked as either "abandoned" or "removed". Where an existing pipe or asset has been made partially redundant the coordinates and invert of the disconnection point are required.

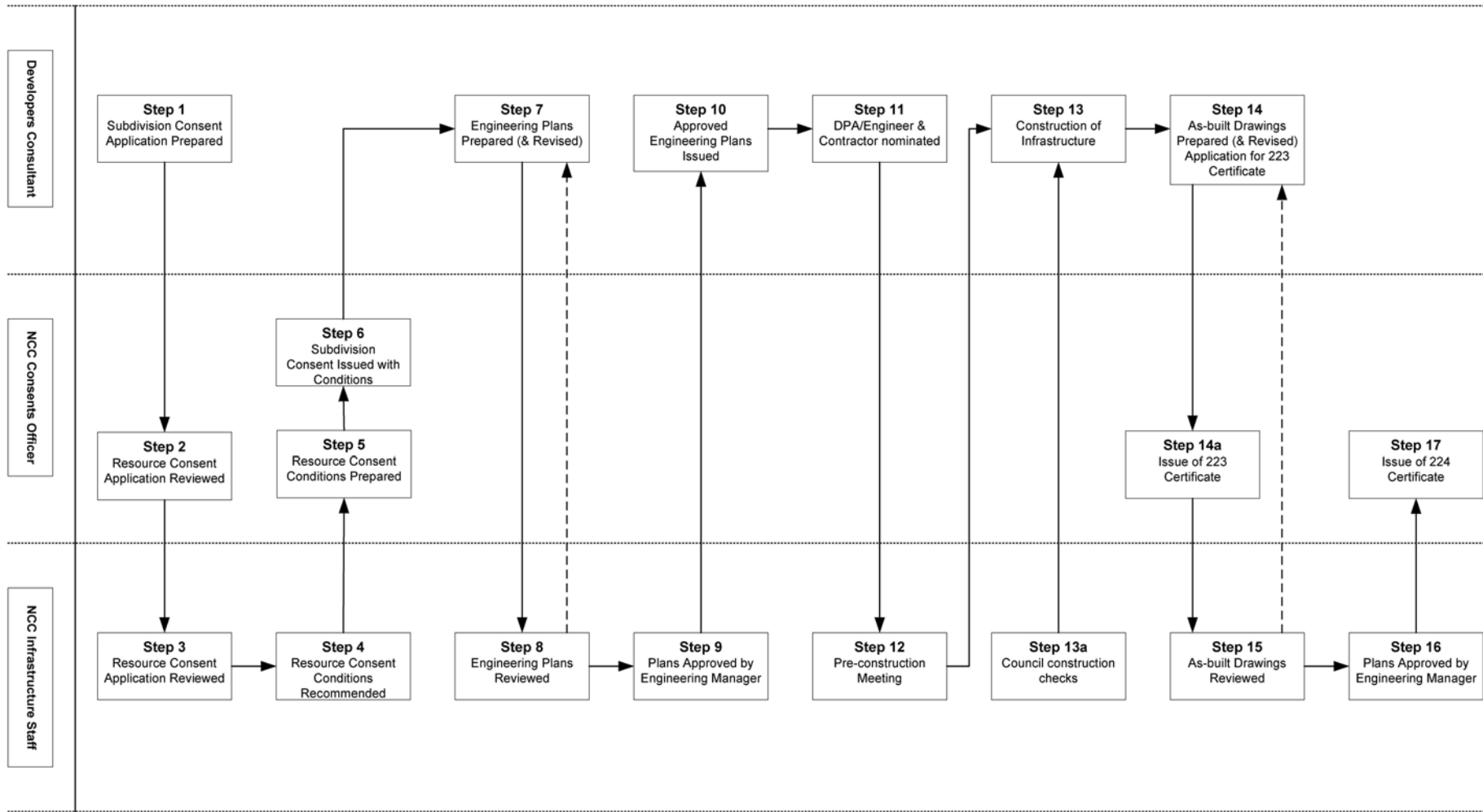
2.6.10 Existing Assets

- a) The location and level of all existing drainage and water services encountered during construction shall be verified and recorded on as-built plans.
- b) As a minimum, at least one asset feature (such as a manhole lid and invert, valve or hydrant lid) adjacent to each new service shall be surveyed and recorded on the as-built plans.

2.7 DISCLAIMER

- a) As-built plans held by Council are to the best of Council's knowledge and information received from DPA's. Council takes no responsibility for inaccurate information or unknown infrastructure found on site.
- b) All contractors, consultants, surveyors, designers and owners have a duty to investigate further and pothole if necessary to verify the position of services.
- c) Council will not be liable for any damages or loss whatsoever suffered from the use of information held by them.

Appendix A Engineering Design Drawing and As-built Drawing Approval Process



All changes to this procedure must be agreed by NCC Engineering Manager and must be notified to the following: NCC Consents Team, All Infrastructure Department Staff, Data Management Co-ordinator. 935322

Appendix B Design Certificate – Land Development/Subdivision Work

ISSUED BY: _____
(Approved certifier)

TO: _____
(Developer/Owner)

TO BE SUPPLIED TO: _____
(Territorial authority)

IN RESPECT OF: _____
(Description of land development/subdivision work)

AT: _____
(Address)

_____ has been engaged by _____
(Consultant/Designer) (Developer/Owner)

to provide _____ services in respect of the land development and/or subdivision work described above.

I _____ have the qualifications and experience relevant to this project as set out herein and have designed the subject works and confirm that the design is to current good engineering practice, and that it satisfies all relevant resource consent conditions, all relevant Nelson City Council requirements and applicable codes and standards. I/My practice holds professional indemnity insurance in the sum of \$ _____ and run-off cover.

(Signature of approved certifier)

(Professional Qualifications)

(Address)

Date _____

RPSurv CPEng
Practice field
Civil Mechanical
Structural Electrical
Geotechnical Industrial
Environmental

Outstanding Works

Appendix C Designer's Check Sheet

NCC Consent No: _____ Date: _____

Site Address:		
Site Legal Description:		
Designer:	Name	
	Address	
Qualification:	Phone No:	
	Fax No:	
Engineer/Surveyor Contact:		
Landowner:	Name:	
	Address:	
	Phone No:	

Place a tick in a box if information is provided, otherwise write NA for not applicable

Reason for Submission:	Subdivision	<input type="checkbox"/>	ROW	<input type="checkbox"/>
	Development	<input type="checkbox"/>	Other	<input type="checkbox"/>
Design Certificate provided		<input type="checkbox"/>		
Drawing Sheet size and number of sheets	A1	<input type="checkbox"/>	A2	<input type="checkbox"/>

Drawing to AS 1100.101 and NCC Standards Section 2.4.

Levels to NCC Datum	<input type="checkbox"/>	Locality Diagram	<input type="checkbox"/>	
Contour Plan	<input type="checkbox"/>	Spot Levels	<input type="checkbox"/>	
Overall Site Plan	<input type="checkbox"/>			
Plans and Sections Road/street works	<input type="checkbox"/>	Power	<input type="checkbox"/>	
	Drainage	<input type="checkbox"/>	Telecommunications	<input type="checkbox"/>
	Water	<input type="checkbox"/>	Earthworks	<input type="checkbox"/>
Sewerage Catchment Plans and Discharge Calculations			<input type="checkbox"/>	
Stormwater Catchment Plans and Discharge Calculations			<input type="checkbox"/>	
Road/Streetworks Pavement Design			<input type="checkbox"/>	
Specific Design – specify aspect:			<input type="checkbox"/>	
Owner's Consent for Work in Private Property			<input type="checkbox"/>	

Appendix D Certification upon completion of Subdivisional Work

ISSUED BY: _____
(Approved certifier)

TO: _____
(Developer/Owner)

TO BE SUPPLIED TO: _____
(Territorial Authority)

IN RESPECT OF: _____
(Description of land development/subdivision work)

AT: _____

(Address)

_____ has been engaged by _____
(Consultant/Designer) (Developer/Owner)

to provide construction observation, review and certification services in respect of the above subdivisional work which is shown on the drawings numbered

NCC _____ approved by _____
(Territorial Authority)

I have sighted the _____ consent and conditions of
(Territorial Authority)
consent to the subdivisional works and the approved drawings.

"I believe on reasonable grounds that the works other than those outstanding works listed below, are complete and have been constructed in accordance with:

- a) The approved engineering drawings and any approved amendments, or as modified by d) below; and
- b) The Council's Land Development Manual; and
- c) Manufacturer's Instructions; and
- d) The resource consent conditions

(Signature of approved certifier) Date _____

(Professional Qualifications)

(Address)

RPSurv

Practice field

Civil

Structural

Geotechnical

Environmental

CPEng

Mechanical

Electrical

Industrial

Outstanding Works

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3. LEGAL RESPONSIBILITY ASSOCIATED WITH COUNCIL ASSETS

3.1 INTRODUCTION

The purpose of this section is to clearly define responsibilities and obligations of any party involved in the design, construction and maintenance of a Council-owned asset, or asset to be vested in Council. In particular it addresses:

- a) Matters concerning training and qualifications of any operator involved in the, construction and maintenance of a Council-owned asset (see section 3.2);
- b) Liability and responsibility for the quality of a Council-owned asset (section 3.3)
- c) Legal and physical protection of an asset in terms of its location, ownership, access and responsibility, whether it is Council-owned or located on Council-owned land (section 3.4).
- d) Standards controlling building work in proximity to or over an underground asset (section 3.5)

3.2 TRAINING AND QUALIFICATIONS

This section sets out minimum requirements for contractors in the construction of assets that will be vested in Council.

3.2.1 Qualifications and Experience

- a) To ensure the highest standard of quality of construction, works carried out on any asset vested or to be vested in the Nelson City Council, contractors must comply with the following standards:
- b) A contractor or the on-site supervisor of the contractor must hold a minimum relevant qualification and training for the proposed design or works in accordance with the Training Requirements Schedule, Table 3-1 and Table 3-2.
- c) For each individual site where there are more than 3 personnel working onsite then one member of the contractor's staff onsite must have an operator (Level 3) qualification or above.
- d) For sites involving multiple works (e.g. subdivision or projects where utility and road works are being constructed and/or sites where more than one contracting company are involved) then one member of the contractor's staff onsite must have a supervisor (Level 4) qualification or above.
- e) Contractors must be suitably experienced in the field of work to be undertaken. Council will request a schedule of qualifications in support of this in advance of any work being undertaken.

- f) Contractors who intend to work on Council's live water reticulation will only be permitted to do so if they are authorised by Council and have submitted the appropriate application and gained approval.
- g) Table 3-1 and Table 3-2 below sets out works usually carried out in the construction of infrastructural assets. Council officers will assess the work involved once engineering plans have been received. Council will then advise the DPA the expected qualifications that a contractor will require to complete the works.

Table 3-1 Qualifications Matrix - National Certificates (*Numbers relate to qualifications listed in Table 3-2*)

Key	Pavement Surfacing	Road Construction & Earthworks	Utilities	Road Marking
Level 5 & 6 <i>Designer Contract Manager</i>	National Diploma in Civil Engineering (Applied) (25)			
	Chipseal Design (1) Hot Mix Asphalt Design (2)	Multi Site Supervision (3)		
Level 4 <i>Supervisor</i>	Single Site Supervision (4)	Civil Plant Management (9)	Civil Construction Supervision (10)	Water Reticulation Supervisor (14)
	Bulk Bitumen Equipment (5)	Agrichemical Application (26)		
Level 3 <i>Operator</i>		Civil Plant Operation (11)	Road Opening Site Co-Ordinator (15)	Horizontal Directional Drilling Controller (17)
	Pavement Surfacing Plant Operation (6)	Asphalt Paving Machine Operation (7)	Civil Plant Operation (Bulk Earthmoving) (12)	Drain Laying (19)
Level 2 <i>Skilled Labourer</i>	Pavement Surfacing Application (8)	Civil Construction Works (13)	Water Reticulation Service Person (16)	Infrastructure Pipe Laying (18)
	General Introductory Skills (GIS) (24)			
Level 1 <i>Basic Skills</i>			Road Opening (Trenching) (20)	

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Land Development Manual 2010
 Section 3 – Legal Responsibility Associated with Council Assets

3

Nelson City Council

Table 3-2 Qualifications Schedule

National Certificate (Numbers in left column relate to qualifications listed in Table 3-1)		Work or issues involved in the construction works
1	Pavement Surfacing Chip Seal Design Level 5	Supervisor or Contracts Manager Specialized Industry in Asphalt
2	Pavement Surfacing (Hot Mix Asphalt Design) Level 5	Supervisor or Contracts Manager Specialized Industry in Asphalt
3	Pavement Surfacing (Multiple Site Supervision) - Level 5	Specialized Industry Skills, Health and Safety, Site Supervision, STMS Bitumen Safety, Specialize in either Asphalt or Chipseal Laying on Multiple Sites
4	Pavement Surfacing (Single Site Supervision) Level – Level 4	Specialized Industry Skills, Health and Safety, Site Supervision Bitumen Safety, Specialize in either Asphalt or Chipseal Laying
5	Pavement Surfacing (Bulk Bitumen Equipment) - Level 3/4	Specialized Industry Skills, Health and Safety. Bitumen Safety, Transporting Materials, Safety, Spraying
6	Pavement Surfacing (Plant Operation) - Level 3	Generic Skills Qualification – Specific to Surfacing Industry Skills, Health and Safety. Bitumen Safety, Truck Driving with Materials, Machinery
7	Pavement Surfacing Asphalt (Paving Machine Operation) - Level 3	Specialized Industry Skills, Health and Safety Paving Machine Operation, Bitumen Safety
8	Pavement Surfacing (Application) - Level 2	Generic Skills Qualification – Specific to Surfacing Industry Skills, Health and Safety
9	Civil Plant Management – Level 4	Specific Industry Skills in Civil Plant Management Management of Plant and equipment
10	Civil Construction Supervisor - Level 4	Supervise Specific Industry Skills, Health and Safety, STMS Coordinate Single or Multiple Sites, Earthworks, Surveying, Consultants, Quality
11	Civil Plant Operations – Level 3	Specific Industry Skills, Health and Safety Machinery Road Construction, Road Maintenance, Culverts and Drainage, Earth Works,
12	Civil Plant Operations (Bulk Earthmoving) – Level 3	Specific Industry Skills, Machinery Operation, Bulk Earth Works
13	Civil Construction Works - Level 2	Generic Skills Qualification – Specific Industry Skills, Health and Safety, Road Construction, Road Maintenance, Culverts and Drainage, Concrete Work, Kerb and Channel, Interlocking Pavers, Retaining Structures, Safety Barriers,

National Certificate (Numbers in left column relate to qualifications listed in Table 3-1)		Work or issues involved in the construction works
		Roadside Amenities, Traffic Signage
14	Water Reticulation Supervisor - Level 4	Specialized Industry Skills, Confine Space, STMS Installing Pipes, Fittings, Dewatering/Pumping Opening and Reinstating, Levels, Testing
15	Road Opening Site Coordinator - Level 3 Qualification being Reviewed	Foreperson or Individual Operator, STMS Coordinate Road Opening Operations, Notify Public of Operations Liaise with relevant parties, STMS, Supervise personnel, Ensure legal standards are met, correct procedures methods and materials are used.
16	Water Reticulation Service Person - Level 2/3	Specialized Industry Skills, Confine Space , Outside the Boundary Replacement, Cleaning, Blockages
17	Horizontal Directional Drilling Site Controller - Level 3	Specialized Industry Skills, Health and Safety
18	Infrastructure Pipe Laying - Level 2/3	Specific Industry Skills, Health and Safety, Electro fusion and Butt Welding, Confine Space, Installing Pipes, Fittings, Dewatering/Pumping Opening and Reinstating, Levels, Testing
19	Drain laying - Level 3	Specialized Skills Inside the Section Boundary
20	Road Opening Trenching - Level 1/2 (Qualification being Reviewed)	Road Opening - Traffic Control, Opening the Surface, Backfilling and Compaction
21	Road marking Skilled Operator - Level 3/4	Specialized Industry Skills, Health and Safety, Supervise Road marking Operations, STMS
22	Road marking (Operator) - Level 3	Specialized Industry Skills, Health and Safety Perform Road marking Tasks
23	Road marking (Assistant) – Level 2/3	Generic Skills for the Trainee - New Trainee into Industry , Health and Safety, Driving, Hazards, Basic Road making Tasks
24	General Introductory Skills – Level 2	Generic Skills Qualification – Basic Industry Skills New Trainee into the Industry
25	National Diploma in Civil Engineering – Level 6	Specialized in Civil Contracting, Local Government and Consulting
26	Agrichemical Application – Level 3/4	General knowledge of applying, transporting and managing agrichemicals.
27	Health and Safety – Level 3	Specific knowledge of safety and emergency response.

Note: Some courses may not be available at the time of writing but will be during the life of this document.

3.3 LIABILITY

3.3.1 Information

The following sets out matters of liability and responsibility for any works involving an asset that is vested in or is to be vested in Nelson City Council ownership.

- a) The Developer is responsible for complying with all statutes, standards, regulations, bylaws, requirements and obligations. The Developer is also responsible for giving all notices, obtaining all necessary consents and providing for the protection of other property from damage resulting from the development works.
- b) Plans held by Council are the best to their knowledge. Council takes no responsibility for inaccurate information or unknown infrastructure found on site.
- c) Council will not be liable for any damages or loss whatsoever suffered from the use of information held by Council.
- d) All contractors/consultants must undertake other (such that there is a duty) field investigations that are necessary for surveyors/designers/owners etc to investigate fully/pothole to verify designs and correct positions of services etc.
- e) The consent holders, their employees, contractors and agents are responsible for physically locating the position of pipes and other utilities and infrastructure before commencing works.

3.3.2 Indemnity

3.3.2.1 General

- a) All Designers or DPA's must have current professional indemnity insurance for an amount not less than two hundred thousand dollars (\$200,000) with run-off cover of at least two years.
- b) Any contractor/operator undertaking excavation and reinstatement works within the road reserve shall hold public liability insurance for an amount not less than two million dollars (\$2,000,000) for any claim or series of claims arising out of the same occurrence.
- c) Compliance with any instruction of Council, or any person acting on its behalf, in performing what is considered to be necessary actions in terms of these standards shall not absolve the contractor from any legal liability that he would otherwise have had in regard to claims for damage or failure of work for the client.
- d) The Council shall not be held liable for a loss of income due to construction works or loss of services while Council's contractors or agents work on programmed works.

3.3.2.2 Excavation and Reinstatement works within legal road

- a) The contractor/operator will be held responsible for any street maintenance work required as a result of the excavation and reinstatement operations until twenty four (24) months after notification to the Council that the final surfacing material has been applied.
- b) Any such maintenance work required by Council shall be undertaken by the operator at the operator's cost within five (5) working days of being notified by the Council to undertake repair works. If on the grounds of safety there is a need for more immediate action this remedial work shall be completed within forty eight (48) hours or such other time as may be directed by the Council. Should this not be complied with, Council reserves the right to arrange or undertake such maintenance work and this work shall be at the cost of the Operator.
- c) See Section 8, Trenching and Reinstatement of the LDM for further details.
- d) For infrastructure, the Developer shall retain responsibility for addressing defects arising from poor workmanship or faulty materials during the required maintenance period.

3.3.3 Performance Bonds

The Developer shall provide a performance bond for unknown construction or design defects in cash or from a bondsman such as a registered bank (as defined in section 2 of the Reserve Bank of New Zealand Act 1989) or insurance company or other approved company, and meet the following conditions:

- a) The bond shall apply to all subdivision or development construction works involving three or more additional lots or three new residential sites or where roads or services are to be vested in the Council.
- b) The bond for maintenance shall be for the sum of \$1,300 per lot or residential site from a minimum of \$3,900 to a maximum of \$26,000.
- c) The term of the performance bond for defects liability shall be for a minimum period of twenty four (24) months from the satisfactory completion of the works (for contracts), or the issue of a 224 certificate as required under the RMA. Note: a maximum term of five (5) years may be imposed for low impact stormwater designs.
- d) The performance bond for defects shall cover maintenance attributable to defects and the remedy of all defects arising from defective workmanship or materials. This shall cover the services and roading construction works that are to be vested in the Council and other civil and structural engineering construction works to serve the subdivision or development and including electrical supply and telecommunication cable systems.

- e) The Developer/consent holder shall be liable for the remedy of all asset defects arising before the end of the period of maintenance, together with Nelson City Council costs in administering the bond. The developer will not be liable for Damage by third parties.
- f) In the event that such a defect arises the Developer shall be advised and, provided that the remedial work is not classified as urgent, given the opportunity to address the defect. Where urgent work is required to maintain service or where work on a 'live' system is required it shall be carried out by Council's contractor at the Developer's cost.

The performance bond for maintenance shall not be required to cover general earthworks but shall be required to cover earthworks considered to be part of the civil engineering construction.

3.3.4 Delegations

The Council has the authority to enforce the provisions of the Land Development Manual and may delegate such authority to any officer of Council or its nominated consultant.

3.3.5 Engineering Manager's Discretion

- a) The Engineering Manager's decision on the interpretation of any aspect of the Land Development Manual is final.
- b) On application to the Engineering Manager for an alternative design, full supporting information shall be provided. This shall include all advantages and disadvantages of the proposal.
- c) Council's interests will concentrate on the long-term public benefits to the ratepayer and limited maintenance costs for the future, rather than a short-term benefit for private individuals or Developers.

3.4 OWNERSHIP AND LOCATION OF SERVICES AND RETAINING WALLS

This section deals with the location of services, and ownership responsibilities associated with all and any part of the service on privately-owned land, or privately-owned services on Council-owned land.

3.4.1 Services on Public Land

Stormwater, water supply and wastewater reticulation shall be located in accordance with the following general requirements:

- a) The preferred location of services to be vested in Council is on Council-owned land;
- b) All services shall be aligned in accordance with the requirements of each section of this document.
- c) All services shall be easily accessible for maintenance and repair works, so as to minimise disruption during excavation.

- d) Diagonal crossing of other services, including kerb lines and boundaries or fence lines, at acute angles less than 45 degrees shall be avoided wherever possible.
- e) A minimum of 200mm vertical separation distance to all other underground services is required.
- f) Must meet the specific conditions of Table 3-3.

Table 3-3 Location of services

Service	Drawing or Standard Reference	Requirements
Stormwater	<p>The extent of the Council's responsibility for public stormwater is defined in NCC Drainage Ownership Policy.</p> <p>Both primary and secondary stormwater systems shall be physically and legally protected.</p> <p>Direct connection of a stormwater pipe into the wastewater system is not permitted under any circumstances.</p> <p>Secondary flow paths shall be identified in all instances and located (in preference) in:</p> <ul style="list-style-type: none"> • roads/reserves • public land, or • private land (protected by suitable easements/consent notices, and on a limited basis). 	<p>Design of overland flow paths through private property will generally not be permitted in new developments.</p> <p>Where a flow path is approved through private property it shall be clear of building sites and protected by an easement in favour of Council or private landowner and a consent notice which prohibits ground reshaping and the erection of barriers or any features that may compromise the functioning of the secondary flow path system.</p> <p>Ponding and overland flow on roads is permitted for storm events exceeding 6.67% and 2% AEP for piped and major streams respectively. Light vehicles shall be able to pass along the road in a 50 year ARI event, and large 4WD in a 100 year ARI event.</p>
Water supply	See SD 414 and 415.	See SD 701 for private connections to properties and meter and lateral location requirements for water services.
Wastewater	<p>The extent of the Council's responsibility for public wastewater is defined on SD 601.</p> <p>Sewer mains shall be aligned within public areas such as roads wherever possible.</p> <p>Sewers in roads shall be aligned parallel to kerb lines within and near the centre of the carriageway to ensure that they do not clash with other services or occupy the full carriageway width.</p> <p>Adequate clearance from other services and kerb lines shall be maintained to allow for: excavation on existing services; the future relaying of the drains; the provision of additional future services.</p>	<p>To be classified as a public wastewater sewer a line must have been inspected, approved, and designated as such by Council. (Council responsibility does not extend to private pumping systems and rising mains which remain the responsibility of the users they serve).</p> <p>Minimising the possibility of surface water infiltration of the wastewater system by ensuring that surface openings are not located in flood routes.</p> <p>Wastewater manholes shall not be located with the manhole cover closer than 2.0m from the channel or edge of seal (in the carriageway) or at low points in the finished ground surface, i.e., secondary flow path or ponding areas.</p> <p>In curved roads, sewers shall generally follow the road alignment in straight lines between manholes on such alignment that they do not occupy the full carriageway width.</p>

3.4.2 Services on Private Land

The preferred location of services is on public land. However, this cannot be achieved in all circumstances, due to the location of existing infrastructure networks, land ownership and the topography of the landscape. The following matters guide the placement of services on private land:

a) Where services are to be located on private land, consideration shall be given to:

- 1) Preserving access to the pipelines for maintenance purposes;
- 2) Preserving the route for relaying services in the future; and
- 3) Avoiding likely positions for buildings, garages, carports and retaining walls.

b) The preferred alignments of piped reticulation on private property shall be:

- 1) Within rights-of-way (ROWs) or driveways;
- 2) Outside probable building envelopes;
- 3) Clear of fence lines and kerb lines;
- 4) Clear of large trees or heavily vegetated areas;
- 5) Adjacent to boundaries;
- 6) Parallel to boundaries.

c) Where a service is located on private land access for repairs and maintenance shall be maintained, and the following conditions met:

- 1) An easement shall be required in favour of the Council, where as part of a subdivision or development proposal, pipes less than or equal to 300mm diameter will be located in private property. The minimum width of easement shall be 2.0m with the pipe placed central within the easement. For pipes greater than 300mm diameter the minimum width of easement shall be 3.0m plus the pipe diameter (i.e. 1.5m either side of the pipe).
- 2) The standard wording required on engineering plans in the "notes" section, shall be: "Memorandum of Easement in Gross shall be provided in favour of Nelson City Council to convey stormwater and/or wastewater in a pipe and to provide unrestricted access along the line of the pipe for maintenance and renewal work and to protect secondary flow paths".
- 3) Similar easements may be required over private common drains in favour of the lots served.

4) Pipelines deeper than 2.5m may require easement widths greater than 3.0m plus pipe diameter to allow for wider than normal trench widths needed to access the pipe in the future.

d) Where any construction work is required on another property, the owners consent shall be endorsed on the original drawing in opaque black ink (not biro) that will permit satisfactory scanning reproduction.

3.4.3 Drainage of Right-of-Way (ROW) Driveways

The Designer shall design a stormwater control method such that the primary stormwater flows are prevented from discharging:

a) Across the footpath (existing or proposed) where the ROW falls towards the road/street and the right of way area is greater than 20m².

b) Across private property where the ROW falls away from the road/street, or at any low point within the ROW.

3.4.4 Private Wastewater Pumping Stations

Private pumping stations should be avoided where possible. Where, due to topography or other circumstances it is not practical or possible to provide a gravity system, Council may give approval for a private pumping station provided it complies with the specific design criteria as follows:

a) Properly designed wet well pumping stations with macerator pumps servicing industrial/commercial sites which employ permanent staff capable of ensuring that adequate maintenance is carried out.

b) Adequate emergency procedures and storage shall be established which precludes the possibility of uncontrolled overflow, e.g. power failure, pump failure.

c) Separate power supply and meter board is provided.

d) Self-contained miniature pumping systems may be approved providing the pump is only to serve a secondary amenity on a lot where the primary service shall be a gravity sewerage system.

e) Any private pumping station and rising main remains the responsibility of the users and shall be located entirely on private property, i.e., discharge to gravity lateral at the boundary. This may require an appropriate odour control system to be installed at that point.

3.4.5 Retaining Walls and Structures

a) Retaining walls and structures required for the primary purpose of retaining/supporting the road (including footpaths and berm areas) shall be positioned entirely within legal road.

- b) Retaining walls and structures required for the primary purpose of retaining/supporting private land adjacent to the road shall be positioned outside of legal road reserve and entirely within the private property that it is retaining.

3.5 STRUCTURES ALONGSIDE OR OVER SERVICES

3.5.1 General

Building over or alongside any Common-Private or Public drain or watermain is only a Permitted Activity if it complies with the rules in the appropriate zone section of the Nelson Resource Management Plan.

The engineering requirements for building over or alongside drains or watermains are as follows:

a) Structures

- 1) Must be located no closer than 1.0 metre measured horizontally from the near side of any public or common private pipe or drain where the pipe or pipe equivalent (in the case of a drain) is less than or equal to 300mm in diameter.
- 2) Must be located no closer than 1.5 metres measured horizontally from the near side of any public or common private pipe or drain where the pipe or pipe equivalent (in the case of a drain) is greater than 300mm in diameter.
- 3) May overhang the line of the pipe or drain, provided the structure is cantilevered or is an eave and the height to the underside of the structure above ground level is not less than 1.8m.
- 4) Which are located within 3 metres measured horizontally from the outside of the pipe or drain must have the base of the foundations deeper than a line drawn at 30 degrees from the horizontal from the invert (bottom) of the pipe or drain (or between 30 degrees and 45 degrees if the design has been certified by a suitably qualified engineer).

b) Carports may be constructed over pipes or drains provided that:

- 1) The foundations are located in accordance with b) 4) above; and
- 2) The fixture to the ground/floor is a bolt-down type design which permits quick and easy removal of the structure; and
- 3) The carport is not closed in; and
- 4) The floor is not concreted to a depth greater than 150mm; and

5) An encumbrance is registered on the certificate of title for the property acknowledging the location of the pipe or drain under the building and reminding future owners that rules (2), (3) and (4) (above) apply and that access to the pipe or drain for maintenance and repair (and reinstatement afterwards) must be made available at the building owner’s cost.

c) As an alternative to (a) and (b) above, structures may be located over common private or public drains or pipes (but not pressurised pipes), if they comply with Table 3-4.

Table 3-4 Acceptable Techniques for Building over Pipes or Drains

Technique A Applicable in the following zones: Industrial, Suburban Commercial, Open Space and Recreation, and Inner City	Technique B Applicable in the following zones: Industrial, Suburban Commercial, Open Space and Recreation, Inner City, and Residential
Structures may be located over common private or public drains or pipes, if:	Structures may be located over common private or public drains or pipes, if:
<ul style="list-style-type: none"> • There are no changes in direction or junctions in the portion built over; and • The pipe is proven to be in good condition by internal inspection or a water test; and • The floor is constructed with lift out sections, and all foundations are designed to allow the entire drain or pipe to be readily exposed for maintenance and replacement work; and • Where the diameter of the pipe is 300mm or less, the design and use of the structure is such that an appropriate sized excavator could readily gain access along the line of the pipe for maintenance and replacement work, or appropriate access is available for hand digging; or • Where the diameter of the pipe is greater than 300mm, the design and use of the structure is such that a 12 tonne excavator and truck could readily gain access along the line of the pipe for maintenance and replacement work. 	<ul style="list-style-type: none"> • The diameter or width of the pipe is 150mm or less; and • The length of pipe built over is no more than 6 metres; and • There are no changes in direction or junctions in the portion built over; and • The length of pipe built over is relaid using a continuous length of pipe without joints, sleeved inside a 225mm diameter class 4 concrete pipe; and • There is practical access and the foundations are designed to allow the pipe to be readily exposed at both ends of the sleeve for maintenance and replacement work; and • There is a minimum 6-metre clear length at one end of the sleeve to allow replacement of the pipe.
<ul style="list-style-type: none"> • Detailed Engineering Drawings of the proposed work are required. 	

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4. TRANSPORT

4.1 INTRODUCTION

- a) The purpose of this section is to provide guidance for the design of transport infrastructure that represents best-practice urban design principles and engineering standards.
- b) This section of the manual covers three main aspects of transport network design:
 - 1) Transport Network.
 - 2) Road Design.
 - 3) Construction.
- c) 'Transport Network' illustrates the multitude of functions roads provide for a diverse range of users. It identifies principles for designing a transport network to accommodate the different functions roads perform and how to provide for the convenient, safe and efficient movement of various user groups.
- d) 'Road Design' identifies design principles and specifies parameters for roads to achieve the objectives sought from both individual roads and the wider transport network for all user groups. It recognises the importance and value of roads as public places and environments in which a range of infrastructural services are located.
- e) 'Construction' specifies engineering standards that apply for the construction of particular aspects of transport infrastructure. Appropriate construction standards are essential to ensure that Council's assets are constructed to an appropriate quality. These standards allow for cost-effective and long-term benefits that consider environmental effects and optimise efficiency of Council's financial investment.
- f) It is important that the reader understands that the information presented in this section of the Land Development Manual applies to new roads only, except where it is explicitly noted otherwise. However, the design principles and guidance is useful in formulating upgrades to existing roads.

4.1.1 Objectives

These general objectives guide Council in developing standards that deliver an affordable, integrated, safe, responsive, and sustainable land transportation system.

4.1.1.1 Transport Network

- a) To provide a managed transport network that clearly distinguishes between the different functions and operating characteristics of roads within the transport network.
- b) To provide a permeable, connected and attractive transport network that encourages walking and cycling and minimises the number of short vehicle trips.
- c) To provide a transport network that is efficient, affordable, legible, minimises travel time, supports access to public transport and contributes to limiting fossil fuel use.
- d) To provide acceptable levels of safety, security and convenience for all road users.
- e) To provide convenient linkages to citywide points of attraction and to local facilities both within and to adjacent neighbourhoods.
- f) To provide a transport network that serves the needs of the community as a whole and specifically those people that may be transport disadvantaged.
- g) To provide a safe, convenient and legible walking (and cycling) network that meet the needs of both able (and experienced) and less able (less experienced) users, including on-road and off-road routes.
- h) To optimise the accessibility of the transport network, especially by sustainable transport modes to key facilities such as centres, schools, local shops, bus stops, and recreational opportunities.
- i) To recognise the existing role of the private motor vehicle and the transition to more sustainable transport modes over time.

4.1.1.2 Road Design

- a) To enable a range of design solutions that support the functional and operational objectives of the transport network.
- b) To identify and reference best-practice documents that enable innovation with design matters.
- c) To provide a high level of public amenity within the road that reinforces the importance and value of roads as public places.
- d) To enhance personal security by designing roads and linkages taking into account the principles of Crime Prevention Through Environmental Design (CPTED).
- e) To design the transport network appropriately to accommodate people that are less able or vulnerable, such as those with mobility and visual disabilities.

- f) To design roads that promote mobility and accessibility by modes in addition to private motor vehicles.
- g) To facilitate the slower movement of motor vehicles in residential neighbourhoods.
- h) To encourage development that is sympathetic to local topography and environmental constraints.
- i) To minimise the visual and environmental impacts of roads in 'Hillside Environments' through appropriate design.
- j) To minimise the extent of earthworks for road construction in 'Hillside Environments'.
- k) To provide appropriate levels of on-road and off-road parking.
- l) To design roads to accommodate a range of utility services.
- m) To design a road edge that is sensitive to the context in which it is located.
- n) To provide for the design of stormwater run-off from paved areas within the road environment.

4.1.1.3 Construction

- a) To construct a cost-effective transport network at a minimum whole of life cost to the community.
- b) To provide a carriageway surface that is durable and safe.
- c) To minimise environmental impacts

4.1.2 Key References

- a) Table 4-1 sets out the Standards and guidelines that apply to the design and construction of the transportation network. The requirements of these documents shall prevail except where modified by the Land Development Manual. Where an Act or Standard is referenced this shall be the current version including any associated amendments.

Table 4-1 Referenced Standards and Guidelines for Transport

Number/Source	Title
AS/NZS 1170:2002	Structural design actions
AS/NZS 2009:2006	Glass beads for pavement-marking materials
AS/NZS 2890.1:2004	Parking facilities – Part 1: Off-street car parking
NZS 3108:1983	Specification for concrete production – ordinary grade
NZS 4402:2006	Methods of testing soils for civil engineering purposes
NZS 4404: (<i>latest version</i>)	Land Development and Subdivision
NZS 4431:1989	Code of practice for earthfill for residential development
Austroads	Guide to Traffic Management: Part 6 – Intersections, Interchanges and Crossings
	Guide to Traffic Management: Part 8 – Local Area Traffic Management
	Guide to Traffic Engineering Practice: Part 14 – Bicycles
	A Guide to the Structural Design of Road Pavements' (1992).
New Zealand Transport Agency	Pedestrian Planning and Design Guide
	NZ Supplement to Austroad's Guide to Traffic Engineering Practice: Part 14 – Bicycles
	Manual of Traffic Signs and Markings (MOTSAM) Part I – Traffic Signs & Part II – Markings
	Road and Traffic Guideline RTS 14 'Guidelines for facilities for blind and vision-impaired pedestrians'
	Economic Evaluation Manual
	M23 Notes 'Notes for Road Safety Barrier Systems' (2009)
	NZTA F/1 (1997) Earthworks Construction
	NZTA F/2 (2000) Pipe Subsoil Drain Construction
	NZTA F/3 (2000) Pipe Culvert Construction
	NZTA M/1 (2007) Roding Bitumens
	NZTA M/4 (2006) Basecourse Aggregates
	NZTA M/6 (2004) Sealing Chip
	NZTA M/10 (2005) Asphaltic Concrete
	NZTA M/13 (1989) Adhesion Agents
	NZTA P/3 (1995) First Coat Sealing
NZTA P/9 (1975) Construction of Asphalt Concrete Paving	
Transit Bridge Manual	
Nelson City Council	Safer By Design (CPTED) Guidelines

4.2 TRANSPORT NETWORK

4.2.1 General

- a) The planning and design of a transport network requires consideration of the movement of current and future road users, the provision of access to property and the valuable and unique areas of community space that roads provide.
- b) At a planning level, these aspects must be considered together to achieve desirable outcomes for those moving through and within the transport network and the broader community, including residents and business.
- c) Thoughtful planning of a transport network is extremely important. The location of roads within our communities exist for a very long time, usually much longer than adjacent activities. So the way roads are laid out and how they relate to the surrounding buildings and places has a great impact on the amenity they provide and their long-term functional success.
- d) An attractive and connected transport network can achieve a number of positive outcomes, including:
 - 1) Encouraging more people to walk and cycle to local destinations, thus improving their health and reducing reliance on the private motor vehicle as a form of transport;
 - 2) Reducing vehicle movement reduces energy use and pollution and provides a safer and more efficient environment for the movement for all modes of transport;
 - 3) Enabling the transport network to be more responsive and more ready to adapt to changes or intensification to land use over time; and
 - 4) Generating more activity on the roads which leads to improved personal security, slower vehicle movements and more chance meetings. The latter strengthens communities and encourages a sense of pride in local environments.
- e) A well designed transport network thus has a crucial part to play in the delivery of sustainable communities.

4.2.2 Road Functions

- a) While roads serve a large number of functions, 'Place' and 'Function' are the principal functions that will determine the character of a road.

4.2.2.1 Place

- a) The sense of 'Place' is fundamental to a richer and more fulfilling environment. It comes largely from creating a strong relationship between the road and the buildings and spaces that frame it.
- b) An important guiding principle of the 'Place' function is that roads should be fitted around significant buildings, public spaces, important views, topography, sunlight and microclimate.
- c) A sense of place encompasses a number of aspects, most notably the road's:
 - 1) Social Space - refers to places for people to be and can include seating areas, informal stopping areas with space for people to linger and space for children to play.
 - 2) Amenity Space - refers primarily to visual amenity and can include landscaping, street trees and other features, as well as buildings and the interface with private space.
 - 3) Local Distinctiveness - refers to whatever makes the road different from elsewhere. It can include aspects such as road alignments, public art, distinctive stormwater management or the retention of historic trees.
- d) The most important 'Places' will usually be near the centre of any community, but important 'Places' will also exist along arterial routes, in district centres, local centres and within neighbourhoods.

4.2.2.2 Movement

- a) Providing for the movement of people and goods along a road is vital, but it should not be considered independently of the road's other functions. Walking and cycling are important modes of travel, offering a more sustainable alternative to the car, making a positive contribution to the overall character of a place, public health and to tackling climate change through reductions in carbon emissions.
- b) Movement status can be expressed in terms of traffic volume and the importance of the road, or section of road, within a network – either for general traffic or within a mode specific (e.g. bus or cycle) network. It can vary along the length of a route, such as where a road passes through a town centre.

4.2.3 Road Hierarchy

- a) The transport network is a system of interconnected road links that provides for the movement needs of people and goods, property access and servicing needs. The role of each road within the transport network needs to be well defined to enable

appropriate construction of new roads and upgrade of existing roads and overall management of the transport system.

- b) The functions of any road within a transport network may be broadly classified in terms of desirable performance outcomes that are based on the influence of the adjacent environment, the level of access and movement objectives for all user groups. The relative importance of these aspects varies in response to the role of each road in the wider network.
- c) One method of defining the role of each road is to identify a functional hierarchy of roads in a network. Properly developed, a functional hierarchy is a powerful planning tool that will assist decision making of activities including, but not limited to the following:
 - 1) Network planning
 - 2) Traffic management
 - 3) Access management
 - 4) Land use consideration
 - 5) The extent and design of facilities for general traffic, public transport, walking and cycling
- d) The functional hierarchy is determined by grouping roads according to the character of operation that is desired.
- e) Policies for these operational and management needs can be usefully and directly tied to the functional hierarchy. Once defined the functional hierarchy will inform the physical characteristics of the road for design purposes and the type and location of facilities suitable to accommodate public transport, walking and cycling.
- f) There are a number of benefits in providing a transport network that reflects a functional hierarchy because it:
 - 1) Encourages appropriate traffic speeds and operating conditions across the various elements of the transport network.
 - 2) Results in the easier organisation and management of the transport network.
 - 3) Improves the overall safety of the transport network.
 - 4) Provides an opportunity to address land use and/or transport deficiencies from a number of land use or transport investment perspectives.

- g) Travel is an activity derived from land use. The structure of land use is a major determinant in the type and scale of travel that occurs on individual road links. As the hierarchy is directly related to the travel function it follows that the hierarchy will be highly influenced by the structure of the land use it serves. However, if the land use structure is ill-defined or inappropriate, the resulting pattern of travel is likely to become complex and potentially could undermine the road function and its operational and amenity objectives.
- h) Transport networks accommodate two types of traffic movement namely;
 - 1) Traffic with direct business in, or having a direct relationship with an area being considered. These movements include access to, or circulation within, an area.
 - 2) Traffic that has no direct business in, or relationship with, the area under consideration. These movements are generally referred to as "through traffic".
- i) The general road hierarchy adopted by the Nelson City Council listed in descending order of importance for through traffic and ascending order of importance for property access is: State Highway, Arterial Road, Principal Road, Collector Road, Sub-Collector Road, Local Road, Residential Lane, Service Lane, Private Way and Accessway. The management of State Highways is the responsibility of the New Zealand Transport Agency.
- j) The inter-relationship of the road hierarchy is schematically illustrated in **Figure 4-A**.

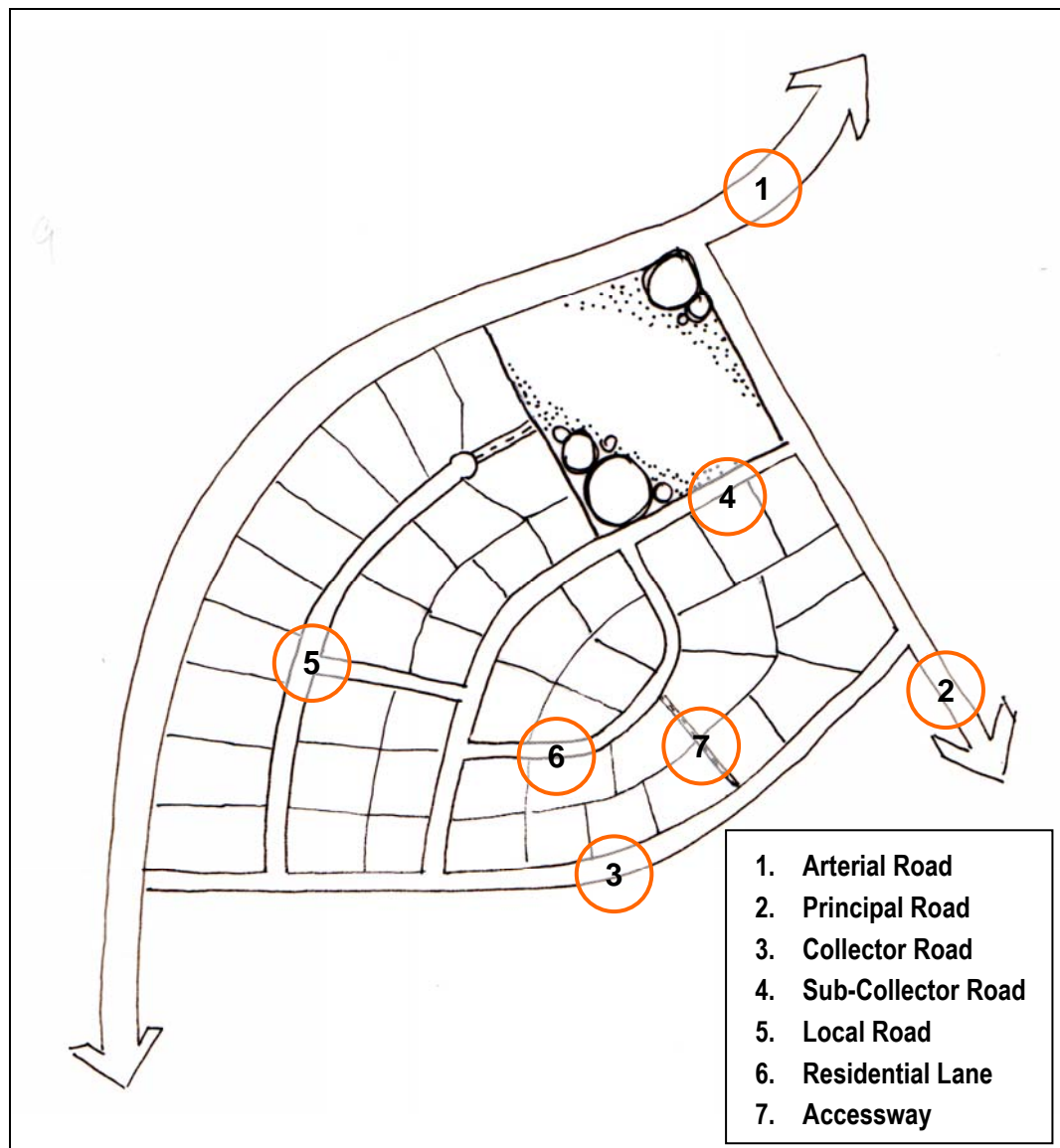


Figure 4-A Inter-relationship of Road Hierarchy

4.2.3.1 Hierarchy Groupings

- a) **Definition:** For the purposes of the Land Development Manual roads with a hierarchical classification of Arterial, Principal and Collector are grouped and termed 'Classified Roads'. Conversely, Sub-Collector Roads, Local Roads and Residential Lanes are grouped and termed 'Unclassified Roads'.

4.2.3.2 Arterial Roads

- a) Arterial roads typically join centres of population within regions and neighbouring regions and provide links to the higher order State Highway network.

- b) Efficient mobility along the corridor is the principal function of Arterials with access to adjacent land being a subordinate function. Arterial roads are constructed and managed to minimise their local access function.
- c) Arterial roads will accommodate a variety of trip lengths.

4.2.3.3 Principal Roads

- a) Principal roads typically connect and augment the higher order transport system. As such, these roads often link adjacent suburbs, smaller centres of population and facilitate movement to and access of major attractors and industrial areas.
- b) Principal roads have multiple functions of moving people and goods efficiently whilst also providing access to major employment areas and attractors and movement across corridors. The function of mobility should not dominate the management of the corridor to the detriment of access to adjacent land use. Likewise, whilst acknowledging the importance of access to adjacent land use, the effects of traffic generated by adjacent land use shall not detract from the mobility function of the corridor.
- c) Principal roads will tend to accommodate short to medium length trips associated with through traffic and local traffic. There is increasing number of trips associated with public transport, walking and cycling.

4.2.3.4 Collector Roads

- a) Collector roads distribute traffic between and within local areas and form a link between higher order (Principal and Arterial) roads and lower order (Sub-Collector and Local) roads.
- b) The main functions of Collector Roads are to accommodate local traffic and provide access to adjoining property. In the urban area, collector roads usually have predominantly residential frontage and will often contain the bus routes within the neighbourhood.

4.2.3.5 Sub-Collector Roads

- a) Sub-Collector Roads distribute the vehicular traffic at a neighbourhood level and form the link between Collector roads and Local roads. A high proportion of traffic on these roads has an origin or destination within the immediate area.
- b) In residential areas, Sub-Collector Roads provide high levels of amenity and prioritise access to adjoining property over local traffic movements. Through traffic is not a desired outcome for Sub-Collector Roads.

4.2.3.6 Local Roads

- a) Local Roads have the primary function of providing direct access to properties fronting the road and along which only traffic having an origin or destination there will travel. Pedestrian and local amenity values are predominant.
- b) Local Roads provide an environment where pedestrians and cyclists can mix with vehicular traffic, so that the road becomes a useable public space.

4.2.3.7 Residential Lanes

- a) Residential Lanes are public roads that provide access for between 7 and 25 residential units.
- b) Residential Lanes have the appearance of a Private Way to discourage use by non-local vehicular traffic. Vehicular and pedestrian access to frontage properties is the key function.

4.2.3.8 Service Lanes

- c) Service lanes are for the purpose of providing side or rear access for vehicular traffic to land from 'Classified Roads' in industrial or commercial areas. When their construction has been completed they may be made into private rights of way.
- d) No parking or separate pedestrian facilities are required to be provided.

4.2.3.9 Private Ways

- a) Private ways include rights of way, access lots and private driveways and are for providing access over private land to private property.
- b) Access to private residential areas can only serve up to 6 potential residential units. If there is potential for more than 6 residential units then a private access is inappropriate and access should be taken from a public road.

4.2.3.10 Accessway

- a) An Accessway is a path providing non-motorised access between two or more public roads or between a road and a reserve. This is schematically illustrated in **Figure 4-B**.
- b) An Accessway may service a number of properties along its length.
- c) Refer to Section 12 'Reserves' of the Land Development Manual for information related to accessways linking roads to reserves.

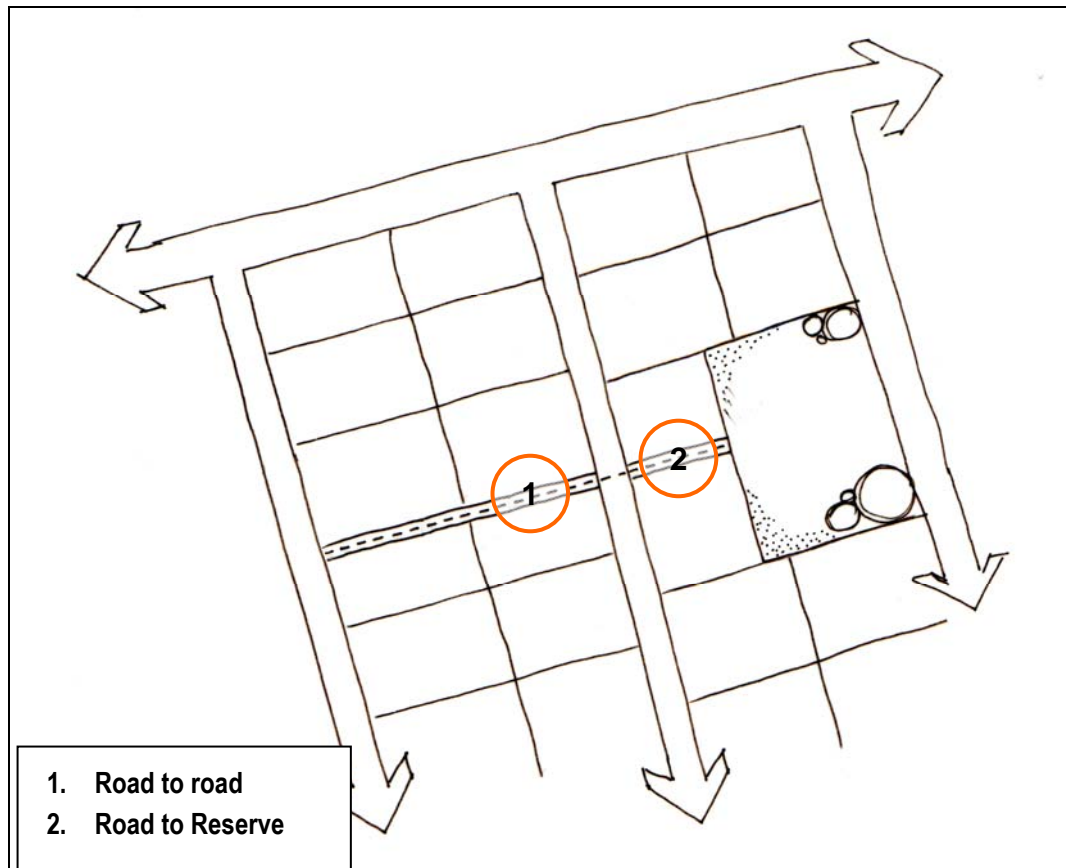


Figure 4-B

4.2.3.11 Central City and Stoke Central Roads

- a) Central City and Stoke Central Roads have a range of functions, which means a 'design led' approach is required for them. Therefore they are not categorised, i.e. neither Classified nor Unclassified. Typically, these roads provide high levels of pedestrian priority, on-road parking supply, amenity, and local traffic circulation/servicing.
- b) Map 1 of the Nelson Resource Management Plan contains the Central City and Stoke Central area.
- c) Refer to Council's 'Heart of Nelson – shaping our inner city: Central City Strategy' for details of the city's vision and planned actions within the Central City and Stoke Central areas.

4.2.4 Transport Network Layout

- a) The layout of a transport network should be structured so that it supports the road hierarchy through the provision of logically connected roads. The road pattern should be laid out to fit with the general roading requirements of the locality and the topography in which they are situated.

- b) The transport network should not only facilitate private motor vehicle travel, but also encourage walking, cycling and use of public transport for access to daily activities. This is achieved by providing a permeable and highly-connected network of roads that enables relatively direct trips in and between neighbourhoods and to local activity points.
- c) Linkages for pedestrians and cyclists must create an attractive, friendly, connected, safe and accessible environment. These linkages must ensure that people can move about the community freely and safely in areas where there are no road linkages.
- d) Large blocks (typically of more than 500m) should be avoided, as this increases trip lengths which ultimately reduces the attractiveness of making trips by active modes.
- e) 'Unclassified Roads' should be configured to support short trips for local traffic moving in and between neighbourhoods and to spread traffic to keep volumes low.
- f) The layout should enhance personal safety and perceptions of safety and minimise potential for crime, vandalism and fear. This can be addressed by providing for roads and urban open spaces to be fronted and overlooked by housing and actively used facilities, especially on routes to and from schools, public transport stops and other routes likely to be used in the hours of darkness. Guidance for achieving development that provides high levels of surveillance to the transport network is provided in Council's Safer by Design (CPTED) Guidelines.
- g) Council may consider variations from these principles where it is satisfied that variations are justified in terms of the following criteria:
 - 1) The design is constrained by topography or existing development and alternative solutions are neither practical nor viable.
 - 2) Where compromises are desirable in order to maintain integrity of the network, to establish effective connections or maintain continuity along a route.

4.2.5 Integration with Adjoining Development

- a) New development should connect well to existing, committed, proposed or potential development¹ in adjacent areas to facilitate interconnection between new and existing communities. A development with poor links to the surrounding area creates an

¹ Potential development means the likely future development within the Services Overlay taking into account the Council's Strategic City Development Plan and the LTCCP, and the provision of services in a manner that integrates with and does not foreclose this likely future development.

enclave which encourages movement to and from it by private motor vehicle rather than by other modes.

- b) Road connections to existing areas should ensure that outcomes of the connection, such as increased traffic volumes, will be commensurate with the design of those areas. Connectivity between new and existing areas should endeavour to enhance and contribute toward an overall more sustainable community, wherever practical.
- c) Where future development on adjoining land is possible, land within the development should be set aside to ensure that future connection is not precluded. The spacing of road connections to adjacent future areas should consider the potential future network requirements of the wider area.

4.2.6 Accessibility

- a) Accessibility is the opportunity to travel to a specific activity through the availability of transport and connections. There are three equally important aspects of accessibility:
 - 1) Access to and provided continuously through the network,
 - 2) The quality of mobility on the network,
 - 3) The importance and number of opportunities at various destinations.
- b) Accessibility varies with need and often the most vulnerable members of the community are the most transport disadvantaged. Accessibility recognises all modes of transport and subsets of the community that may have less transport choice because of age, physical, financial or other variables.

4.2.6.1 Walkable Neighbourhoods

- a) A walkable neighbourhood is characterised by having a high proportion of households within a walkable time of a range of facilities, including but not limited to bus stops, local shops, schools, place of employment, and medical facilities.
- b) Walking time is considered to be the best measure for determining walkable catchments, as it takes factors such as waiting times at road crossings into account unlike distance measurements.
- c) Creating linkages between new development, local facilities, community infrastructure and the public transport network is fundamental to reducing walking times thereby achieving more sustainable patterns of movement and to reducing people's reliance on the car.

- d) The provision of an interconnected and highly permeable transport pattern that is promoted throughout this section of the Land Development Manual will assist in the development of walkable neighbourhoods. The other key component in the achievement of a walkable neighbourhood is land use planning. Land use planning governs the location in which particular types of activities may establish. If there is a dearth of facilities at a local level, then the quality, interconnectedness and permeability of the walking network will be of little value.

4.3 ROAD DESIGN

4.3.1 Speed Environment

- a) The speed environment can have a huge impact on the actual and perceived safety of roads and therefore have a large influence on a person's willingness to walk and cycle. High speed environments also detrimentally affect the level of amenity that roads provide compared to roads of a similar character that offer a lower speed environment.
- b) It is important that roads are designed to achieve an appropriate speed. The speed environment of roads within a transport network should reflect the function of each road in the context of the environment through which it travels.
- c) Local roads in residential areas should be designed to create low speed environments where pedestrians and cyclists can safely and comfortably share road space with motorised traffic.
- d) The target speed environment for new 'Classified Roads' in urban areas should be equal to the speed limit. Lower speed environments are acceptable and encouraged where the topography constrains the road alignment.
- e) The target speed environment for 'Unclassified Roads' in urban areas are lower than the speed limit i.e. in urban areas with a 50km/h speed limit these roads should aim to achieve a speed environment as set out in Table 4-2.

Table 4-2 Target Speed Environment

Road Hierarchy	Target Speed Environment
Arterial Roads	Speed Limit
Principal Roads	Speed Limit
Collector Roads	Speed Limit
Sub-Collector Roads	10km/h less than speed limit *
Local Roads	10km/h less than speed limit *
Residential Lanes, Service Lanes and Private Ways	20km/h
* Assuming a speed limit of 50km/h. The target speed environment should not be below 30km/h.	

- f) Speed is known to be a key factor for road safety. There are a number of techniques that can be used to achieve a lower speed environment than the speed limit to make the road more conducive to accommodating road users in a mixed manner, including:
- 1) Forward visibility – reducing lines of sight has the greatest effect on the speed environment at both intersections and at mid-block locations.
 - 2) Carriageway width – a narrow carriageway will generally result a lower speed environment, especially when combined with reduced forward visibility and the presence of parked vehicles.
 - 3) Parking – parked vehicles generally create a speed environment that is 3 to 8km/h lower than when parking does not occur.
 - 4) Landscaping – appropriately designed on-road landscaping can visually narrow the road. It can also be used with changes to the kerb alignment to physically narrow the carriageway.
 - 5) Geometry – long, straight roads are beneficial in optimising connections between places to better serve the needs of pedestrians who prefer direct routes. However, roads with this geometry also create higher speed environments. Consideration should be given to providing short and curved or irregular roads whilst avoiding excessive or gratuitous curves that are less efficient and make access for pedestrians and cyclists more difficult.
 - 6) Intersection spacing – short lengths of road between intersections make it difficult to reach higher speeds.
 - 7) Intersection design – small kerb radii force motorists to slow down when entering an intersection. This can be combined with an intersection treatment (e.g. change in road width or surfacing) to indicate a change in the speed environment to drivers.
 - 8) Traffic calming – localised road narrowing, changes in road texture, changes in the road alignment (both horizontal and vertical) can all be used to reduce speeds and to create safe crossing points for pedestrians and cyclists.
 - 9) Thresholds – localised narrowing of the road through kerbs, road markings, signage and/or roadside planting can provide a signal to drivers that they are entering an area with a lower desired speed environment.

- g) The design of all new 'Unclassified Roads' must be accompanied by a brief report from an experienced transportation professional identifying those features of the design that will contribute towards achieving the target speed environment.

4.3.2 Intersection Spacing

- a) Refer to Figure 4-C
- b) Accessibility by walking is enhanced through the provision of more links to create a highly permeable and connected walking network. Long lengths of road between intersections where the surrounding land type would benefit from increased accessibility should be avoided.
- c) On 'Classified Roads' a balance needs to be found between achieving a permeable and connected walking network and the greater importance that is placed on these roads for their through movement function. On these busier roads, closely spaced intersections can:
 - 1) Lead to a confusing and unsafe driving environment that reduces the movement function of the corridor.
 - 2) Deter cyclists, as each intersection increases a cyclist's exposure to a greater number of potential conflict situations from vehicles turning into and out of side roads.
- d) Intersections of 'Unclassified Roads' shall provide a minimum centreline to centreline separation of 40m.
- e) The minimum centreline to centreline separation of any two roads intersecting a 'Classified Road' shall be 110m, increased to 150m where the intersecting roads meet the 'Classified Road' in a left-right stagger.
- f) Intersections on Principal and Arterial roads that are controlled by traffic signals or roundabouts should have greater separation to balance movement for through traffic with the needs of local traffic and access.
- g) Roads that have a speed limit of 80km/h or more should have intersection spacing of no less than 800m.

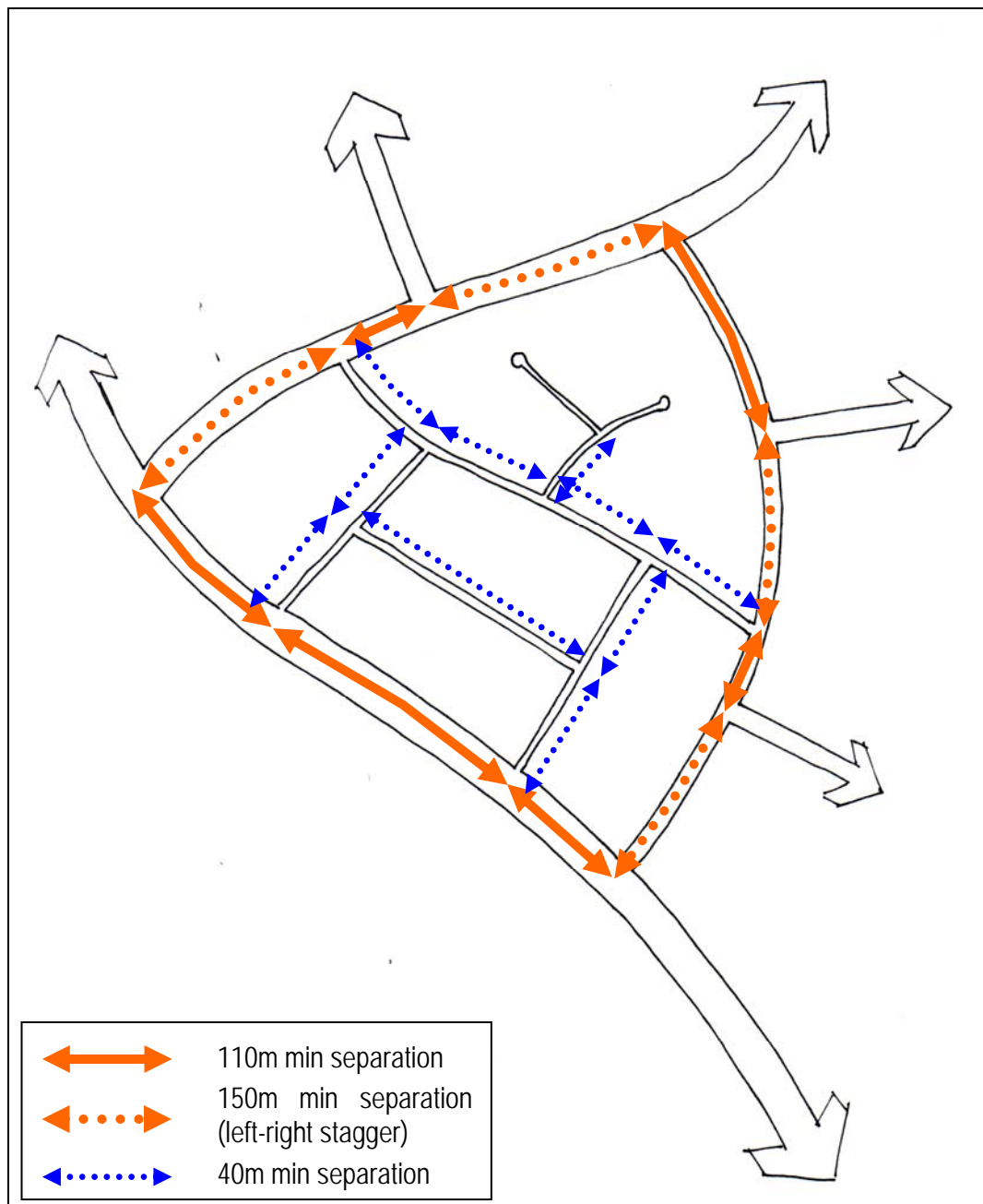


Figure 4-C Minimum Intersection Separation by Road Hierarchy

4.3.3 Cross Section

- The design of new roads or the improvement of existing ones should take into account the road function, the operating objectives, and the type, density and character of surrounding development.
- The width of the legal road reserve and carriageway should be sufficient to cater for all functions that the road is expected to fulfil, including safe and efficient movement of all users, provision for parking, buffering residents against traffic nuisance, provision

of utilities, transport infrastructure, stormwater management, retaining structures and streetscape features.

- c) All roads need to accommodate pedestrians and cyclists in some manner. They also need to be designed to accommodate a range of vehicles from private cars, with frequent access requirements, to larger vehicles such as service and emergency vehicles, with less frequent access requirements. Geometric design which satisfies the access needs of larger vehicles will also cover the needs of private cars.
- d) However on lower order roads, especially in residential areas, meeting the needs of vehicles should not be to the detriment of pedestrians, cyclists and public transport users. Care should be taken to avoid unnecessarily wide roads and verges as this can encourage higher traffic speeds, reduce the amenity of the adjoining land, and discourage pedestrian activity.
- e) The aim should be to achieve a harmonious mix of user types.
- f) The number and minimum widths (specified in metres) of key road elements, categorised by road hierarchy, are shown in Table 4-3 for Collector, Principal and Arterial Roads and in Table 4-4 for Sub-Collector Roads, Local Roads, Residential Lanes and Service Lanes.
- g) The design standards for Private Ways are identified in Section 4.3.7 Private Ways.

Table 4-3 Minimum Provision and Width of Elements for 'Classified Roads'

Road Hierarchy	Zoning ¹	Traffic Lanes	Flush Median	On-Road Cycle Lanes	Parking	Berm	Footpaths ²	Service Strip ³	Indicative Legal Road Reserve Width (nearest metre)
Arterial Roads	Residential	2 x 3.5	1 x 2.0	2 x 1.8	2 x 2.0	2 x 1.5	2 x 2.0	2 x 1.6	27
	Commercial	2 x 3.5	1 x 2.0	2 x 1.8	2 x 2.3	-	2 x 3.0	-	23
	Industrial	2 x 3.5	1 x 2.0	2 x 1.8	2 x 2.3	2 x 1.5	2 x 2.0	2 x 1.6	27
	Rural	Subject to specific design							
Principal Roads	Residential	2 x 3.2	-	2 x 1.8	2 x 2.0	2 x 1.5	2 x 2.0	2 x 1.6	24
	Commercial	2 x 3.2	1 x 2.0	2 x 1.8	2 x 2.3	-	2 x 3.0	-	22
	Industrial	2 x 3.2	1 x 2.0	2 x 1.8	2 x 2.3	2 x 1.5	2 x 2.0	2 x 1.6	27
	Rural	Subject to specific design							
Collector Roads	Residential ⁴	2 x 3.0	-	2 x 1.8	2 x 2.0	2 x 1.5	2 x 1.5	2 x 1.6	23
	Commercial	2 x 3.0	-	2 x 1.8	2 x 2.3	2 x 1.5	2 x 2.0	2 x 1.6	24
	Industrial	2 x 3.0	-	2 x 1.8	2 x 2.3	2 x 1.5	2 x 1.5	2 x 1.6	23
	Rural (up to 100km/hr)	2 x 3.5	-	Shared (on shoulder)	-	See SD 417	Shared (on shoulder)	See SD 417	20

1 - Where a road or access serves land in more than one zone the requirements for footpaths and berms on each side of the road or access shall be the maximum required for any of the adjoining zones.

2 - Where a road fronts a reserve that has a footpath aligned parallel to, and in close proximity of the road reserve boundary, then a footpath is not required to be provided within the road reserve on that side of the road.

3 - The 'Service Strip' may be reduced to 0.5m where there is sufficient space to locate services under the footpath without precluding the introduction of street trees.

4 - In 'Hillside Environments' the berm and footpath may be excluded from the uphill side of the road.

5 - Shared on sealed shoulder. Sealed shoulder to be widened to 1.5m where the road is defined as a cycle route.

Table 4-4 Minimum Provision and Width of Elements for 'Unclassified Roads'

Road Hierarchy	Zoning ¹	Traffic Lanes	On-Road Cycle Lanes	Parking	Berm (Shoulder for Rural)	Footpaths ²	Service Strip ³	Indicative Legal Road Reserve Width (nearest metre)
Sub-Collector Roads	Residential ⁴	1 x 5.6	-	2 x 2.0	2 x 1.5	2 x 1.5	2 x 1.6	18
	Commercial	1 x 5.6	-	2 x 2.3	2 x 1.0	2 x 2.0	2 x 1.6	19
	Industrial	2 x 3.0	-	2 x 2.3	2 x 1.5	1 x 1.5	2 x 1.6	21
	Rural (50 to 80km speed environment)	1 x 6.0	Shared (on shoulder)	-	See SD 417	Shared (on shoulder)	See SD 417	20
Local Road	Residential ⁴	1 x 5.2	-	1 x 2.0	2 x 1.5	2 x 1.5	2 x 1.6	16
	Residential (< 25 dwellings)	1 x 3.5 ⁵	-	1 x 2.0	2 x 1.5	1 x 1.5	2 x 1.6	13
	Rural (50km speed environment)	1 x 6.0	Shared (on shoulder)	-	See SD 417	Shared (on shoulder)	See SD 417	15
Residential Lane	Residential (7 to 25 dwellings)	1 x 5.5 ⁶	-	Indented bays	1 x 1.5	1 x 1.5	1 x 0.5	9

1 - Where a road or access serves land in more than one zone the requirements for footpaths and berms on each side of the road or access shall be the maximum required for any of the adjoining zones.

2 - Where a road fronts a reserve that has a footpath aligned parallel to, and in close proximity of the road reserve boundary, then a footpath is not required to be provided within the road reserve on that side of the road.

3 - The 'Service Strip' may be reduced to 0.5m where there is sufficient space to locate services under the footpath without precluding the introduction of street trees.

4 - In 'Hillside Environments' the berm and footpath may be excluded from the uphill side of the road.

5 - Passing bays shall be provided at least every 50m. Mutual driveways may be used as passing bays, see **6** below.

6 - Required for the first 12m from any intersection with higher order roads i.e. Local Roads and above. Thereafter, the traffic lane width may be narrowed to 3.5m. Mutual driveways shall be provided at adjoining lot boundaries (12.0m total width) to function as passing bays at least every 50m. The minimum dimensions for a passing bay are set out in section 4.3.7.g).

- h) The indicative Legal Road widths assume that all elements are provided to the minimum width and located alongside one another. The indicative Legal Road width will vary depending on the ultimate design of the road. Some of the more common factors that will affect the indicative Legal Road widths are:
- 1) On roads in residential areas parking may be provided as indented parking bays within the berm area. This will result in a narrower overall Legal Road width.
 - 2) Where services are located under the footpath (refer Section 4.3.19 'Utilities') the Service Strip may be reduced to 0.5m.
 - 3) Some elements may not be mandatory in 'Hillside Environments' to minimise the adverse environmental and amenity effects created by excessive earthworks.
 - 4) The use of alternative stormwater methods such as swales, which are likely to require additional berm width.
 - 5) Wider legal road widths may be required to accommodate road retaining structures.
- i) The planning and incorporation of bus routes into a new subdivision should be included as part of the subdivision application. Roads that accommodate, or may accommodate a future bus route should be designed in accordance with the requirements specified in Section 4.3.11 Public Transport.
- j) Council may consider variations from these indicative cross sections where alternative cross-sections and supporting analysis is provided.

4.3.3.1 Shoulders

- a) The shoulder is that portion of the carriageway beyond the traffic lanes, adjacent to, and flush with the surface of the pavement. Its purpose is to accommodate stopped vehicles, provide lateral support to the road pavement layers and, if sealed, offer improved conditions for cyclists.
- b) The shoulder width is measured from the edge of the traffic lane (delineated with a marked edge line) to the berm.
- c) All roadside furniture, including landscaping should be located outside the shoulder wherever possible.
- d) The minimum width of shoulders on non-urban roads without kerb and channel are specified in Table 4-5.

Table 4-5 Minimum Width of Shoulders

Road Hierarchy	Minimum Shoulder Width (m)			
	Up to 50km design speed		50 – 80 km/hr design speed	80 – 100 km/hr design speed
	Formed Width	Sealed Width	Formed and Sealed width	Formed and Sealed width
Collector Roads	2.0	1.0	2.0	Sealed path separated by verge to specific design
Sub-Collector Roads	1.5	0.5	2.0	
Local Roads	1.0	0.5	2.0	
Private Ways	0.5	0.5 ¹	1 – Plus, passing bays every 50m	

4.3.3.2 Medians

- a) A raised traffic island is a useful traffic management device to channel traffic or provide a refuge for pedestrians crossing the road.
- b) Flush medians are most commonly used on 'Classified Roads' where property access needs to be maintained but where there are safety benefits in removing turning vehicles from the through traffic stream, and in providing pedestrians with an opportunity to cross the road in two stages.
- c) Flush medians are intended primarily for urban speed environment conditions i.e. a speed limit of 70km/h or less.
- d) Flush medians may be appropriate when:
 - 1) Right turning traffic is interfering with through traffic causing accidents or problems with delays,
 - 2) Pedestrians are having difficulty crossing a busy road,
 - 3) The carriageway is excessively wide, or
 - 4) Property access needs to be maintained and any of the above conditions exist.
- e) Flush medians are not recommended for use on high speed roads (80km/h +) due to difficulties in controlling overtaking vehicles in these environments.
- f) Flush medians shall be designed with a width that is between 2.0m and 2.5m.
- g) Flush medians that accommodate a pedestrian island must be at least 2.4m wide. For marking details refer to the NZTA Manual of Traffic Signs and Markings (MOTSAM) Part II – Markings.

4.3.4 Cul-de-sacs

- a) A cul-de-sac is a 'no exit' street for motor vehicles. The extent of a cul-de-sac is defined from the last intersection that provides driver choice to multiple destinations within the wider transport network i.e. a through road. The roading layout presented in **Figure 4-DA** shows a layout where the entire road network off the main road would be classified as a long cul-de-sac.

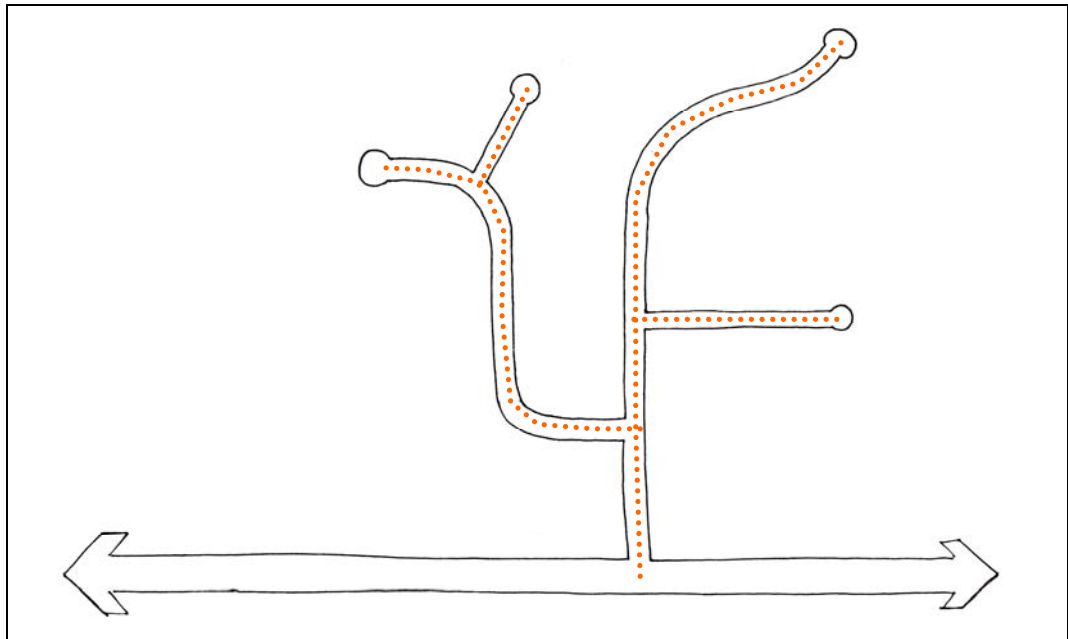


Figure 4-DA Extent of Cul-de-sac

- b) The roading layout presented in **Figure 4-DB** shows how a connected road network can reduce the prevalence of cul-de-sacs.

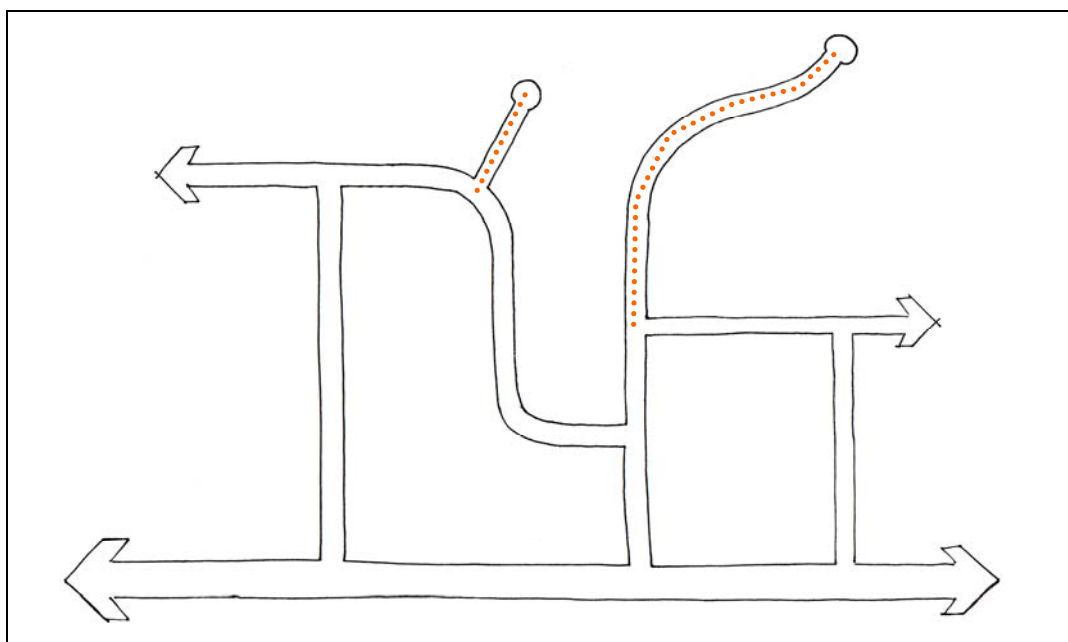


Figure 4-DB Extent of Cul-de-sac

- c) Cul-de-sacs are normally introduced into developments to develop awkward sites and to maximise lot yield by servicing land that could not readily be serviced by a connecting through road. Cul-de-sacs can also provide a pleasant residential environment in which to live because of low traffic volumes.
- d) However, there are also a number of potential disadvantages of cul-de-sacs. These are particularly evident if cul-de-sacs are used excessively within a residential development. The potential issues include:
 - 1) An impermeable road network that reduces transport accessibility and the opportunity to access community facilities,
 - 2) The discouragement of walking and cycling leading to increased reliance on private motor vehicle travel,
 - 3) Poor public transport route structures and accessibility, and
 - 4) Lost opportunity to link with future roads.
- e) A balanced approach to the use of cul-de-sacs is required.
- f) A cul-de-sac shall be no longer than 150m and serve no more than 25 potential residential dwellings, except in 'Hillside Environments' where the topography may preclude the interconnection of roads. In 'Hillside Environments' a cul-de-sac may have a length of up to 400m while serving no more than 40 potential residential dwellings.
- g) No more than 15 per cent of lots in any development, except in 'Hillside Environments', shall have frontage to a cul-de-sac.
- h) Cul-de-sacs must be designed so that pedestrians and cyclists can have through access, especially where that access would link to local facilities, other roads or recreation opportunities, as illustrated in Figure 4-K.
- i) Cul-de-sacs that may function as future through roads must be designed to the standard of the future function.

4.3.4.1 Turning Head

- a) A turning facility shall be provided at the end of all cul-de-sacs.
- b) Turning areas require a lot of road space and they are generally wasteful in land terms. The road area for manoeuvring should be kept to a minimum and opportunities taken to incorporate design features such as landscaping, street furniture and central parking spaces to make these areas attractive focal points.

- c) The minimum radius of the turning circle of a cul-de-sac shall be 7m in residential areas, 11m in commercial and 12m in industrial areas, as per SD 419 'Cul-de-sac Turning Circles'.
- d) For residential cul-de-sacs and Residential Lanes in 'Hillside Environments' the turning area may be a 'Hammerhead' or 'Fishtail' layout, as indicated in **Figure 4-E** provided it is sufficient to allow an 8m medium rigid truck with 10m turning radius to undertake a three point turn.

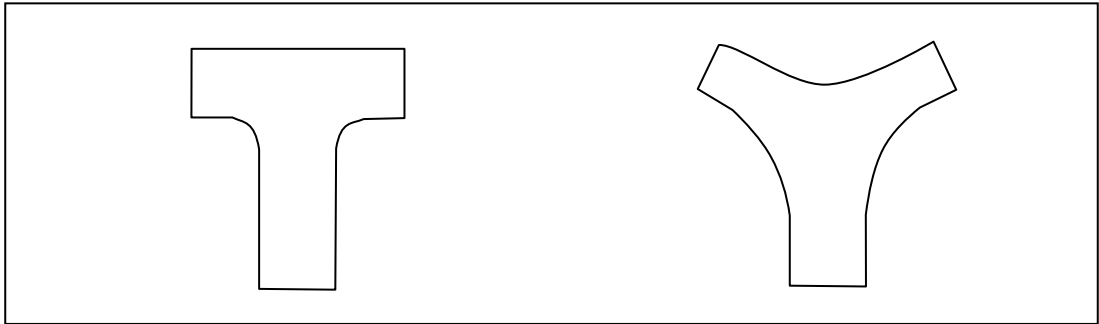


Figure 4-E Hammerhead and Fishtail Turning Head Arrangements

- e) Where a road is developed in stages a turning area shall be provided at the end of the construction or within at least 20m of the end of the road. The pavement shall be formed to the same standard as the road and permanently surfaced to provide an area sufficient to allow a 3-point turn by an 8m medium rigid truck with 10m turning radius.

4.3.5 Residential Lanes

- a) Residential Lanes are public roads that serve between 7 and 25 residential units.
- b) A road shall only be designed and constructed as a Residential Lane with the prior approval of Council. Council will consider allowing a Residential Lane where:
 - 1) The natural or physical constraints inhibits or precludes construction of an access road to a Local Road standard; or
 - 2) The lane would only serve dwellings on one side i.e. the other side borders a riparian strip or other land accessed from elsewhere; or
 - 3) Vehicular access is required to the rear of residential properties that have frontage, but no vehicular access to a 'Classified Road'; or
 - 4) A Residential Lane is the most efficient form of access for a residential intensification / infill development.

- c) Residential Lanes that have only one intersection with higher order roads must be designed with a turning area at the head that is sufficient to accommodate a 3-point turn of a 90th percentile 2-axle truck.
- d) The design of Residential Lanes shall be consistent with the minimum standards shown in Table 4-4.

4.3.6 Service Lanes

- a) Service lanes are for the purpose of providing side or rear access for vehicular traffic to land from 'Classified Roads' in industrial or commercial areas.
- b) Service Lanes must have at least two intersections with higher order roads i.e. Service Lanes must not be designed as a cul-de-sac.
- c) A Service Lane must have a minimum carriageway width of 4m. Separate parking or pedestrian facilities are not required to be provided.

4.3.7 Private Ways

- a) Private ways are not directly a Council responsibility, but their safe and efficient functioning and ongoing maintenance can have an effect on Council's transport network.
- b) Where necessary, private ways can be used to create a more private, secluded environment and, because they minimise the amount of hard surface, can look very attractive, if carefully managed.
- c) The use of shared turning space in a private way allows more semi-public space to be provided between sections, creating a sense of openness. Furthermore, it reduces the need for on-site turning which takes up space on the section and requires large areas of hard surfacing.
- d) Private ways must:
 - 1) Provide good passive surveillance into, along and through lanes.
 - 2) Only serve up to 6 potential residential units. Any access that serves more than 6 potential residential units must be designed as a Local Road. In certain circumstances, Council may permit the access to be designed and constructed as a Residential Lane, subject to satisfying the criteria set out in Section 4.3.5 'Residential Lanes'.

- 3) Be designed in accordance with the widths specified in Table 4-6 so as not to be confused with public roads.
- 4) Not create a more direct through-route alternative for vehicles, cycles or pedestrians than the adjoining road network.
- 5) Provide adequate sightlines for both pedestrians and cars at intersections without excessive truncations on adjoining properties that are required at intersections with public roads.
- 6) Provide for utility services.

Table 4-6 Private Way Design

	Potential Number of Units	Carriageway Width	Legal Reserve Width	Footpath
Residential	1 to 6	2.75 m	4.5 m	No
Rural	1 to 6	2.5 m	6.0 m	No
Commercial and industrial	See NZS 4404			

- e) In situations where more than one residential unit uses a private way and where a shared section of private way is more than 50m long a passing bay shall be provided at least once every 50m.
- f) Passing bays shall be positioned at regular intervals and achieve a clear line of sight from the passing bay to the start and end of the private way or to the next passing bay.
- g) Any passing bay shall be constructed to a minimum width of 5.5m and have a minimum length of 6.0m with a 4.0m long taper at each end.
- h) Private ways must have a permanent surface for a minimum distance of 5m into the property from the legal boundary of the road. Private ways serving more than one unit must have a permanent surface throughout the length of the right of way
- i) When designing private ways, the long term maintenance costs for the residents must be balanced against the benefits of providing access through a vested road. Irrespective, design and construction standards, including drainage, for private ways must comply with the requirements for an equivalent construction within legal road, including the 50-year design life.

4.3.8 Road Geometry

4.3.8.1 Gradients

- a) In general, road gradients shall not be steeper than those values specified in Table 4-7.

Table 4-7 Maximum Road Gradients

Road Hierarchy	Maximum Gradient *
Arterial Roads	1 in 20 (5.0%)
Principal Roads	1 in 15 (6.7%)
Collector Roads	1 in 10 (10.0%)
Sub-Collector Roads	1 in 8 (12.5%)
Local Roads	1 in 7 (14.3%)
Private Ways	1 in 5 (20%) **
* Gradients on bus routes shall not be steeper than 1 in 15 (6.7%)	
** The average gradient over 50m shall not exceed 1 in 6 (16.7%)	

- b) Council will consider steeper gradients on a case-by-case basis and these may be permitted over short lengths, but the Council reserves the right to impose special conditions of construction. Grades should be as long as possible and vertical curves provided at all changes of grade.
- c) Gradients are measured on the inside of any curves.
- d) Kerb grades shall not be less than 1 in 250 (0.4%).

4.3.8.2 Crossfall

- a) Normal crossfall of 1 in 33 (3%) in both directions from the crown shall be developed on all standard carriageways. However, where the kerb levels differ for design purposes, crossfalls varying from 1 in 50 (2%) to 1 in 20 (5%) from the crown may be permitted, coupled with a lateral shift in crown position of up to one quarter of the carriageway width.
- b) The minimum crossfall of 2% must be provided for asphaltic concrete surfaces and 2.5% for chipseal surfaces.
- c) Where a uniform crossfall is developed from kerb to kerb, this shall not be flatter than 1 in 50 (2%), unless on a curve, where super-elevation may be permitted.
- d) Generally at road intersections it is important to ensure that the crown of the intersecting road does not extend out into the carriageway of the through road, to maintain driver safety. Normally, this means running the crown of the minor road into the nearside edge of the main road lane line or quarter point.

4.3.8.3 Super-Elevation

- a) Super-elevation is not required in areas with a 50km/h speed limit.
- b) On roads where the speed limit is over 50km/h, specific design of super-elevation is required. Where super-elevation is required, the maximum value on 'Unclassified Roads' shall be 5%.
- c) In 'Hillside Environments' super-elevation may be employed where it suits boundary levels up to the allowable design maximum crossfall.

4.3.8.4 Kerblines

- a) Generally, kerbs shall be at the same level on both sides of the road. However, in some circumstances, the left and right hand kerb lines may be better graded individually in conjunction with centre line levels, footpath levels and boundary levels. Under such circumstances, at a given cross section, the left and right hand kerbs must only differ from each other in level within the following tolerance:

Maximum difference in kerb level = 120mm + 15mm/m for roads with a carriageway wider than 7.0m.

4.3.8.5 Stormwater Drainage

- a) All stormwater from the carriageway and footpaths on roads and private ways shall be collected by an approved stormwater system. Refer to Section 5 Stormwater of the Land Development Manual for design and construction guidance on stormwater matters.

4.3.8.6 Horizontal Curves

- a) Horizontal curves in 50 km/hr zones that are circular must have a minimum centreline radius of 80m for roads in industrial areas and 40m for roads in residential areas. For Local Roads in residential areas and Residential Lanes, horizontal curves may be reduced to a 25m circular radius with associated widening to the inner edge to enable truck and trailer combinations to safely negotiate curves in one pass.
- b) 'Classified Roads' that have or may have a speed limit of more than 50km/h in the future require spiral transition curves consistent with a specified speed value.
- c) Reverse curves shall be avoided where possible. If they are necessary, balance and separate them by a sufficient length of straight road to allow for a satisfactory rate of super-elevation reversal (where the design speed is greater than 50km/h).

- d) Curves in the same direction in close proximity must be compounded to avoid “broken back” effects.

4.3.8.7 Sight Distance

- a) Safe Stopping Sight Distance (SSSD) is distance required for a vehicle to safely stop between the time when the driver receives a stimulus signifying a need to stop and the time the vehicle comes to rest.
- b) Table 4-8 shows acceptable SSSD for various design speeds in urban areas.

Table 4-8 Safe Stopping Sight Distance (SSSD)

Design Speed	Safe Stopping Sight Distance (m) *
≤ 30 km/h	25
40 km/h	35
50 km/h	45
60 km/h	65
* As required on level grade. Correction factors are to be applied on non-level roads.	

- c) SSSD is important in the design of ‘Unclassified Roads’ (roads that generally do not require a centreline to be marked) to ensure that sufficient visibility is provided between opposing vehicles on narrow carriageways to see each other and stop.
- d) SSSD is measured both in relation to vertical and horizontal curvature as illustrated in **Figure 4-F**.

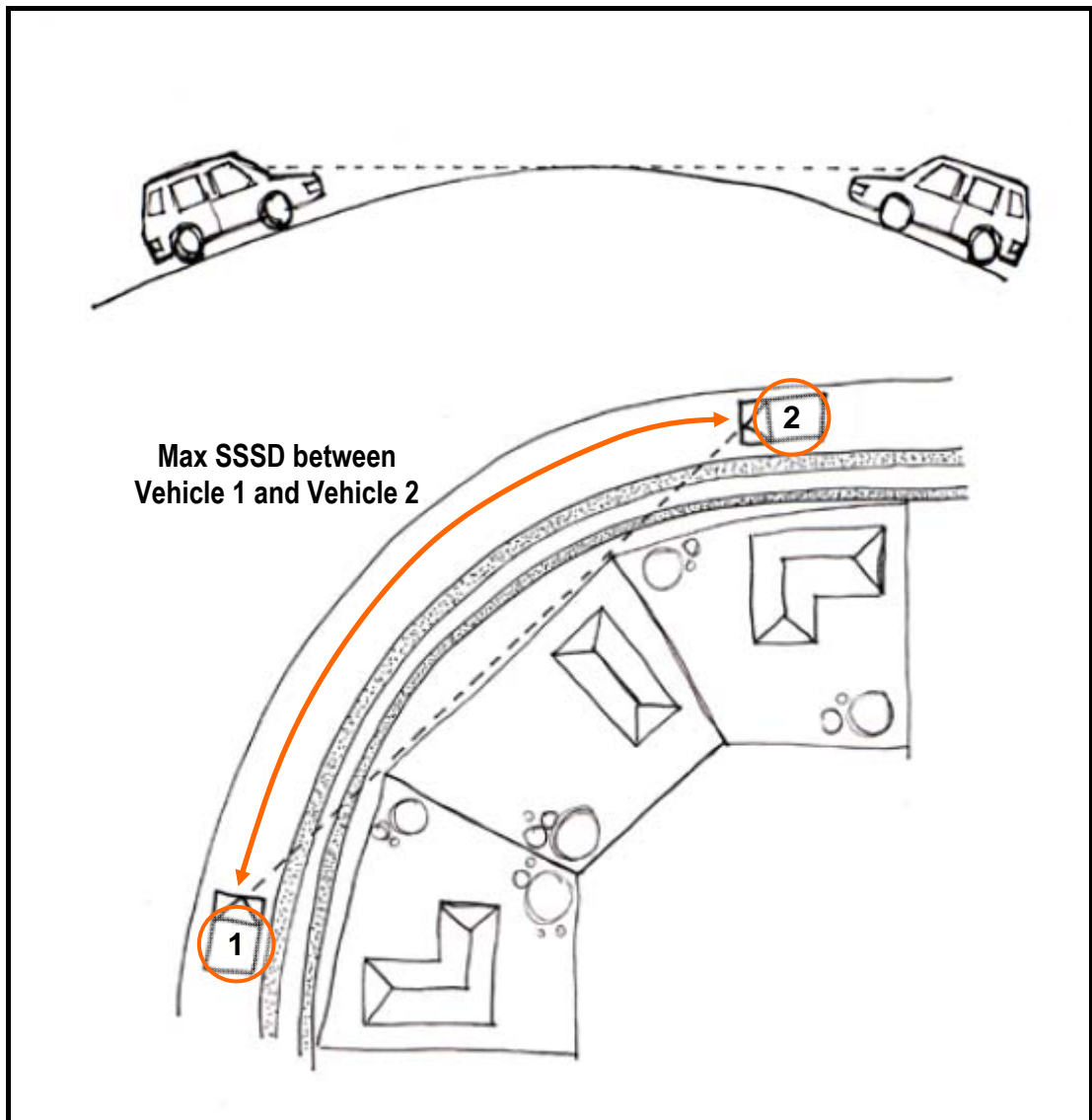


Figure 4-F Measurement of Safe Stopping Sight Distance

- e) On roads where 2 times the SSSD cannot be achieved, a centreline must be marked. This is likely to require the banning of kerbside parking and may necessitate some carriageway widening.
- f) SSSD is also important to ensure adequate visibility is provided to traffic management devices.

4.3.8.8 Intersection Radii

- a) Kerb radii at intersections shall be small enough to:
- 1) Provide pedestrian desire lines that are as straight as possible.
 - 2) Encourage low speed left turn movements.

- 3) Enable an RTS-14 compliant tactile paver layout to be provided.
- b) Kerb radii at intersections shall be large enough to accommodate the turning requirements of the design vehicle as follows:
 - 1) For turns at intersections where both roads are 'Classified Roads' the design semi-trailer with turning path radius of 12.5m, without crossing the centreline of the road being entered.
 - 2) For turns between a 'Classified Road' and a 'Unclassified Road' the design semi-trailer with turning path radius of 12.5m, using any part of the 'Unclassified Road' carriageway, and the design large rigid truck with turning path radius of 12.5m using the correct side of the 'Unclassified Road' carriageway.
 - 3) For turns at intersections where both roads are 'Unclassified Roads', the design medium rigid truck with turning path radius of 10m, using any part of the carriageway. However, Council may require intersections to be designed for a larger vehicle if larger vehicle movements are expected.
 - 4) For turns between all public roads, the 85th percentile design car with a minimum turning path radius of 5.8m, using the correct side of the carriageway only.
 - c) For any of these cases, the design vehicle must not cross the road centreline of any 'Classified Road' when turning left into or out of the intersecting road.
 - d) Kerb radii shall not be less than 3.0m.
 - e) At signalised intersections it is better to minimise the kerb radii and set the limit line of the rightmost lane back from other lanes to facilitate the turning requirements of larger vehicles in preference to providing a larger kerb radii.
 - f) Consideration should always be given to narrowing the width of the carriageway at intersections with kerb extensions to keep pedestrian crossing distances to a minimum and control turning vehicle speeds while allowing for safe passage by cyclists, as shown in **Figure 4-G**.
 - g) A radii of 5m is typically required at kerb extensions to facilitate mechanical street cleaning.



Figure 4-G Example of Kerb Extensions at an Intersection

4.3.9 Batters

- a) No batter in either cutting or filling shall be steeper than 1 in 1.5 (67%) without the approval of Council, and in certain cases, a soils report will be required to establish the safe batter slope and specific low maintenance landscaping/vegetation will be required, other than grass. See 4.3.9g) below.
- b) In flat terrain, the bottom edge of the fill batter or the top of a cut batter shall start at least 600mm on the roadside of the property boundary. In 'Hillside Environments', the toe of the cut batter may start 1m from the kerb or back of footpath, and the top of the fill batters may start 1m from the kerb or back of footpath (see SD 21 /305, Sheet 4).
- c) All new cut faces must be retained or stabilised with vegetation. Slopes steeper than 1 in 2 (45%) require a geotechnical assessment to determine if retaining is required.
- d) Where conditions indicate, retaining walls or benching may be required. Where retaining walls are required, certified design plans for any such walls shall be submitted and a building consent obtained.
- e) Stabilised faces or retaining structures that support private assets or property must be located outside of the legal road reserve.
- f) Structures supporting the road must be located within the legal road reserve. This may require adjustment of the legal road boundary. See also, Section 3.4.5.

- g) Where a batter is not required to cater for foot traffic, grassed batters are permitted, to a maximum of 1 in 4 (25%) to ensure they are mowable.

4.3.10 Hillside Construction

- a) **Definition:** For the purposes of the Land Development Manual, a road is considered to be in a hillside environment where the road is formed on ground that has an average slope of greater than 10 degrees.
- b) Roads should generally follow the natural contours of the land and should not be placed perpendicular to contour lines unless absolutely unavoidable. Curvilinear road alignments are preferred to influence a lower speed environment.
- c) Cut and fill shall be kept to a minimum to avoid earthworks altering the natural land form and avoiding removal of natural features, i.e. sediment and vegetation.
- d) Where the road is or will be constructed on a slope, this can affect the ability to provide all the required elements of a streetscape and therefore impact on the achievable widths for some or all of those elements.
- e) A balance should be achieved between complying with design standards and minimising the adverse effects that excessive earthworks can create such as visual pollution and high construction and maintenance costs. Council may consider deviations from the design guidance provided in the Land Development Manual for sites that are topographically constrained or to minimise the effects of earthworks. The type of deviations that Council may consider for hillside construction include:
 - 1) Providing narrower legal road widths. Wider widths may be impractical as it may be impossible to utilise more than a certain width due to crossfall restrictions. Property access may also be compromised if wide roads require high cuts or retaining walls.
 - 2) Provide for on-road parking in parking bays as an alternative to continuous kerbside parking lanes.
 - 3) Provide a lesser standard of elements, such as constructing only one footpath. Where only one footpath is provided it should generally be on the downhill side of the road.
 - 4) Locate pedestrian and cycle facilities separately from the carriageway.

4.3.11 Public Transport Routes

- a) The development of urban land and design of transport networks must attempt to maximise the convenient access of public transport.
- b) Bus routes are typically located on 'Classified Roads' and in residential neighbourhoods these may extend onto Sub-Collector and Local Roads to maximise the residential catchment. Bus routes are chosen to achieve a highly accessible residential catchment that provides access to high transport intensity land uses (such as schools, tertiary institutions, hospitals, medical facilities, shopping areas, retirement villages and community facilities).
- c) Residential development should be designed to maximise the number of sites within a 5 minute walk (approximately 400m) of a bus stop. Residential development that does not have a frontage on the bus route shall be provided with convenient walking access to that route.
- d) An efficient bus service may be assisted by:
 - 1) Locating bus stops conveniently to maximise the walkable catchment while balancing spacing with bus journey times;
 - 2) Locating bus stops on the downstream side of intersections;
 - 3) Ensuring bus stops and most access routes to them will have some surveillance from surrounding development; and
 - 4) Ensuring traffic management devices are bus friendly.
- e) Roads that accommodate, or may accommodate a future bus route shall be constructed to ensure two-way traffic flow is maintained at all times. Intersections shall be designed to accommodate the turning requirements of the bus without crossing the centreline of the road being entered (or exited from for left turns).
- f) The gradient of roads with a bus route shall be suitable for the bus servicing the route.

4.3.12 Walking

4.3.12.1 Guiding Principles

- a) 'Getting there – on foot, by cycle', is the national strategy for walking and cycling². It states in its key principles that:

"Individuals are more likely to choose to walk or cycle if they see the environment as being walk-and-cycle-friendly – that is, convenient, safe and pleasant, with direct routes that minimise travel time.

"A comprehensive approach that works to maximise the range of destinations within walking or cycling distance, to improve the environment for walking and cycling, and to show individuals how these modes can effectively meet their personal needs will have the best chance of success."

- b) The NZTA 'Pedestrian Planning and Design Guide' identifies nine primary characteristics that describe walkable communities and these are summarised in Table 4.9.

Table 4-9 Primary Characteristics of Walkable Communities

Characteristic	Description
Accessible	The places people want to reach, including bus stops, are within an appropriate walking distance.
Comfortable	The walking infrastructure is sufficiently wide, low gradient, smooth and clean. There is frequent shelter from the elements and places to rest.
Connected	The walking network connects people with places they wish to reach, including access to bus stops for longer trips.
Convenient	Walking routes are continuous, unimpeded by obstacles and minimise delay in preference for other road users.
Legible	The walking network is clearly signposted enabling visitors to find their way. Walking facilities are intuitive to use.
Pleasant	Walking spaces are enjoyable and interesting and encourage people to engage in social interaction.
Safe	Road and driveway crossings are appropriately designed. The walking surface provides high levels of grip in the wet and is free of trip hazards.
Secure	The walking environment is designed using the principles of Crime Prevention Through Environmental Design (CPTED).
Universal	The walking network is suitable for pedestrians of all abilities including mobility and visually impaired persons.

² Ministry of Transport 'Getting there – on foot, by cycle' (February 2005) is a strategy to advance walking and cycling in New Zealand transport

4.3.12.2 Crime Prevention Through Environmental Design (CPTED)

- a) The design of buildings and the arrangement of streets, parks and other outdoor spaces can influence the opportunity for crime and the level of fear of crime.
- b) Careful environmental design can help make places less susceptible to crime and enable people to feel more comfortable outdoors.
- c) To ensure that crime prevention is properly taken into account, it is important that the way in which permeability is provided is given careful consideration. A highly permeable and connected transport network is conducive to walking and cycling, but can lead to problems of anti-social behaviour if it is only achieved by providing routes that are poorly overlooked, such as enclosed walking/cycling links.
- d) Methods that should be considered in the design of transport networks to reduce the likelihood of crime and enhance perceived personal security are:
 - 1) Providing clear sightlines – ensure pedestrians are able to see and be seen clearly in the surrounding area. Avoid sudden corners, blind bends and recessed areas along walking/cycling links and ensuring that planting does not grow to reduce passive surveillance or provide hiding places for offenders.
 - 2) Providing good quality lighting – choose lighting that illuminates pedestrian areas as well as roads and ensure it is consistently placed to not conflict with planting or create large areas of shadow.
 - 3) Providing environments that encourage high level of social interaction – design walking/cycling links to ensure that they are well used to prevent them becoming isolated and unsafe. Refer Section 4.2.2.1 'Place' for further guidance.
 - 4) Providing highly maintained environments – places which are run down and neglected tend to feel less safe. Regular maintenance of buildings and garden areas along with the removal of graffiti and litter all help to make people feel more comfortable in outdoor spaces.
 - 5) Avoiding potential entrapment situations – providing alternative walking/cycling routes so people do not have to take unsafe routes.

4.3.12.3 Footpath Width

- a) Table 4-3 and Table 4-4 specify the number and width of footpaths that are to be provided in various planning zones.
- b) Notwithstanding the widths specified in those tables, the minimum footpath width along any road with frontage to a school shall be 2m.
- c) The widths specified in Table 4-3 and Table 4-4 are 'Through Route' widths that must be free of all obstructions such as vegetation, light standards, signs, utility furniture, bollards etc. Where objects are located adjacent to a footpath a pedestrian will tend to 'shy away' from those objects. In order to ensure 'Through Route' widths are maintained, the minimum footpath width shall be increased by 150mm where such an object is present on one side and by 300mm where objects are present on both sides.
- d) Where any footpath is located directly against the property boundary it must have a minimum width of 1.65m. Where a footpath is located against a kerb, the width of the footpath excludes the top of the kerb.
- e) Where topography or existing features preclude providing the minimum widths, discuss options with Council.
- f) Refer to Figure 4-H

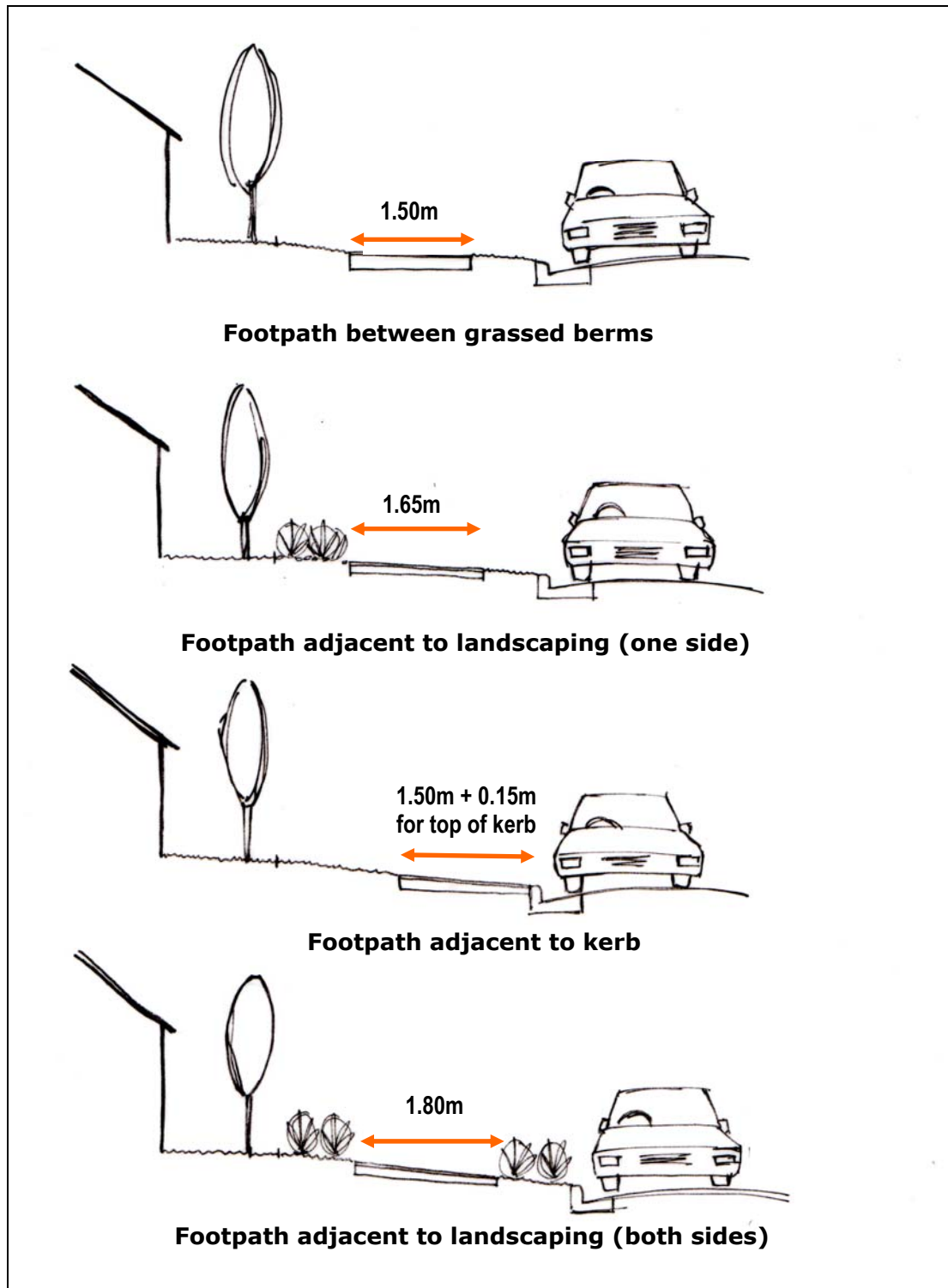


Figure 4-H Minimum Footpath Widths

4.3.12.4 Footpath Location

- a) In residential areas, footpaths shall be separated from the carriageway by a berm. Footpaths may only be located abutting kerbs in 'Hillside Environments', where the provision of additional road width to accommodate a berm will result in excessive earthworks.

- b) In commercial areas, footpaths should generally be located against the kerb and typically they will extend from kerb to property boundary.
- c) In other areas, the location of the footpath should be selected by taking into account pedestrian amenity, sun and shade, road lighting, postal deliveries and likely use patterns.

4.3.12.5 Design of Footpaths

- a) Footpaths are designed to accommodate the movement of pedestrians. Pedestrians are a diverse user group and include people of all ages, sizes and abilities. Accordingly, the design of footpaths needs to satisfy a wide range of user requirements. Generally, this can be achieved by designing footpaths to accommodate the needs of children and disabled people.
- b) The design of footpaths should be in accordance with the requirements of the NZTA Pedestrian Planning and Design Guide.
- c) For convenience, critical aspects of footpath design specified in this guide that must be adhered to are presented in Table 4-10. Where a conflict exists between any design criteria specified in the NZTA Pedestrian Planning and Design Guide and this Land Development Manual, the Land Development Manual takes preference at the discretion of the Council.

Table 4-10 Critical Aspects of Footpath Design

Design Aspect	Design Requirement
Gradient *	<ul style="list-style-type: none"> ➤ The mean gradient (change in vertical elevation between the top and bottom of a footpath) on any footpath should not exceed 5%. ➤ The maximum gradient (change in vertical elevation measured at 0.6m intervals along a footpath) shall not exceed 8% for a continuous distance of 9m. ➤ Where one or both are unavoidable, the footpath shall be designed as a ramp i.e. provides rest areas.
Crossfall	<ul style="list-style-type: none"> ➤ The maximum crossfall for any footpath is 2%. ➤ At driveways, a level ($\leq 2\%$ crossfall) landing not less than 1.2m wide is maintained for the safe passage of wheeled pedestrians. This may be facilitated by using a mountable kerb and channel at the vehicle crossing. ➤ The crossfall of any footpath must facilitate stormwater flow to on-road drainage systems and not create ponding on the footpath or flow into private property.
Vertical Drop	<ul style="list-style-type: none"> ➤ In situations where there is more than a 1m high drop, within 1m of the back of a footpath, a handrail shall be constructed at the back of the footpath or the top of the bank.
Overhead Clearance	<ul style="list-style-type: none"> ➤ Footpaths shall have a minimum vertical (overhead) clearance of 2.4m
<p>* Council acknowledges that in 'Hillside Environments' it may not be practical to achieve the footpath gradients or to design the footpath as a ramp. The gradient requirements are therefore not applicable to new roads in 'Hillside Environments'.</p>	

4.3.12.6 Crossing Facilities

- a) Pedestrians perceptions of the walking experience largely focus on difficulties crossing roads and any problems with this can cause delays and create a sense of insecurity. Therefore, correctly designing, constructing and signing appropriate crossing facilities should be a major consideration when developing pedestrian routes.
- b) Crossing facilities should meet the same minimum design standards as footpaths with respect to crossfall, overhead clearance, and surfacing.
- c) The choice of crossing facilities should always be appropriate for the prevailing environment. Section 6.5 of the NZTA Pedestrian Planning and Design Guide provides guidance on the selection of appropriate crossing facilities.
- d) Crossing facilities can generally be categorised into three groups:

Table 4-11 Crossing Facilities

Crossing Facility	Description	Example Treatments
Physical Aid	These facilities reduce crossing distances and simplify decisions	<ul style="list-style-type: none"> ➤ Kerb extensions ➤ Pedestrian islands ➤ Medians
Pedestrian Priority	These facilities provide pedestrians with intermittent (time separated) or continuous priority.	<ul style="list-style-type: none"> ➤ Zebra crossings ➤ Kea crossings ➤ Signalised mid-block crossings and intersections
Spatially Separated	These facilities physically locate the crossing of pedestrians away from general traffic	<ul style="list-style-type: none"> ➤ Underpasses ➤ Overpasses

- e) Having selected the appropriate crossing facility, the facility shall be designed in accordance with design guidance specified in the NZTA Pedestrian Planning and Design Guide.

4.3.12.7 Kerb Crossings

- a) All kerb crossing points must be designed to accommodate all potential users and to minimise the crossing distance for pedestrians. This means ensuring:
- 1) Kerb crossings are provided on both sides of the road.
 - 2) Kerb crossings facilitate crossing perpendicular to the direction of the road.
 - 3) The roadway is as narrow at the crossing point as possible.
- b) Where possible, crossing points should be located on the pedestrian desire line. At intersections, the kerb crossing shall be offset from the intersection corner to line-up with the direction of travel. Where the ramp cannot be offset from the corner, or where an intersection allows pedestrian traffic to cross the road at an angle, the kerb crossing ramp shall be graded and carried around the quadrant of the kerb corner.
- c) Kerb crossings shall be located so that users have an unobstructed view of traffic approaching from any direction.
- d) Some crossing points are raised to the same level as the footpath, while others require pedestrians to change grade. In both cases, it is important to ensure that all types of pedestrian can make the transition between the footpath and the crossing safely and easily.

4.3.12.8 Tactile Paving

- a) The layout and installation of tactile paving shall be in accordance with the NZTA Road and Traffic Guideline RTS 14 'Guidelines for facilities for blind and vision-impaired pedestrians'.
- b) Tactile paving shall be installed on all new and upgraded roads at all kerb crossings and other places where the footpath is not separated from the carriageway by an abrupt change in grade (more than 1 in 8) or vertical kerb face (higher than 70mm).
- c) Tactile paving shall provide a high visual contrast to the adjoining walking surface. 'Safety Yellow' is the preferred colour standard for tactile paving.
- d) An example of tactile paving is shown in **Figure 4-I**.

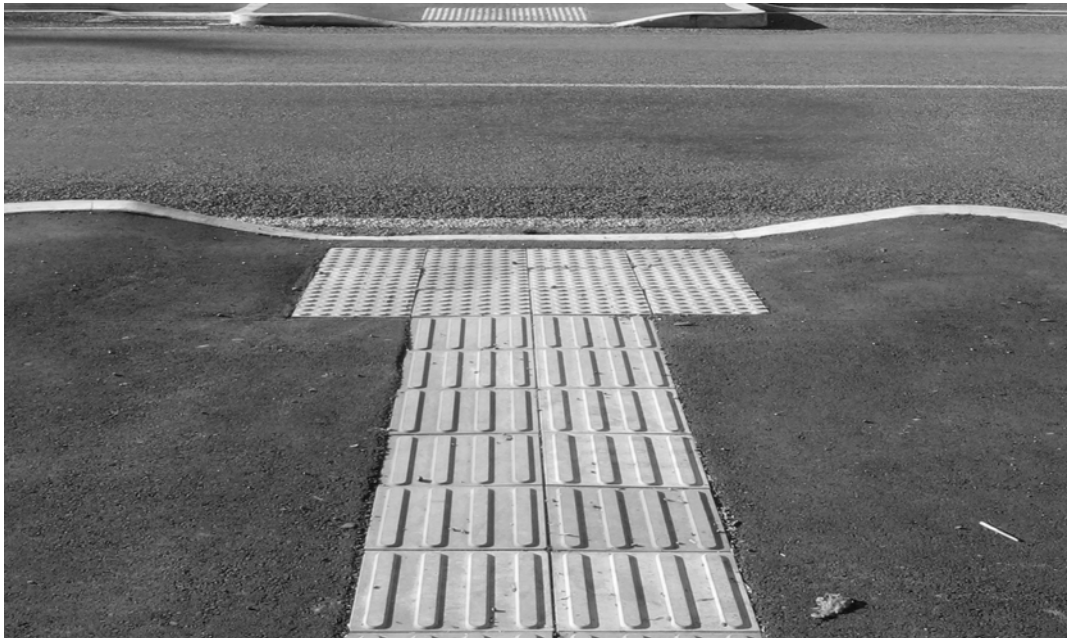


Figure 4-I Tactile Paving

4.3.13 Cycling

- a) A safe, convenient and legible cycle network (cycleway) should be provided for both experienced and less experienced cyclists. The network may comprise both on-road and off-road routes, planned in accordance with Nelson's Cycling Strategy. Off-road routes usually provide linkages for pedestrians as well as cyclists.
- b) An attractive and well-connected road network will encourage more people to cycle to local destinations, thus improving their health and reducing reliance on the private motor vehicle as a form of transport.

4.3.13.1 On-Road Cycle Lanes

- a) On-road cycle lanes shall be provided on all 'Classified Roads', except in 'Hillside Environments' where cycle lanes may be excluded in the downhill direction.
- b) Cycle lanes are generally not required on 'Unclassified Roads' because these roads typically have low traffic volumes and are designed to achieve operating speeds that facilitate safe cycling in a mixed traffic environment. The following guidance directs the need to provide cycle lanes on these lower order roads:
- 1) Roads that have a speed environment of 40km/h or lower and carry less than 5,000 vehicles per day (vpd) do not require specific provision for cyclists.
 - 2) Roads that have a speed environment of 50km/h and carry more than 2,500 vehicles per day should be designed to accommodate cyclists separately from the traffic lane.
 - 3) Roads that have a speed environment of 60km/h or more should be designed to accommodate cyclists separately from the traffic lane.
- c) In addition to the above, cycle lanes should be considered on 'Unclassified Roads' in the immediate vicinity of schools.
- d) The design of mid-block on-road cycle lanes shall generally comply with the principles specified in the New Zealand Supplement to Austroads Guide to Traffic Engineering Practice, Part 14: Bicycles (September 2008) and the dimensions specified in Table 4-12 below.

Table 4-12 Desirable Width of On-Road Cycle Lanes

Cycle Lane Location	Speed Environment		
	≤ 50km/h	70km/h	100km/h
Adjacent to kerb ¹	1.5	1.9	2.5
Adjacent to parallel parking	1.8	2.2	-

¹ Assumes the channel provides a suitable profile and surface for cycling i.e. includes cycle friendly sump grates.

- e) Cycle lanes located adjacent to angled parking need to provide a clear space buffer between parked vehicles and the cycle lane to provide an exiting vehicle with adequate visibility to approaching cyclists. The clear space buffer varies with the parking angle as shown in Table 4-13.

Table 4-13 Clear Space Buffer Between Parked Vehicles and Cycle Lane

	Parking Angle		
	45°	60°	90°
Clear Space Buffer (m)	2.0	2.5	3.0
Note: Where 'reverse-in' angle parking is provided, the clear space buffer shall be 1.0m.			

- f) The success of any cycling network is dependent on having appropriate intersection treatments and overall route continuity. Where cycle lanes are provided mid-block they should also be provided on the transition between mid-block and intersection, on the approach to the intersection, at the intersection (storage) and on the departure of the intersection. Methods for accommodating cyclists at signalised, unsignalised and roundabout intersections is provided in the New Zealand Supplement to Austroads Guide to Traffic Engineering Practice, Part 14: Bicycles (September 2008).

4.3.13.2 Wide Kerbside Lanes & Shoulders

- a) In certain circumstances it may be preferable to accommodate cyclists by means of a wide kerbside lane or sealed shoulder. Circumstances where it may be appropriate to accommodate cyclists in this manner include rural roads with low cycle volumes and in urban areas where provision of a cycle lane would be out-of-character with adjoining sections of the transport network.
- b) On 'Classified Roads' in urban areas, the desirable width of kerbside lanes to safely accommodate both cyclists and general traffic is shown in Table 4-14.

Table 4-14 Widths of Wide Kerbside Lanes to Accommodate Cyclists

Parking Provision	Desirable Width (m)	
	≤ 50km/h	70km/h
With Parking	4.5	4.8
Without Parking	4.2	4.5

4.3.13.3 Cycleways

- a) Linkages for pedestrians and cyclists should create an attractive, friendly, connected, safe and accessible environment. These linkages should ensure that people can move about the community freely in areas where there are no vehicular road linkages.

- b) The design of off-road cycleways should take into account the specific requirements of users of the route e.g. commuter and/or recreational cycling, level of pedestrian activity etc.
- c) The three types of cycleways that are provided for cycling are:
 - 1) Shared Use Path;
 - 2) Separated Path; and
 - 3) Exclusive Cycle Path
- d) **'Shared Use Paths'** are the most common type of facility.
- e) The provision of a 'Shared Use Path' acknowledges that there is additional benefit to the community in allowing other users access to the path and also the impracticability of restricting users other than cyclists.
- f) However, there is potential for conflict between the various users of a shared use path. To minimise this, a shared use path should provide adequate sight distance between cyclists and other users.
- g) A 'Shared Use Path' may be appropriate where:
 - 1) Demand exists for both a pedestrian path and a bicycle path but where the intensity of use is not expected to be sufficiently great to provide separate facilities;
 - 2) An existing low use footpath can be modified to provide for cyclists by satisfying legal requirements and as necessary upgrading the surface, width and kerb ramps; and/or
 - 3) There is an existing road nearby which is available for faster cyclists to use, to limit the extent of user conflict on the shared path.
- h) The width of a 'Shared Use Path' should reflect the function of the path. See Table 4-15

Table 4-15 Shared Use Path Dimensions

	Path Function *	
	Local Access	Community Access
Desirable Path Width (m)	2.0	3.0
* A 'Local Access' path includes paths that are expected to accommodate local people only e.g. paths that provide links between two residential cul-de-sacs. A 'Community Access' path includes paths that provide access from 'Classified Roads' or from 'Unclassified Roads' to key community facilities such as a school or shopping centre.		

- i) Shared Use Paths must be marked with a 20m long painted line to separate the directional movement of path users at all entry points to the path, at other conflict points and intermittently at no less than every 300m along the path.
- j) **A 'Separated Path'** is a path on which cyclists and pedestrians are required to use separate designated areas of the path. These designated areas are created by the use of pavement markings, contrasting surfaces, and the erection of regulatory signs. Typically, separated paths are available to cyclists and pedestrians requiring access in both directions.
- k) Separated paths are not common because they are generally considered to be justified only where there are large numbers of pedestrians and cyclists desiring to use the path. Sites where a separated path is appropriate include promenades along a foreshore or river frontage, and major inner city bridges.
- l) **An 'Exclusive Cycle Path'** is a path that does not permit use by pedestrians.
- m) Exclusive Cycle Paths are not anticipated in Nelson in the foreseeable future.
- n) Guidance on the selection of the type of path to provide is provided in Section 6.6 of the New Zealand Supplement to Austroad's Guide to Traffic Engineering Practice Part 14 – Bicycles (September 2008). To assist with the use of the flow chart provided in the aforementioned document, demand is considered to be 'low' where the use of the path in a peak hour is expected to have less than 10 users per hour. Conversely demand is considered to be 'high' where the use of the path in a peak hour is expected to have more than 50 users per hour.
- o) Preferably, paths should be located on sections of road with little direct vehicle access to adjacent property to minimise the number of conflicts between users of the shared path and vehicles accessing adjacent property.
- p) The following design requirements apply to paths within a road reserve:
 - 1) Paths must be surfaced as per the minimum requirements of Section 4.4.12 Footpaths.
 - 2) Where a path is provided within a road reserve that has frequent driveways, a buffer between the property boundary and the path must be provided to minimise the risk of a collision between a cyclist on the path and a vehicle exiting from a driveway.
 - 3) In circumstances where visibility from driveways does not satisfy the visibility splays shown in Figure 4-M or Figure 4-N, a 3m buffer between the property boundary and the path

must be provided, see Figure 4-J. In circumstances where visibility from driveways satisfies the visibility splays, the buffer may be reduced to 1.5m.

- 4) The path must be buffered from the carriageway by at least 0.7m, see Figure 4-K. A berm must be provided between the path and carriageway where kerbside parking is permitted to avoid conflict between cyclists and opening doors on the left hand side of vehicles. Paths located against the kerb also create issues on rubbish collection days, as rubbish for collection is usually placed kerbside.
- 5) A minimum lateral clearance of 0.5m (desirably 1.0m) must be provided between the edge of the path and any obstacle, including vegetation, light standards, signs, utility furniture, bollards etc.

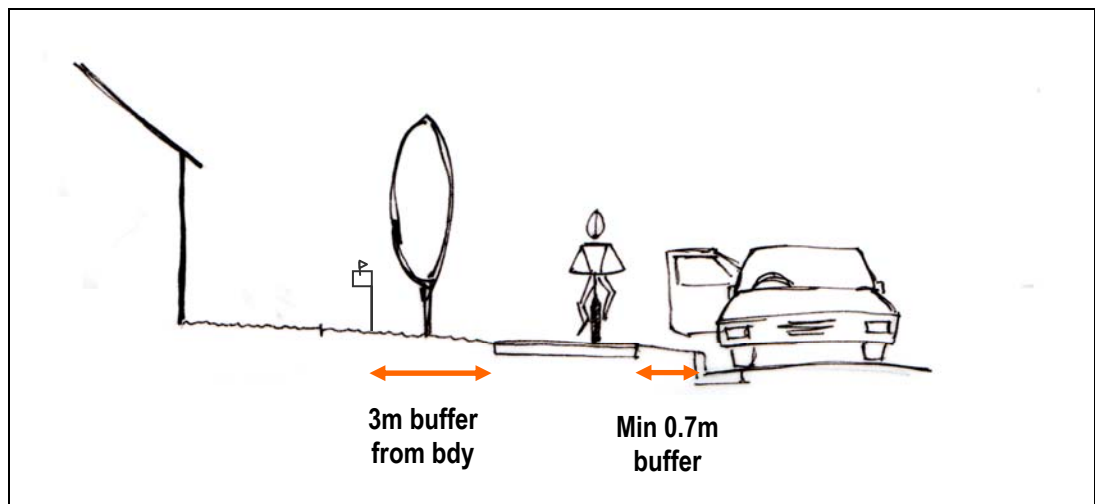


Figure 4-J Path Buffers

4.3.13.4 Accessways

- a) Accessways are linkages for pedestrians and cyclists that do not run alongside a vehicular carriageway but link road to road or road to reserve. See Figure 4-K.
- b) The width of an Accessway path shall be consistent with the Shared Use Path Dimensions specified in Table 4-15. The minimum legal reserve width of any Accessway shall be 6m including berms and landscaping. Refer to SD 429 for detailed design information.

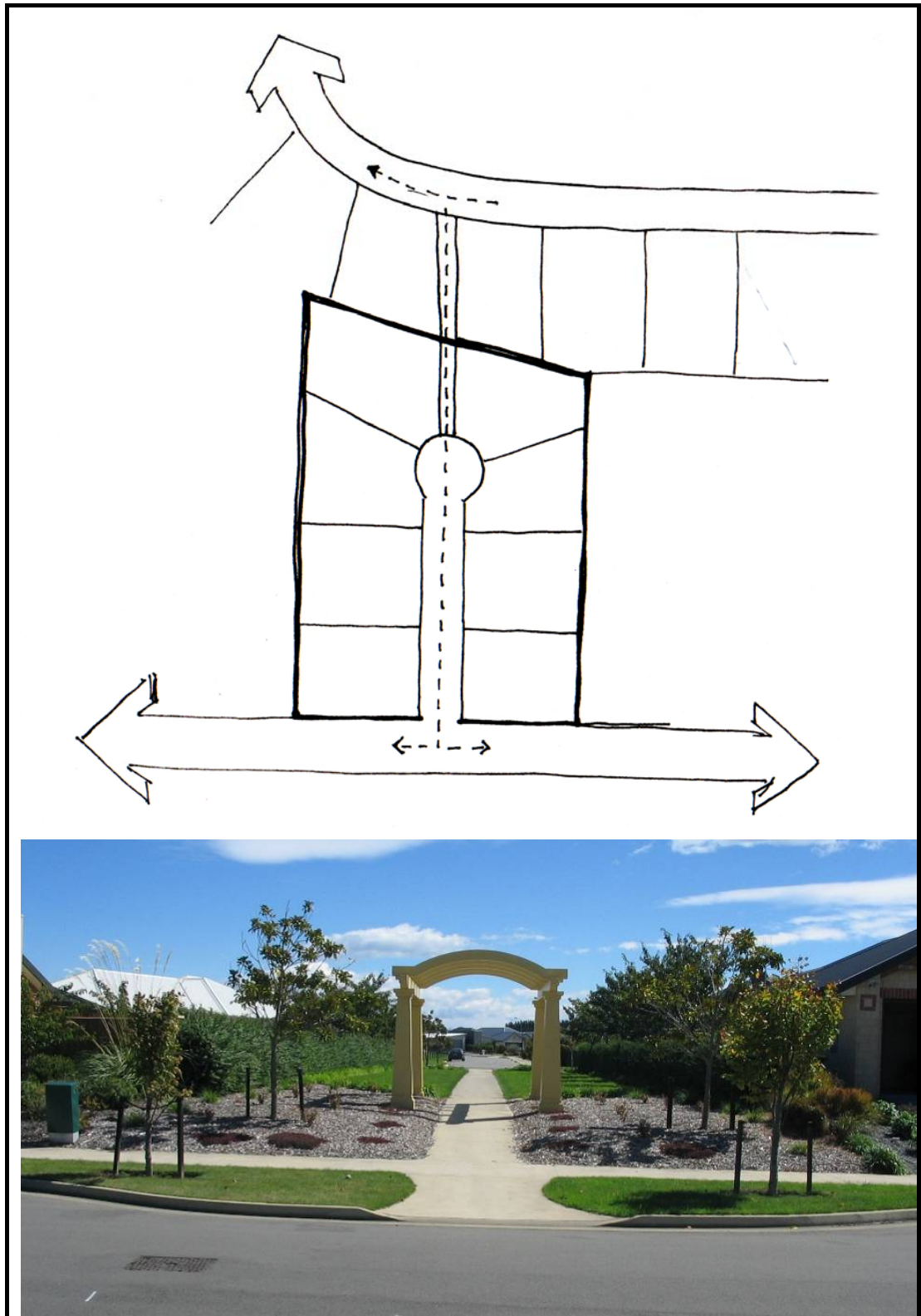


Figure 4-K Accessway with Berm and Landscaping

c) Accessways must be designed in accordance with Nelson City Council’s Safer by Design (CPTED) Guidelines and so that a person using the Accessway can see from one end of the accessway to the other at all times.

4.3.14 Streetscape

- a) Streetscape elements include paving, berms, street trees, plant beds, streetlights and street furniture. Landscaping and street furniture in particular can create a visually attractive and interesting environment to encourage more use of the road as a public place. Landscaping and street trees can also provide a 'buffer' between the footpath and the carriageway, create the perception of a narrower road and encourage drivers to travel more slowly and may also provide shade and shelter.

4.3.14.1 Berms

- a) Berms are the areas between the edge of the carriageway and the property boundary, not including footpaths. Berms provide numerous functions, including:
- 1) Space for pedestrians to pass
 - 2) Access to and from parked vehicles
 - 3) A corridor for underground utilities such as water, power and telecommunications
 - 4) The planting of street trees and plant beds
- b) Where possible, a services free berm at least 1.5m wide shall be provided between the carriageway and the footpath for the establishment of street trees.
- c) Berms typically have a grassed surface. For the berm between the kerb and the footpath (where the footpath is offset from the kerb) Council may allow the following options as an alternative to grassed surfaces:
- 1) A crushed stone; or
 - 2) An ornamental ground cover; or
 - 3) More extensive landscaping where there is no parking adjacent the kerb.
- d) For the berm between the footpath and the road boundary, residents are permitted to establish their own landscaping plants and ground cover as an alternative to grass provided the total width from the edge of the carriageway and the edge of the property berm is at least 2.0m and complies with the following requirements:
- 1) All vegetation shall be maintained to be no closer than 150mm to the edge of the footpath. Overhanging vegetation that maintains a 2.4m envelope above the footpath is permitted.

- 2) Boulders shall not be larger than 300mm equivalent spherical diameter.
- 3) Retaining structures shall not be installed.
- 4) Ground levels shall not be raised more than 500mm. Ground levels shall not be lowered.
- 5) Appropriate sight-lines shall be preserved at vehicle entrances and around corners.
- 6) Trees are not permitted.

- e) The slope of the grass berms from kerb to boundary shall generally be 1 in 33 (3%). This slope may vary, but shall not be less than 1 in 50 (2%) nor more than 1 in 12 (8%).

4.3.14.2 Street Trees and Landscaping

- a) Opportunities for street trees and landscaping shall be taken where possible to improve the visual amenity of roads in Nelson. Landscaping shall be designed to meet the following objectives:

- 1) **Functional**
 - Provide a sense of separation between the road and the footpath.
 - Provide shade.
 - Integrate with the network of reserves and open space.
- 2) **Safety**
 - Maintain adequate visibility for road users.
 - Maintain adequate visibility from residential properties to the road.
 - Adequate separation from parking areas.
 - Avoid obstructions to pedestrians.
- 3) **Aesthetic**
 - Frame views.
 - Emphasise landscape features.
 - Soften hard surfaces.
 - Enhance aesthetic values.

- b) Street trees are to be provided on services free berms that are at least 1.5m wide or services free paved areas within the inner city or commercial areas as appropriate. Street trees planted within berms shall be provided in accordance with SD 1201 and within

pavement areas they shall be provided in accordance with SD 1202.

- c) No trees or shrubs shall be planted within a 2.0m radius of any water valve or hydrant.
- d) Street trees and landscaping species must be selected and located so that future growth will not impede pedestrian flow, compromise the integrity and efficient operation of infrastructure services, or reduce visibility on curves or at driveways.
- e) The positioning of street trees within the road must not create a hazard to vehicles that leave the road. Non-frangible trees i.e. trees with a trunk of more 100mm diameter measured 400mm above ground surface at maturity shall be positioned so that the clear zones specified in Table 4-18 or Table 4-19 are satisfied.
- f) Section 12 Reserves and Landscaping of the Land Development Manual provides detailed requirements for street tree planting.

4.3.14.3 Street Furniture

- a) Every piece and type of street furniture shall be easily detectable (and avoidable) by the vision impaired. This means each street furniture element must:
 - 1) Be at least 1m high.
 - 2) Have an element within 150mm of the ground for its entire length parallel to the ground, so that it is detectable by a vision impaired person with a cane.
 - 3) Be placed so that the minimum 'Through Route' widths are maintained. See Table 14.3 of the NZTA Pedestrian Planning and Design Guide.
 - 4) Be placed in a consistent manner to promote the confident movement of vision impaired persons.
- b) All street furniture that is located within 4m of the edge of the nearest traffic lane on roads that have a speed environment above 50km/h shall be collapsible or frangible so as not to create a hazard for vehicles that leave the road.
- c) Street furniture design should be sympathetic to the surrounding environment and, where it is intended for use by pedestrians, should be accessible to all types.
- d) Typical characteristics and conventional locations of common street furniture for new or upgraded streets roads are shown in Table 14.9 of the NZTA Pedestrian Planning and Design Guide.

4.3.15 Property Access

- a) Every property is entitled to have vehicular access to the road network. However, the proliferation of access points may produce many negative effects, including:
 - 1) Increasing the number of conflict points with people walking and cycling on shared paths and footpaths.
 - 2) Reducing the area of berm that is available for landscaping, street trees and street furniture, thereby reducing the amenity of the road environment.
 - 3) Reducing the amount of on-road parking that is available.
- b) The Land Development Manual covers the design and construction aspects of vehicle crossings between the road and private property, including the transition between private property and the road.
- c) Design standards and planning rules governing on-site parking and manoeuvring matters are presented in Appendix 10 'Standards and Terms for Parking and Loading' of the Nelson Resource Management Plan. Planning rules governing the number and spacing of access points is presented in Appendix 11 'Access Standards' of the Nelson Resource Management Plan.
- d) All vehicle kerb crossings are to ensure the satisfactory passage of the applicable design vehicle for the nature and size of the activity. Appendix 12 'Tracking Paths' of the Nelson Resource Management Plan specifies tracking and vehicle clearances for a number of design vehicles.

4.3.15.1 Width of Vehicle Access Points

- a) In residential areas, vehicle access points shall have dropped kerb width of between 3.5m and 6.0m. Refer to SD 409 and 410 for design details.
- b) In commercial areas, but excluding service stations and where verandas are required, vehicle access points shall have dropped kerb width of between 5.0m and 7.0m. Refer to SD 409 and 410 for design details.
- c) In industrial areas, vehicle access points shall have dropped kerb width of between 6.0m and 8.0m. Refer to SD 409 and 410 for design details.
- d) Where 'B trains' will be using a vehicle entrance on a regular basis, a crossing width of 9.0m may be permitted on specific application to the Council.

- e) In the case of adjacent property owners in any zone wishing to have a mutual crossing at their shared boundary, the maximum permitted total length is 8.0m.
- f) In all cases the first 2m of the access formation from legal boundary shall be at right angles to the carriageway formation.
- g) Continuous vehicle crossings may be used within the turning head of a cul-de-sac provided the footpath is offset from the carriageway by at least 1.5m.

4.3.15.2 Domestic Driveway Gradients

- a) **Definition:** *A domestic driveway is any vehicular path providing access to three or fewer residential units.*
- b) Critical aspects of domestic driveway design with respect to gradient are (also refer to Figure 4-L):
 - 1) The maximum gradient of a domestic driveway shall be 1 in 4 (25%).
 - 2) The maximum gradient of a domestic driveway across the property line shall be 1 in 20 (5%).
 - 3) The maximum gradient of a domestic driveway that crosses a footpath or path shall be 1 in 50 (2%) for a lateral distance of at least 1.2m within that footpath or path.
- c) Grade changes across a footpath and within private property are required to ensure vehicles will not scrape their undersides. Grade transitions of 2.0m long are required whenever the ramp grade changes by more than 12.5%. Refer to 'AS/NZS 2890.1:2004 Parking facilities – Part 1: Off-street car parking' for detailed design guidance.

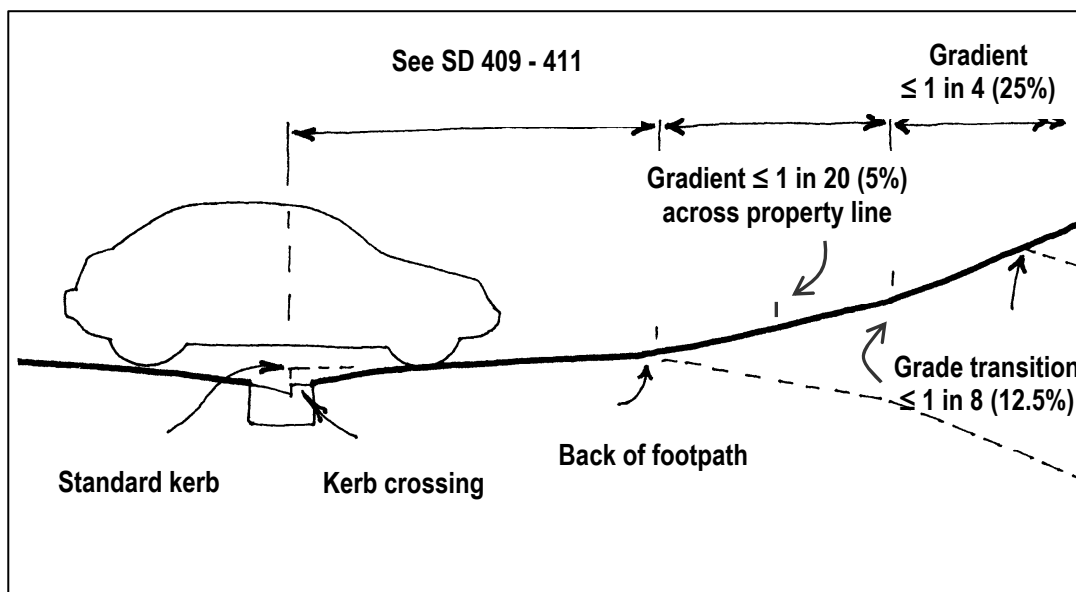


Figure 4-L Design Gradients for Domestic Driveways

- d) On roads where the footpath is located adjacent to the kerb and where the target speed environment (refer Table 4-2) is 40km/h or lower, vehicle crossings shall be designed with a mountable kerb and channel to minimise crossfall where the driveway crosses the footpath.

4.3.15.3 Access Driveway Gradients

- a) **Definition:** An access driveway is any vehicular path providing access to four or more residential units, any non-residential activity or public car park.
- b) Critical aspects of access driveway design with respect to gradient are (also refer to Figure 4-L):
- 1) For ramps longer than 20m the maximum gradient of an access driveway shall be 1 in 5 (20%).
 - 2) For ramps up to 20m in length the maximum gradient of an access driveway shall be 1 in 4 (25%).
 - 3) The maximum gradient of an access driveway ramp for the first 6m from the property boundary line shall be 1 in 20 (5%) unless there is no footpath or path between the property boundary and carriageway, or the following conditions are met whereby the grade can be increased to 1 in 8 (12.5%) for the first 6m:
 - i) The ramp is a downgrade for traffic leaving the property; and
 - ii) The vehicular access is to a 'Unclassified Road'

4) The maximum gradient of an access driveway that crosses a footpath or path shall be 1 in 50 (2%) for a lateral distance of at least 1.2m within that footpath or path.

c) Grade transitions of 2.0m long are required whenever the ramp grade changes by more than 12.5%. Refer to 'AS/NZS 2890.1:2004 Parking facilities – Part 1: Off-street car parking' for detailed design guidance.

4.3.15.4 Sight Distance

- a) Vehicle access points need to be located and constructed so that there is adequate sight distance between vehicles exiting the access point and traffic and pedestrians on the frontage road.
- b) The minimum sight distance that must be available from any vehicle access point along the frontage road is shown in Table 4-16.

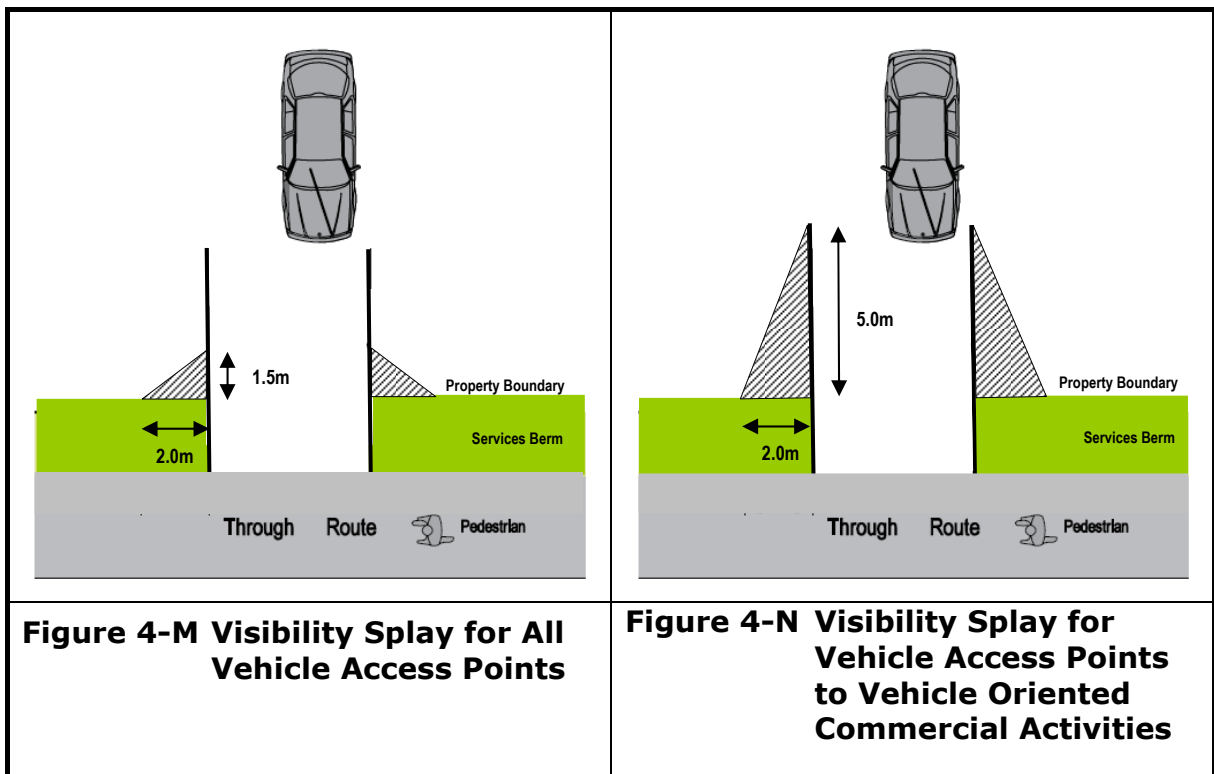
Table 4-16 Minimum Sight Distance from Vehicle Access Points

Speed Environment *	Minimum Sight Distance (m)	
	Domestic Driveways	Access Driveways
≤ 30 km/h	25	25
40 km/h	35	35
50 km/h	45	45
60 km/h	55	65
70 km/h	70	85
80 km/h	95	105
90 km/h	130	130
100 km/h	160	160
110 km/h +	190	190

* If the speed environment is not known, the speed environment shall be taken as 10km/h above the speed limit for the purposes of determining minimum sight distances.

- c) Sight distance is measured from the driver's position at the access point (2.5m back from the edge of the carriageway) in both directions along the frontage road. Where the frontage road is one-way or is median divided, the sight distance is only required in the direction of approaching and potentially conflicting traffic movements.
- d) Vehicles exiting from driveways can be hazardous to people using a shared path or footpath, particularly young children. Adequate visibility shall be provided between motorists exiting from a driveway and users of a shared path or footpath users.

- e) For all vehicle access points, a visibility splay with the dimensions shown in **Figure 4-M** must be provided. Items may be located within the visibility splay provided they do not obstruct visibility to pedestrians. Generally this means avoiding objects and vegetation with a height of more than 1.2m.
- f) For vehicle access points to 'vehicle oriented commercial activities', a visibility splay with the dimensions shown in **Figure 4-N** must be provided.



4.3.15.5 Tracking Paths

- a) Vehicle access points must be located so that no part of the access, nor the tracking path of the required design vehicle, must cross:
 - 1) Any part of another site except where there is a Right of Way or other similar legal easement over those parts of the other site; or
 - 2) Any part of the legal road between the site boundary and any carriageway to which an adjoining property has frontage without the prior written consent of the owner of the other site and the controlling authority of the legal road (refer **Figure 4-O**).

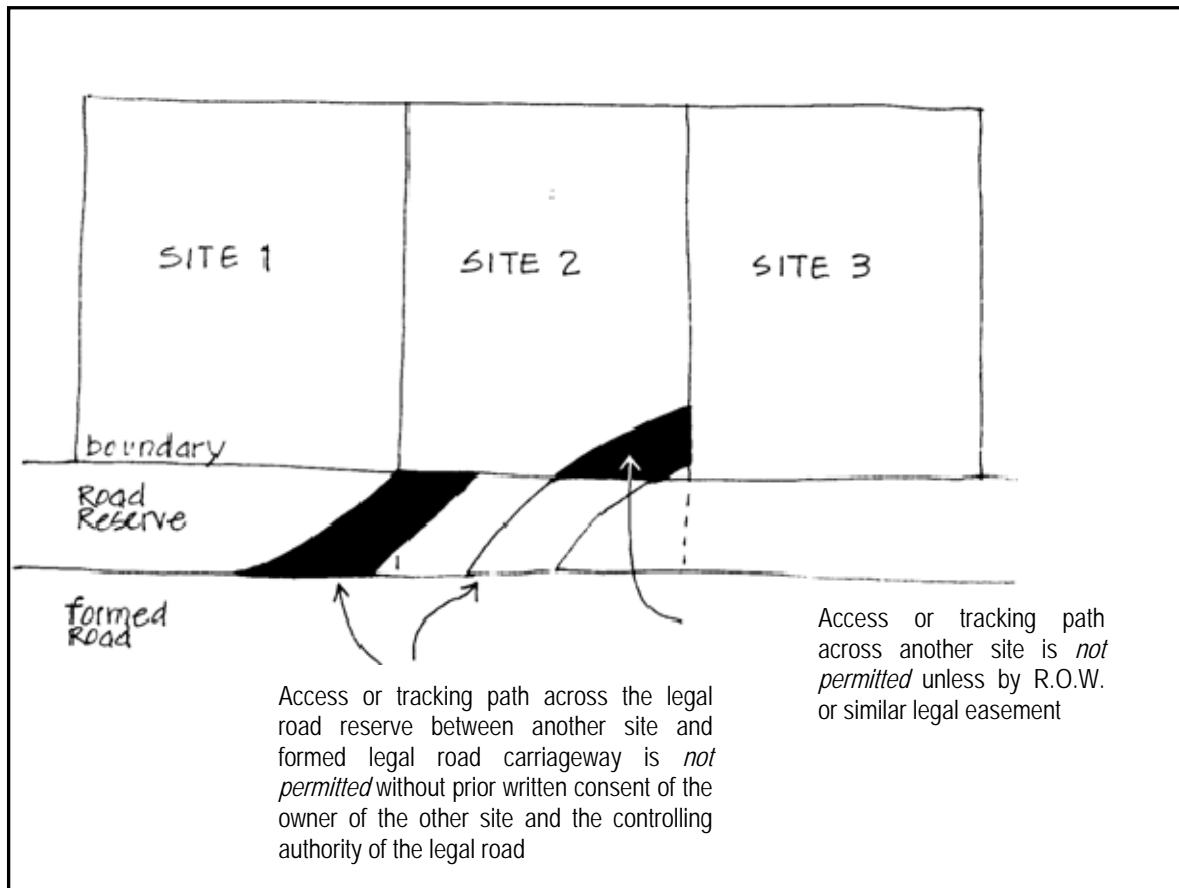


Figure 4-0 Illustration of Access and Tracking Path Requirements

4.3.16 Intersections

- a) The philosophy of the way in which a transport network is configured is fundamental to the design of intersections.
- b) At a broad level, intersections shall be designed to improve the comprehensibility and legibility of the transport network and reinforce the function of the intersecting roads as defined by the road hierarchy. At a local level, intersections exist to facilitate the safe and efficient movement of conflicting movements for all road user groups. While priority may and in some cases will be afforded to a particular movement or road user group, no user group shall be significantly disadvantaged at an intersection.
- c) To support the function and operation of the road hierarchy, there shall be no more than two hierarchy classifications between any intersecting road i.e. Local Roads shall not intersect Principal Roads or Arterial Roads, and Sub-Collector Roads shall not intersect Arterial Roads. If it is unavoidable that roads more than two classification levels apart must intersect, then the Council shall consider movement controls such as left in/out only or entry only.
- d) Generally, the geometry of any road intersection should be designed so that the major route is the through road and has traffic priority. Wherever the roads are of equal classification,

traffic volumes and the nature of upstream and downstream intersections will inform the decision of which approach is provided with priority. In some circumstances it may be appropriate to control these intersections with a roundabout or for the intersection of classified roads with traffic signals.

- e) The potential for crashes to occur at intersections is higher than other areas of the road network, due to the number of conflicting vehicle, cycle and pedestrian movements. Proper design of intersections can reduce the number of conflicts, while providing for a range of turning movements at the intersection.

4.3.16.1 Intersection Design

- a) Intersections shall be designed in accordance with the guidance provided in Austroad's Guide to Traffic Management: Part 6 – Intersections, Interchanges and Crossings. Where any conflict exists between that guide and the Land Development Manual, the Land Development Manual shall take precedence.
- b) Refer to Sections 4.3.2 and 4.3.8.8 of the Land Development Manual for intersection spacing and intersection radii design guidance.

4.3.16.2 Safe Intersection Sight Distance

- a) Safe Intersection Sight Distance (SISD) is the distance required for the driver of a vehicle on the non-terminated approach to observe a vehicle entering from a side road, decelerate and stop prior to a point of conflict. It is also generally sufficient to enable cars to cross a major road safely from a side road.
- b) SISD is the minimum sight distance that should be available from intersection legs with priority to vehicles which could emerge from non-signalised legs.
- c) SISD shall be provided at all intersections. It is measured along the carriageway from the approaching vehicle to the conflict point.
- d) SISD is viewed between two points 1.15m above the road surface. One point is the driver's eye height on the leg with priority and the other represents eye height of a driver in the side road. The driver in the side road is assumed to sit at a distance of 5.0m from the lip of the kerb or edge line projection of the major road.
- e) SISD allows for a 3 second observation time for a driver on the through leg of the intersection to detect the problem ahead e.g. car from minor road stalling in through lane, plus safe Stopping Sight Distance (SSD).
- f) SISD is to be provided in accordance with Table 4-17.

Table 4-17 Safe Intersection Sight Distance (SISD)

Speed Environment	Safe Intersection Sight Distance (m) *
≤ 30 km/h	50
40 km/h	70
50 km/h	90
60 km/h	115
70 km/h	140
80 km/h	180
90 km/h	215
100 km/h	255
110 km/h +	300

* As required on level grade. Correction factors are to be applied on non-level roads in a manner that is consistent with Austroad's Guide to Traffic Management: Part 6 – Intersections, Interchanges and Crossings.

4.3.16.3 Types of Intersections

Priority Intersections

- a) Give Way and Stop controlled (priority controlled) intersections and uncontrolled intersections are the most common form of intersection control in Nelson, especially on intersections where one approach is a 'Unclassified Road'.
- b) These intersections promote movements dictated by the road hierarchy i.e. prioritise movement on higher order roads over lower order roads.
- c) The selection of Give Way or Stop control is primarily governed by sight distance from the minor leg. A Stop control is appropriate when:
 - 1) Visibility measured from a point 9m back from the limit line on the side road does not provided sufficient visibility to see a vehicle on an uncontrolled approach at a distance measured in metres that is 1.2 times the speed environment e.g. 60m in a 50km/h speed environment; or
 - 2) Intersections have an unusual layout or unusual traffic pattern where it is essential to give one controlled approach priority over another controlled approach.
- d) A Give Way control is appropriate when:
 - 1) Crossroads do not have visibility constraints requiring Stop signs; and
 - 2) Intersections have an unusual layout, or an unusual traffic pattern, to clearly define who should give way, where it is

otherwise desirable to override the normal application of the right-hand rule, e.g. at T-intersections with 'Classified Roads'.

- e) In the absence of Give Way or Stop signs, traffic is controlled by traffic regulations. In New Zealand, current traffic regulations require right turning vehicles on the main road to give way to right turning vehicles exiting from the minor (stem) leg and right turning traffic has priority over conflicting left turning traffic.
- f) Intersections within residential areas should primarily be T-intersections for safety reasons. However, to improve connectivity, especially for pedestrians, Council will consider the use of four-way intersections. As priority intersections do not afford any priority to pedestrians, consideration should be given to providing traffic calming or physical crossing aids to improve pedestrian crossing opportunities. This may be achieved through the use of facilities such as kerb extensions, intersection platforms, raised medians and pedestrian islands.
- g) The provision of a threshold treatment on a lower order road, as shown in **Figure 4-P**, will also reinforce traffic priority and assist with comprehending the intersection layout.



Figure 4-P **Intersection Threshold Treatment**

- h) Priority controlled four-way intersections may be an appropriate form of intersection treatment in residential areas where all intersecting roads are 'Unclassified Roads' that have an approach speed environment of no more than 40km/h and where the total number of vehicles passing through this type of intersection should not exceed 2,000 vehicles per day.

- i) Where higher traffic volumes are anticipated, the intersection should be controlled with a roundabout or the intersection redesigned as a three-leg T-intersection.
- j) An example of a four-way Stop controlled intersection is shown in Figure 4-Q.



Figure 4-Q Four-Way Stop Controlled Intersection

Roundabouts

- a) Roundabouts can be used as an effective form of intersection control in a number of situations.
- b) Conventionally designed roundabouts with comparatively large central islands and approach deflection are generally not appropriate in residential areas at the intersections of 'Unclassified Roads'. Their capacity advantages are not usually applicable in these lower traffic volume situations and they can also have a negative impact on walking and cycling. Larger roundabouts are inconvenient for pedestrians because they are deflected from their desire lines, and people waiting to cross one of the arms may not be able to anticipate easily the movement of motor vehicles on the roundabout, or entering or leaving it.
- c) The preferred form of roundabouts at intersections of 'Unclassified Roads' incorporates a semi-mountable apron, as shown in **Figure 4-R**. A well-designed roundabout with semi-mountable apron will slow cars whilst providing for the larger turning requirements of vehicles such as buses, waste collection vehicles and emergency vehicles.



Figure 4-R Roundabout with Semi-Mountable Apron

- d) Roundabouts should be designed to ensure low entry and exit speeds. For safety reasons, it is important that comparable levels of visibility to the right are provided on all approaches to ensure that the entry speed of vehicles on any one approach is not substantially different from other approaches.
- e) Roundabouts give no priority to pedestrians waiting to cross the intersection. However, roundabouts can be designed to benefit pedestrians, as follows:
 - 1) Splitter islands should incorporate pedestrian island crossing facilities.
 - 2) Approaches and departures can be combined with kerb extensions to reduce crossing distances and reduce vehicle speeds
 - 3) By providing pedestrian platforms where speed environment on an approach is less than 50 km/h. Zebra crossings can be marked on such platforms where the general requirements for zebra crossings are met, and queues generated by crossing pedestrians will not block the roundabout.
- f) While roundabouts generally reduce crashes involving pedestrians, they can create problems for the vision impaired pedestrians due to confusing auditory signals from approaching and circulating vehicles.
- g) Roundabouts can also be hazardous for cyclists. Drivers entering at relatively high speed may not notice cyclists on the circulatory carriageway, and cyclists travelling past an arm are vulnerable to being hit by vehicles entering or leaving the junction.

- h) When considering installing multi-lane roundabouts, walking and cycling needs to be carefully considered.
- i) The design of roundabouts shall be in accordance with Austroad's Guide to Traffic Management: Part 6 – Intersections, Interchanges and Crossings.

Traffic Signals

- a) Traffic signals separate conflicting road user movements on a time basis.
- b) The primary factor in proposing use of traffic signals has to do with the availability of safe gaps. If the gaps in the major street flow can safely accommodate entering traffic from side streets for the majority of the time, it is reasonable to assume that traffic signals are not required. However, as vehicle volumes increase, the likelihood of having to provide traffic signals increases. Detailed information on warrants for installing traffic signals is provided in Austroad's Guide to Traffic Management: Part 6 – Intersections, Interchanges and Crossings
- c) Traffic signals may be a viable option where there is an accident history at an unsignalised intersection that greatly exceeds that which would be predicted for the intersection type and traffic volumes. Refer to the NZTA Economic Evaluation Manual for details.
- d) At busy junctions requiring multiple approach lanes, traffic signals are generally preferred over roundabouts.
- e) The location and design of each installation must conform to the requirements and approvals set by the Council, to enable coordination of the traffic signals.
- f) Traffic signals are perceived by pedestrians as an effective and safe method of crossing the road. This perception is heightened when young, or elderly pedestrians are involved.

4.3.17 Parking

- a) Parking is a key function of many roads, although it is not always a requirement. A well-designed arrangement of on-road parking provides convenient access to frontages and can add to the vitality of a road. Conversely, poorly designed parking can create safety problems and reduce the visual amenity of the area.
- b) Some of the positive effects of on-road parking are:
 - 1) In residential areas, parked vehicles create the perception of a narrower carriageway, which is likely to reduce vehicle speeds. Research suggests that parked vehicles generally

- create a speed environment that is 3 – 8km/h lower than when parking does not occur.
- 2) Parked vehicles provide a barrier between traffic lanes and the footpath.
 - 3) That they provide a common resource, catering for residents', visitors', customers and service vehicles in an efficient manner.
 - 4) Able to cater for peak demands from various users at different times of the day.
 - 5) Introduces activity to the road environment.
- c) Some of the negative effects of on-road parking are:
- 1) Indiscriminately parked vehicles may make access to fronting properties difficult through restricting visibility and possibly blocking driveways.
 - 2) On narrower roads, there may be a tendency for vehicles to park on footpaths restricting pedestrian movement.
 - 3) On-road parking spaces can visually dominate the road scene and undermine speed objectives, particularly when parking demand is low.
 - 4) Safety issues may arise for pedestrians if high parking demand reduces the availability of crossing opportunities with adequate visibility.
 - 5) Cars parked on-road can be more vulnerable to opportunistic crime than off-road spaces.
- d) The above demonstrates the importance of providing an appropriate quantum and type of parking to achieve the different objectives that are sought in different parts of the community.

4.3.17.1 Parking Supply

- a) The following factors should be taken into consideration when determining an appropriate level of on-road parking to be provided:
- 1) The nature of the surrounding land use.
 - 2) The function and geometry of the road.
 - 3) The amount of off-road parking provided.
 - 4) The total amount of parking expected to be generated.
 - 5) The turnover rate of parking that is anticipated.

- b) In residential areas, the rate of on-road parking shall be a minimum of one space per three residential units.
- c) The provision of parking on 'Classified Roads' shall be determined by Council, giving regard for any relevant parking strategy.

4.3.17.2 Parking Design

- a) Parking is most commonly and safely provided parallel to the kerb.
- b) Parking that is provided parallel to the traffic lane shall be at least 2.0m wide and no wider than 2.3m. A parking width of 2.0m is appropriate in low turnover parking areas where most parked vehicles are cars. Wider dimensions are more appropriate in high turnover parking areas or where larger vehicles could be expected to park.
- c) In residential areas, it is preferable for parking spaces to be visually separated from the carriageway, for instance by the use of different surfacing, as shown in **Figure 4-S**.



Figure 4-S Different Surfacing Provides Visual Separation between Parking Spaces and the Carriageway

- d) Parking bays can break up the visual impact of on-road parking through separating small groups of parking spaces by kerb extensions, street furniture and planting. They generally provide more and safer opportunities for pedestrians to cross at mid-block locations, and contribute to better overall road environment amenity.
- e) Parallel parking that is provided as indented bays shall be at least 2.2m wide and no wider than 2.5m. The crossfall of parking bays should be designed to have them drain towards the road. The

width of any flat kerbside drainage channel may be included as part of parallel parking width dimensions.

- f) Parallel parking spaces shall be 5.0m long where access is possible from an end and 6.0m long when between other parking spaces or where access is restricted. Parking spaces shall commence a minimum distance of 6.0m from any side road.
- g) In low parking demand areas, parallel parking shall be delineated by a 100mm wide continuous white line parallel to the kerb.
- h) In moderate parking demand areas, the extent of parking at intersections and kerb crossings shall be identified with inverted 'L' or parking tick markings, as defined in Section 2.11.04 of the Manual of Traffic Signs and Markings. The markings shall be located 1.5m from the edge of driveways and other kerb crossing points.
- i) Where parking is metered or where there is high parking demand, individual parking spaces shall be marked.
- j) Marking is required for all parking on 'Classified Roads', and on 'Unclassified Roads' where angle parking is provided or where parking restrictions are in place.
- k) Angle parking on Local Roads may be designed so that vehicles manoeuvre to and from spaces within the traffic lane. On higher order roads, adequate space must be available for vehicles to manoeuvre to and from spaces completely clear of the traffic lane.
- l) Angle parking is only appropriate on roads where the speed limit is 50km/h or less.
- m) The dimensions of angle parking spaces shall be in accordance with Austroad's Guide to Traffic Management: Part 11 - Parking.

4.3.18 Clear Zones

- a) The purpose of a clear zone is to provide space for the driver of a vehicle that leaves the traffic lane to regain control while sustaining minimum damage to the vehicle and its occupants.
- b) A clear zone is measured from the edge of the traffic lane and is the width of roadside available for the driver to corrective action.
- c) To provide this zone, potential hazards such as above ground utilities, road furniture and street trees, lighting columns shall be located at a distance from the edge of the traffic lane greater than the widths shown in **Table 4-18** or **Table 4-19**, whichever is applicable.

Table 4-18 Clear Zone Widths (Without Kerb)

One Way Daily Traffic Volume	Speed Environment		
	50km/h	70km/h	100km/h
1,000 vpd	3.0	3.4	6.0
5,000 vpd	3.0	5.4	9.0

Table 4-19 Clear Zone Widths (With Kerb)

Road Hierarchy	Speed Environment		
	≤ 50km/h	70km/h	100km/h
Arterial	2.5	3.0	NA
Principal	2.0	3.0	NA
Collector	1.5	3.0	NA
Sub-Collector	1.0	NA	NA
Local	1.0	NA	NA
Residential Lane	0.75	NA	NA

- d) The clear zone is most commonly applicable to the left side of the traffic lane. However, on median-divided roads it is also applicable to the right hand side. The clear zone distance is related to predicted traffic volumes and speed and takes into account the widths of adjacent lanes, shoulders, medians, berms, footpaths and traversable batters.
- e) To be regarded as part of the clear zone the areas should be:
- 1) Relatively flat, with a maximum side slope of 1 on 3 (cutting) and desirably 1 on 4 (embankment) or flatter; and
 - 2) Traversable, having slope changes that will keep all wheels of an errant vehicle in contact with the ground (this assists the driver of an errant vehicle to regain control).
 - 3) Clear of all non-collapsible and non-frangible objects. Only objects which will collapse or break away on impact should be located in the clear zone to ensure minimal damage to an errant vehicle and its occupants.
- f) Where it is not possible to provide an adequate clear zone, free of non-frangible obstacles for the appropriate distance, a vehicle barrier must be considered. Any vehicle barrier within the clear zone, must include the barrier deflection when determining the offset between the edgeline and the hazard. Guidance on the design and construction of vehicle barriers shall comply with NZTA M23 Notes 'Notes for Road Safety Barrier Systems' (2009).

- g) Hazards within the clear zone also include vertical drops from features such as drains, culverts and hillside topography. Any vertical drop of more than 1m within the clear zone shall be considered to be a hazard and must be removed or treated to prevent entry by an errant vehicle. A vehicle barrier is likely to be the most common form of treatment.

4.3.19 Utilities

- a) The layout of all roads must accommodate infrastructural services and provide convenient access for the maintenance of those services. These can usually be accommodated within a 1 to 2m wide corridor, which is positioned under the berm or under the footpath.
- b) For new roads, it is preferable for services to be located under the footpath, particularly in hillside developments to minimise the width of road reserve that is required. Where services will be located under the footpath, the width of the service strip adjacent to the property boundary may be reduced to 0.5m.
- c) For upgrades to existing roads or the provision of new services in existing roads, services may be located under the berm adjacent to the property boundary or under the footpath.
- d) Services are not permitted to be located in the berm between the footpath and the kerb, as this will preclude the planting of street trees. Where street trees are not proposed, the water pipe may be located in this area.
- e) The width between the kerb and property boundary must be designed to provide sufficient clearance between services. In addition, there must be at least 600mm horizontal separation between the power and the property boundary (refer SD 414 and 415).
- f) Where street trees are planned, sufficient space must be allowed for them outside of the service corridor with sufficient clearance so that services are not damaged by roots as the trees grow.

4.3.20 Service Vehicles

- a) The design of roads shall accommodate service vehicles without allowing their requirements to dominate the layout. On 'Unclassified Roads', it may be assumed that they will be able to use the full width of the carriageway to manoeuvre.
- b) Larger vehicles which are only expected to use a road infrequently, such as removal vehicles, need not be fully accommodated on 'Unclassified Roads'.

- c) The design of intersections to accommodate turning requirements of larger vehicles shall follow the principles specified in Section 4.3.8.8 'Intersection Radii' of this Land Development Manual.
- d) Well-connected road networks have significant advantages for service vehicles. A shorter route can be used to cover a given area, and reversing may be avoided altogether.
- e) However, some sites cannot facilitate such ease of movement (e.g. linear sites and those with difficult topography), and use cul-de-sacs to make the best use of the land available. Turning heads must be provided in cul-de-sacs in accordance with Section 4.3.4.1 'Turning Heads' of this Land Development Manual.
- f) The most common type of service vehicle accessing residential areas will be those associated with regular waste collection. The operation of waste collection services should be an integral part of road design and achieved in ways that do not detract from road environment amenity.
- g) While it is always possible to design new roads to take the largest vehicle that could be manufactured, this would conflict with the desire to create quality places and create low speed environments in local residential areas. Accordingly, it is important that the authority responsible for waste collection consider potential conflict with the transport objectives of this Land Development Manual when proposing changes to the size of waste collection vehicles.

4.3.21 Road Marking

- a) All new and upgraded roads shall provide road marking in accordance with the NZTA Manual of Traffic Signs and Markings (MOTSAM) – Part II Markings.
- b) Council requires that:
 - 1) Centrelines are marked on all 'Classified Roads' and 'Unclassified Roads' that have a speed limit of 60km/h or above.
 - 2) Centrelines are marked on sections of 'Unclassified Roads' where insufficient forward visibility is provided between opposing vehicles on narrow carriageways to see each other and stop (refer Table 4-8 for Safe Stopping Sight Distances for various design speeds).
 - 3) Lane lines are installed wherever there is more than one lane in the same direction.
 - 4) Edge lines are marked on all 'Classified Roads' and on 'Unclassified Roads' in rural areas. Edge lines may also be provided on other roads to improve delineation.

- 5) No stopping lines are marked within the turning head of a cul-de-sac. However, the use of no stopping lines in other location shall be done so sparingly and must be approved by Council.

4.3.22 Signage

4.3.22.1 Traffic Signs

- a) All new and upgraded roads shall provide traffic signs in accordance with The Manual of Traffic Signs and Markings (MOTSAM).

4.3.22.2 Road Name Signs

- a) Developers constructing new roads may submit to the Council, at the time of submission of Engineering Plans, a list of suggested road names, with alternatives, including any supporting information for the preferred choices. This includes walkways and common accessways.
- b) Names of local significance are encouraged. The Designer will be advised of the name(s) that have been approved by the Council in terms of its policy.
- c) All walkways and common accessways shall use the word 'Way' on the sign.
- d) Road name frames and posts may be customised to suit the character of the subdivision and matched with street lighting columns and other road furniture, subject to approval by Council.
- e) Road name signs shall be located between 500mm and 1500mm of the kerb or sealed road shoulder and within the area formed by the intersecting legal road boundaries.
- f) Road upgrade projects must include the relocation of the road name sign, if the works make its old position inappropriate.

4.3.22.3 Entrance ('Gateway') Signs and Structures

- a) Entrance signs and 'gateway' structures need to be carefully considered and designed to ensure they are not interpreted by the public as private areas, where no through access is provided or permitted.
- b) For developments where the public has rights of access (including neighbourhood parks) the erection of entrance signs and structures other than standard road name signs is discouraged, but may be permitted by Council on a case-by-case basis.
- c) Applications for signs and structures must be shown on the Engineering Plans for approval by Council prior to construction.

- d) Where approval from Council has been obtained to erect entrance or 'gateway' signs and structures then these must be designed and constructed to ensure little, if any, on going maintenance and up-keep is required.
- e) The materials used (including lettering) shall be constructed of permanent, solid materials that are unpainted and do not require painting. They shall be located clear of all other above ground and underground services and shall not restrict visibility for motorists or pedestrians.

4.3.23 Traffic Calming Devices

- a) A lower speed environment is more likely to be achieved by considering the relationship of all design features within and beyond the road corridor when designing roads.
- b) The road design principles presented in the preceding sections should, if properly implemented, reduce the need for traffic calming measures to manage the speed environment to be introduced at a later date.
- c) Traffic calming measures, outside of those indicated as being suitable in other sections of the Land Development Manual, shall not be incorporated into the design of any road without approval from Council.

4.3.23.1 Device Selection

- a) The selection of traffic calming devices must be compatible with the intended road function. Ideally, traffic calming devices should inhibit inappropriate behaviour by changing the user's perception of the environment.
- b) Traffic calming devices have effects not only on road users, but also on the environment in which they are located in terms of noise and air pollution generated by vehicle deceleration and acceleration.
- c) Where alternative devices support a similar objective, consideration should be given to the degree of effectiveness required and the likely environmental effects.
- d) The selection and placement of traffic calming devices shall be consistent with Austroads Guide to Traffic Management: Part 8 – Local Area Traffic Management.

4.3.23.2 Design Considerations

- a) Overuse of devices will reduce their effectiveness globally, as will the passage of time reduce it locally, as drivers become familiar with them. Regardless of this, ensure a degree of consistency in the use of traffic calming devices:

- 1) Use similar devices in similar ways.
 - 2) Design devices so that drivers can recognise and react to them appropriately both in approach speed and alignment.
 - 3) Provide road marking, signage and lighting to support the device's purpose.
 - 4) Ensure sight distances comply with Section 4.3.8.7 Safe Stopping Distance.
 - 5) When designing the device layout, first consider where in the street the device is best placed to achieve the objectives.
 - 6) Design longitudinal vertical gradients under 3% at intersections where traffic calming devices will be installed.
- b) Some key design consideration from that document are:
- 1) Traffic calming devices that introduce a high degree of restraint, like speed humps, should be spaced 80 - 120m apart to control speeds effectively along a length of road.
 - 2) Traffic calming devices should be designed so that they do not create pinch-points for cyclists or confuse priority between general traffic and pedestrians.
 - 3) The maximum carriageway gradient that speed humps are permitted is 1 in 12 (8%).
 - 4) All speed control devices shall be signposted (including the negotiation speed) and be provided with appropriate lane marking.

4.4 CONSTRUCTION

4.4.1 Road Formation

4.4.1.1 Design Life

- a) The carriageway pavement shall be designed to a 25-year design life. If a method of construction other than the standard New Zealand Transport Agency (formerly Transit New Zealand – TNZ) specifications is to be used then this method shall be required to achieve the specified design life.

4.4.1.2 Method of Compliance

- a) The Designer shall nominate his method of construction for approval by the Council.
- b) If the Designer wishes to use a method of construction other than the standard New Zealand Transport Agency specifications then full details of the construction method including programming, plant, etc. shall be submitted to the Council for approval. The Designer shall also submit details of where the nominated alternative construction method has previously been employed together with performance details, acceptance testing results and an independent reference in support of this method.
- c) If no specific alternative construction method is nominated and approved by the Council then all works shall comply with the New Zealand Transport Agency Specifications shown in Table 4-20.

Table 4-20 Relevant NZTA Specifications

NZTA Specification (Name)	NZTA Specification (ID)
Earthworks Construction	NZTA F/1 (1997)
Pipe Subsoil Drain Construction	NZTA F/2 (2000)
Pipe Culvert Construction	NZTA F/3 (2000)
Basecourse Aggregates	NZTA M/4 (2006)
Sealing Binder	NZTA M/1 (2007) and NZTA M/13 (1989)
First Coat Sealing	NZTA P/3 (1995)
Sealing Chip	NZTA M/6 (2004)
Asphaltic Concrete	NZTA M/10 (2005)
Construction of Asphalt Concrete Paving	NZTA P/9 (1975)

4.4.2 Road Assessment Maintenance Management (RAMM) Data

- a) The Designer shall submit a completed Road Assessment Maintenance Management (RAMM) Data Sheet (see Appendix A) to the Council for each separate job or section of a continuing job which involves road construction. This shall be submitted at the As Built engineering plan stage.

4.4.3 Earthworks

4.4.3.1 General Requirements

- a) Refer to Section 9 'Earthworks' of the Land Development Manual for design principles.

4.4.3.2 Planning and Regulation Requirements

- a) Land disturbance and earthworks activities are the subject of rules within the Nelson Resource Management Plan.
- b) Before planning or commencing any such activities the Designer is required to contact the Resource Management Department of the Nelson City Council to determine what rules apply and obtain Resource Consent where required.

4.4.3.3 Erosion and Sedimentation Control

- c) Due to the increased rate of run-off brought about by site clearance in mass earthworks, particular care shall be taken to control stormwater, and to ensure that it is permitted free entry to stormwater culverts at all times.
- d) Prior to the commencement of any earthworks, the Designer shall submit an Erosion and Sedimentation Control Plan to the approval of Council.
- e) The designer shall be responsible for ensuring that all works shown on the approved Erosion and Sedimentation Control Plan are constructed and maintained during the construction period of the work, and until such times as the land becomes stabilised to the satisfaction of the Council.
- f) Any of the Council's stormwater systems obstructed by silt shall be thoroughly cleaned by the Developer on which the development is taking place at the Developers cost.

4.4.4 Placement of Filling

4.4.4.1 General Requirements

- a) NZS 4431: 1989 'Code of Practice for Earthfill for Residential Development' shall, except as noted below, provide the standard

for fill placement generally. The following criteria may be modified where the Designer is, or employs the services of a person who specialises in slope stability and soils engineering.

- b) The fill material shall be spread and compacted in uniform homogeneous layers. In road reserves, the material shall be spread parallel to the length of the road.

4.4.4.2 Compaction Against Existing Slopes

- a) In areas of unenclosed filling, where the original ground has a slope steeper than 1 in 2.75 (36%), the original ground surface shall be properly prepared before any material is placed against it. Any benches shall be of sufficient width to accommodate compaction and spreading equipment, and shall be arranged so as to be adequately drained during the placement of filling material.

4.4.4.3 Depth of Layer

- a) The depth of the layer shall be related to the type and model of compaction plant proposed to be used and the type and size of material.
- b) The Designer shall nominate the proposed layer depths and plant, and should expect to be required to supply supporting documentation that shows that the proposed compaction method is compatible with the material being used.
- c) When no information is supplied the following shall apply:
 - 1) In the carriageway within 500mm of the finished subgrade, the layers shall be spread and compacted to a loose depth not exceeding 150mm.
 - 2) Elsewhere, the layers shall be spread and compacted to a loose depth not exceeding 200mm.

4.4.4.4 Moisture Content

- a) The material shall at all times be placed at a moisture content close to the optimum moisture content for the material under consideration. The allowable tolerance shall not exceed limits of minus 2% or plus 2%. The Designer shall be responsible for supplying a test certificate, quoting optimum moisture contents of the materials encountered on the work.

4.4.4.5 Standard of Compaction

- a) The Designer shall ensure that for heavy clay silts, sandy clays and gravels the minimum density to be achieved is 95% of the maximum dry density, and for sands the minimum density to be achieved is 100% of the maximum dry density.

- b) The maximum dry density shall be obtained by standard compaction at optimum moisture content as detailed in NZS 4402: 2006 Methods of Testing Soils for Civil Engineering Purposes.
- c) Within the carriageway the criteria for the structural design of pavement (Section 4.4.6 'Structural Design of Pavement') shall take precedence over standards of compaction given in this clause.

4.4.4.6 Routine Testing

- a) Routine testing shall be carried out on earthworks at the rate of one test every one metre depth of filling spaced at 30 metre grid points over the area concerned.
- b) The results of these tests shall be supplied to the Council. All tests prior to and during construction shall be carried out by or under the supervision of a Designer experienced in soil compaction techniques. The Council may carry out further tests at any stage if it considers them necessary.

4.4.4.7 Stability of Embankments

- a) Where in the opinion of the Council the stability of any embankment as planned is in doubt, then the council may require a stability analysis of the slope, under saturated condition to be carried out (see also AS/NZS1170: 2002 Structural Design Actions or the Transit Bridge Manual).

4.4.4.8 Exemption from the above requirements

- a) Where the area of fill does not exceed 100m² and the depth does not exceed 600mm maximum, the above requirement concerning testing (Section 4.4.4.6 'Routine Testing') may, at the discretion of Council, not be enforced.

4.4.5 Mass Earthfills for Residential Areas

- a) Where mass earthworks (cutting or filling) are proposed that will extend beyond existing or proposed road boundaries the Council shall require the following information, in addition to any requirements under Section 4.4.3 'Earthworks' and Section 4.4.4 'Placement of Filling'.
 - 1) A plan showing the contours or levels of the existing site, final contour levels, the existing watercourses, together with any available information on the water table and the ground surface of the area concerned, and logs of any bores taken during investigations. The positions of boreholes and other geotechnical investigation/testing are to be geo-referenced.

- 2) A pattern of sections showing the extent of cut and fill and a plan showing batter slopes, drainage or culverting.
- 3) The naming of a Designer experienced in soil compaction techniques who will be responsible for supervising and controlling the operations on the site as set out in the specification.
- 4) A specification on the compaction methods and degrees of compaction required, also giving moisture/density test results of the soil to be encountered.
- 5) On completion of the earthworks certification shall be supplied from the Designer, stating that the requirements of the specification have been carried out and giving details of the test results in accordance with the requirements of the specification (as per Section 10 of NZS 4431: 1989 Code of Practice for Earthfill for Residential Development).

4.4.6 Structural Design of Pavement

4.4.6.1 General Requirements

- a) The pavement shall be designed in accordance with recognised techniques that include, but are not limited to those listed below.
 - 1) CBR Method - CBR design curves are given on SD 405 or Austroad's 'A Guide to the Structural Design of Road Pavements' (1992).
 - 2) Scala/Dynamic Cone Penetrometer (Design curves are given on SD 406).
 - 3) Design method based on Benkleman beam deflections (Design curves are given on SD 404).
- b) The Designer shall state the method used and may be requested to supply information to support the design method.

4.4.6.2 Submission of Test and Design Data

- a) The following information shall be submitted at the same time that Engineering Drawings are submitted for approval.
 - 1) All test information obtained to provide a basis for pavement design.
 - 2) Copy of design calculations used to determine pavement thickness.

4.4.6.3 Basecourse and Sub-basecourse Aggregate

- a) Basecourse and sub-basecourse aggregate used in the construction of pavements shall comply with the following material requirements:
 - 1) Percentage passing and proportion of broken rock in accordance with the grading envelopes shown on SD 401 to 403
 - 2) A crushing resistance of not less than 130kN for basecourse and 110kN for sub-basecourse.
 - 3) A weathering resistance of category of either AA, AB, AC, BA, BB or CA.
 - 4) A sand equivalent of not less than 40 when tested in accordance with NZS 4407: 1991.

4.4.6.4 Minimum depth of Construction Metal Course

- a) The minimum metal depth shall be 200mm in all public and private roads, except for Private Ways serving residential properties only where a metal depth of 150mm is permitted.

4.4.6.5 Stabilisation of Construction Courses

- a) The Designer may choose to use stabilising agents on the construction courses to reduce the depths required. The Designer shall supply supporting information and test results to prove the type and quantity of stabilising agent is compatible with the type of material and projected use of the road.
- b) The Designer shall indicate relevant experience in this field and also supply information on the experience of the proposed contractor.
- c) This design option shall only be permitted after consultation with and approval by the Council.

4.4.6.6 Filter Fabrics/Geotextiles

- a) Depending on the ground conditions, a layer of filter fabric/geotextile may be required to separate the subgrade from construction courses. The filter fabric/geotextile used shall be carefully chosen to achieve the desired results.
- b) The use of geotextiles as a structural element of the pavement design shall only be permitted after consultation with and approval by the Council.

4.4.6.7 Acceptance Criteria – Pavement Strength

- a) The Designer shall nominate a method of testing to be used to demonstrate that the construction is within the design criteria.

This testing shall be carried out immediately prior to the surfacing of the pavement.

- b) If no method is nominated or approved by the Council then the method of testing for compliance with the pavement design standard shall be the carrying out of Benkleman Beam tests. The maximum allowable deflections shall comply with Table 4-21.

Table 4-21 Maximum Pavement Deflection

Road Hierarchy	Maximum Deflection (mm)
Arterial Roads	0.8
Principal Roads	1.0
Collector Roads	1.3
Sub-Collector Roads	1.5
Local Roads	1.8
Residential Lanes	1.8
Private Ways	2.0
Notes:	
1. Not more than 5% of the tests shall exceed the maximum as set out in the above table	
2. No single result shall exceed the maximum allowable by more than 50%	
3. Any area of excessive deflection shall not exceed 5.0 square metres.	

- c) Where any areas of the carriageway fail the acceptance testing the Designer shall nominate his proposed remedial action for approval by the Council.
- d) If required by the Council the failed areas shall be dug out and clean sub-base and or basecourse compacted in the excavation, and the surface prepared for sealing.
- e) A further set of tests shall be carried out to show that the affected area is up to the required standard.

4.4.6.8 Acceptance Criteria – Road Profile

- a) The finished shape of the road shall be such that when a straight edge is laid parallel to the centre line of the road or a camber board laid perpendicular to the centre line, the surface shall not vary from the straight edge or camber board by more than 10mm in any 3-metre length.
- b) Prior to sealing, the surface of the road shall be clean, reasonably dry, and free of ice, frost, or loose material, tightly compacted and shall present a clean mosaic appearance. All concrete surfaces, channels, sump surrounds, service boxes, manholes etc shall be completed to their final height to fit the finished (sealed)

road profile. All service boxes and manhole lids shall be finished to within 5 to 10mm above the finished (sealed) road profile.

- c) The shape of the carriageway shall conform to the Camber Table, SD 420.

4.4.7 Subgrade Checking

- a) Where the extent of cut or fill for the project is too great to make subgrade CBR testing feasible at the design stage it may be done on completion of earthworks when subgrade levels have been exposed. Even in cases where subgrade has been tested as part of the design its condition shall be reviewed on exposure during construction and pavement thicknesses adjusted accordingly.
- b) The results of such testing and/or review along with consequent adjustments to pavement layer thicknesses shall be advised to the Council before placing of pavement layers commences.

4.4.8 Subgrade Drainage

- a) This shall be a 100mm diameter or equivalent proprietary sub-soil drainage system surrounded by bedding chip.

4.4.8.1 Sub-soil Drains in Cuts (on Hillside Subdivisions)

- a) When the road or right of way is in cut, a sub-soil drain shall be placed at the toe of the batter and connected into the back of the nearest sump downstream.

4.4.8.2 Wet Spots in Subgrade

- a) Any permanent wet spot in the subgrade or any area undercut below adjacent sub-soil drains shall be connected to the nearest piped stormwater system by another sub-soil drain. Where the drain is located under the carriageway, traffic loading shall be taken into consideration for the type of pipe.

4.4.8.3 High Groundwater

- a) In areas of high groundwater or where the road pavement design is reliant on the subgrade remaining reasonably dry, it may be necessary to install a sub-soil drainage system to prevent excessive moisture getting into to the subgrade.

4.4.8.4 Subgrade Drainage Systems

- a) In some cases, it may be necessary, due to the nature of the country, to lay an extensive sub-soil drainage system. In such a case, the material covering the pipes shall be graded upwards so that particles cannot enter the pipes. In general, to satisfy the

condition that particles do not enter the pipe and no scour occurs in the "filter", the following ratios must be complied with:

- 1) $\frac{\text{85\% size of filter material}}{\text{Size of opening in pipe}} \geq 2$
 - 2) $\frac{\text{15\% size of filter material}}{\text{85\% size of protected soil}} \leq 5$
 - 3) $\frac{\text{15\% size of filter material}}{\text{15\% size of protected soil}} \geq 5 < 40$
- b) It shall be necessary in most cases to manufacture a suitable filter material to comply with the above requirements.
 - c) Alternatively, the sub-soil drainage system may be wrapped with a Council approved filter material.

4.4.9 Carriageway Surfacing

4.4.9.1 General

- a) The minimum requirement for residential streets is a wearing surface of approved two coat Grade 3 and Grade 5 chipseal or 25mm asphaltic concrete mix 10 over a Grade 5 chip seal constructed on the approved basecourse.
- b) The minimum requirement for streets in industrial areas is a wearing surface of 35mm depth of mix 15 asphaltic concrete on an emulsion Grade 5 chipseal constructed on the approved basecourse. Alternative surfacing may be allowed to specific limited areas with the approval of the Council.
- c) For all roundabouts, the turning heads in cul-de-sacs, and in other high stress environments the surface shall be 50mm depth of mix 15 asphaltic concrete on an emulsion Grade 5 chipseal constructed on the approved basecourse.
- d) Prior to surfacing, the basecourse finish shall be such that when swept it presents a tightly compacted, non-glazed, clean stone mosaic surface that will not ravel as a result of sweeping. The standard of sweeping shall be sufficient to remove all loose aggregate, dirt, dust, silt and other deleterious matter.

4.4.9.2 Chip Seal

Seal Design

- a) The seal design shall generally be the responsibility of the Designer.
- b) The Designer shall submit his seal design for approval by the Council 7 days prior to any sealing commencing.

- c) The submitted designs shall include details of:
 - 1) Bitumen/Emulsion to be used
 - 2) Additives to be used
 - 3) Application rates
 - 4) Construction method

Sealing Binder

- a) The materials used shall meet the requirements of the relevant clauses of the following NZTA specifications.
 - 1) M/1: Roothing Bitumens (2007)
 - 2) M/13: Adhesion Agents (1989)
- b) Sealing binder shall be either 180/200-penetration grade bitumen or emulsion of a suitable type from an approved supplier.

Sealing Chip

- a) Sealing chip shall meet the requirements of the relevant clauses of NZTA M/6 (2004) Sealing Chip.

Application of Sealing Binder

- a) Spraying operations shall be carried out so that private property and street furniture are not affected by overspray.
- b) The end of each sealed area shall be a straight line at right angles to the road edge. Sealing runs should start and finish on paper and no binder shall be allowed to drip onto sections of the roadway that have previously been sealed.

Application of Chip

- a) Chip spreading equipment shall be capable of spreading the aggregate evenly, at a controlled rate and in such a way that chip does not tumble on impact with the sprayed surface.
- b) All excess chip shall be swept from the carriageway and removed from the channels, footpaths, berms and sumps prior to the acceptance of the works by the Council.

Acceptance Criteria

- a) The two coat seal shall provide a fully interlocked surface after rolling. Chip loss, bleeding or flushing shall not exceed 5% in any one metre by one metre square of the total sealed area during the maintenance period.

4.4.9.3 Asphaltic Concrete

- a) For residential streets asphaltic concrete paving (hot mix) shall comply with NZTA Specification M/10 'Asphaltic Concrete' (2005) Table 5.1 Mix 10 and shall be a minimum compacted thickness of 25mm. The binder shall be 80/100-penetration bitumen. The construction of the paving shall be carried out in accordance with NZTA P/9 'Construction of Asphaltic Concrete Paving' (1975), unless otherwise approved by the Council.
- b) For streets in industrial areas, asphaltic concrete paving (hot mix) shall comply with NZTA Specification M/10 Table 5.1 Mix 15 and shall be a minimum compacted thickness of 35mm. The binder shall be 80/100-penetration bitumen. The construction of the paving shall be carried out in accordance with NZTA P/9 'Construction of Asphaltic Concrete Paving' (1975), unless otherwise approved by the Council.
- c) The asphaltic concrete wearing course shall be laid on a Grade 5 chip seal constructed in accordance with Section 4.4.9.2 'Chip Seal'.
- d) All cold asphalt joints are to be Polymer Modified Bitumen (PMB) hot bandaged. The bandage shall be at least 100mm wide and 1.5mm thick. Alternative PMB methods will be considered by Council.
- e) Note that for all roundabouts and the turning heads in cul-de-sacs the surface shall be 50mm depth of Mix 15 asphaltic concrete on an emulsion Grade 5 chipseal.

4.4.9.4 Weed Protection

- a) Immediately prior to any form of surfacing, a strip one metre wide adjacent to each channel shall be applied with an approved ground sterilising weed killer at the manufacturer's recommended rate of application.

4.4.10 Standards of Formation

4.4.10.1 Residential Lanes, Service Lanes and Private Ways

Formation

- a) The finished surface shall have a crossfall of 1 in 33 (3%) and shaped with a crown or camber.

Metalling

- a) All topsoil and growth shall be removed and compacted basecourse and sub basecourse (where required) laid and graded to an even surface.

Structural Design of Pavement

- a) The pavement shall be designed as detailed in Section 4.4.6 'Structural Design of Pavement'.

Sealing

- a) All formations are to be surfaced in accordance with Section 4.4.9 'Carriageway Surfacing'.

Channelling

- a) Kerb and channelling on Private Ways shall arise when any of the following are present:
 - 1) The Private Way has a gradient of less than 1 in 60 (1.7%).
 - 2) The Private Way has a length in excess of 20m.
 - 3) Three or more potential household units served by the access.
- b) Kerb and channel shall be provided on at least one side for the full length of the Private Way and the crossfall shall fall towards this.
- c) For Residential Lanes, kerb and channel shall be provided on the footpath side for the full length and the crossfall shall fall towards this. A nib kerb, or similar, shall be provided on the other side for the full length of the Residential Lane.
- d) For Service Lanes, kerb and channel shall be provided on both sides for the full length.
- e) The high side of the formation shall be retained by either of the following: kerb and channel, nib kerb or 100mm x 25mm ground treated (H4) timber batten and 50mm x 50mm pegs.
- f) The kerb and channel shall be constructed in accordance with Section 4.4.11 'Kerb and Channelling'.

Stormwater

- a) For private ways more than 10m in length or more than 30m² of sealed surface, all stormwater off the formation shall be collected by an approved stormwater system.
- b) Sumps shall be located at the low side of the formation within kerb and channel (or similar) and at the street boundary where falls are towards the carriageway. New sumps shall not be permitted within a vehicle crossing on the line of the street kerb and channel.

4.4.10.2 Commercial and Industrial Areas

- a) Service Lanes in commercial and industrial areas shall be formed as for streets; see Section 4.4.6 'Structural Design of Pavement' and Section 4.4.9 'Carriageway Surfacing'.
- b) Kerb and channel and stormwater drainage shall be provided.

4.4.11 Kerbing and Channelling

- a) Kerb and channel should be provided on both sides of the carriageway except for carriageways with single crossfall such as private ways and residential lanes.

4.4.11.1 Excavation and Basecourse

- a) If unsuitable soil conditions are encountered at the base of kerb and channel excavations the site shall be trenched out below this depth and backfilled with gravel or other approved fill material in layers of a thickness that is compatible with the type of compaction equipment and material being used. Compaction shall be to a minimum of 98% of maximum dry density. A minimum depth of 50mm of compacted base course shall be placed under the kerb and channel.

4.4.11.2 Concrete

- a) All concrete shall be mixed using separately graded fine and coarse aggregates in a power-driven weight batch mixer, or it may be supplied by an approved "ready mix" concrete works. In either case, the concrete shall comply with specified requirements of High Grade Concrete in NZS 3108: 1983 'Specification for concrete production – ordinary grade' that is, have a minimum cement content of 362kg per cubic metre and a maximum water/cement ratio of 0.52, giving a minimum specified crushing strength at 28 days standard cured of 28 MPa.
- b) Construction joints to control cracking shall be installed in the kerb and channel every 6 – 8m.

4.4.11.3 Formwork

- a) Slip forming of the kerb and channel is generally acceptable provided the standard of work produced by an individual machine has been approved by the Council.
- b) Formwork for kerb and channel shall be approved dressed timber, steel or aluminium alloy sections adequately oiled or otherwise treated to allow ease of striking without staining of the stripped concrete surface. All formwork shall be accurately placed to the lines and levels of the works and shall be such as to give the finished kerbs smooth and pleasing lines free of kinks and angles.

- c) The profile shall conform with SD 407 and the finish and accuracy of the work comply with that stated in Section 4.4.11.4 'Accuracy and Standard of Workmanship'.

4.4.11.4 Accuracy and Standard of Workmanship

- a) Construction joints (for crack control) shall be installed at 6.0m intervals. Kerbs and channels shall be finished such that on straight portions there is no deviation of more than 5mm within the length of a 3m straight edge; nor a deviation of more than 5mm from the line and level.
- b) Kerbing and channelling be finished with a steel float and any concrete work showing honeycombing or scale in the face is to be removed and replaced with fresh concrete of the grade specified in Section 4.4.11.2 'Concrete'.
- c) All repairs to damaged kerb must be made prior to footpath surfacing.

4.4.11.5 Curves

- a) The Council may direct that horizontal or vertical curves of less than 60m radius shall be constructed using special insitu formwork.
- b) Use of regular forms to produce a chorded effect shall not be accepted.
- c) Changes of grade shall be made with a smooth vertical curve, and horizontal curves shall be true.

4.4.11.6 Benchmarks

- a) The Designer shall install NCC standard benchmark plaques on the top of the kerb. A minimum of one plaque shall be installed in each new street, at maximum intervals of 300m. Where a plaque is installed to meet the requirement of Land Information NZ (LINZ) this shall be used as the benchmark and the NCC plaque omitted.
- b) The proposed location shall be shown on the engineering plans. The Designer shall establish a reduced level and coordinates on each new benchmark and show this on the "As Built" plans to two decimal places. The origin for the levels shall be from a previously established benchmark, and the origin stated on the drawings. A closed circuit run shall be used to establish each new benchmark level. The coordinates shall be established to Fourth Order survey standard accuracy.
- c) The levelling shall be carried out to second order standards and levels are to be shown to two decimal places.

- d) Where a subdivision is staged the Designer may not be required to install a benchmark in each stage.
- e) NCC benchmark plaques will be supplied by the Council at no cost to the Designer.

4.4.12 Footpaths

- a) The following construction standards apply to footpaths and paths in roads, accessway links between roads, accessways linking roads to reserves and paths in reserves.
- b) Footpaths and accessways must have a durable and non-skid surface.
- c) The surface may be concrete, asphaltic concrete or block paving where specifically approved by the Council.
- d) Where a footpath is constructed and there is a mountable kerb, both shall be designed to carry the same vehicle loadings as the carriageway. Refer to 4.4.14 Kerb Crossings.
- e) The footpath pavement shall be designed in accordance with recognised techniques that include but are not limited to those listed below.
 - 1) CBR Method (CBR Design curves are given on SD 405).
 - 2) Scala/Dynamic Cone Penetrometer (Design curves are given on SD 406).
- f) Shared accessway and footpath construction must be continuous across driveways to ensure priority of shared accessway or footpath users is reinforced.

4.4.12.1 Concrete Footpaths

- a) The minimum construction is to be 100mm thickness of 25MPa at 28 days concrete. The finish shall be wooden float, or other equivalent non-skid surface.
- b) Residential entrance slabs shall be increased to a minimum of 150mm thick for full width of crossing including wings.
- c) Commercial entrance slabs shall have a minimum of 200mm thickness of 30MPa concrete and shall be reinforced with one layer of 665 wwf placed 50mm from bottom edge of concrete.
- d) Industrial entrance slabs shall have a minimum thickness of 300mm of 30MPa concrete and shall be reinforced with 2 layers of 665 WWF reinforcing mesh. The 2 layers of mesh shall be placed 200mm apart with each layer having 50mm cover from the outside surface of the concrete.

- e) Construction joints are required at 6m intervals, and on both sides of entrance slabs. Refer to 409 for full details

4.4.12.2 Asphaltic Concrete Footpaths

- a) The path shall be paved with 25mm compacted depth of asphaltic concrete (refer NZTA M/10 Mix 10). All areas to be paved must be tack-coated prior to paving.
- b) A ground treated (H4) timber batten 100mm x 25mm minimum shall be firmly pegged along the edges of the footpath with the top of the batten at finished level, and shall remain intact after the completion of the work. Refer to 410.
- c) Joints in the asphalt surfacing shall be either saw cut or formed to produce a neat straight line at right angles to the edge of the footpath and a flush smooth finish to the surface of the footpath. Joints shall have a tack coat applied.
- d) The compacted basecourse depth shall be a minimum depth of 150mm on a subgrade with a minimum CBR of 6.
- e) Commercial and Industrial entrances shall be designed to take the same traffic loadings as the carriageway. Refer to SD 410 for full details.

4.4.12.3 Acceptance Criteria

- a) At no point on the finished basecourse surface shall the Clegg Impact Value be less than 25 for footpaths and residential crossings, and 35 for commercial vehicle crossings.
- b) The surface of the finished footpath shall be such that when a 3m long straight edge is placed across the footpath no area deviates from the straight edge by more than 5mm. The edge of the footpath shall not deviate by more than 5mm from the line and levels shown on the approved Engineering Drawings.
- c) Where adjacent to a kerb, the surface of the footpath shall be flush with or no more than 5mm above the top of the kerb.

4.4.12.4 Handrail

- a) Where located adjacent to public roads accessible by a motor vehicle, the handrail shall comply with Juralco Viking Balustrade (full height baluster) design, or other similar approved design as in SD 425.
- b) In other environments, such as 'Accessways', the handrail may comply with the alternative design as in SD 424.
- c) If the designer wishes to erect a fence or handrail of alternative design to the two above, then full details shall be submitted to the Council for approval.

4.4.13 Retaining Walls

- a) A building consent shall be obtained for all retaining structures retaining more than 1.5m depth of ground and/or supporting a surcharge.
- b) All retaining structures on Council land and structures that will be vested in Council ownership shall have a design life of 80 years minimum. The design and construction shall be supervised by a Chartered Professional Engineer.
- c) To improve visual amenity, retaining walls shall be of the minimum height necessary. Also, where possible and practical, retaining walls shall be constructed in such a manner as to allow planting in the wall or in front of the wall.
- d) The design of all retaining structures supporting roads, ROW's, footpaths or areas likely to have buildings erected within the area between the wall and a line measured at 45 degrees to horizontal from the base of the wall, shall include specific information from the Designer's Professional Advisor (DPA) stating what design and construction methods will be implemented to ensure that future settlement of the ground behind the wall and the ground surface will be no greater than 20mm over a 6m horizontal length.
- e) Generally retaining walls shall be constructed of either (or a combination) of the following types:
 - 1) Concrete Tilt slab
 - 2) Timber Pole (or Steel) with Timber rail
 - 3) Concrete Crib
 - 4) Galvanised Mesh Gabion
- f) Mechanically Stabilised Earth, Timber Crib or Rock walls are subject to specific design approval by Council.

4.4.13.1 Drainage of Retaining Walls

- a) Sub-soil drainage is not a general requirement for a permeable retaining wall such as a crib wall or timber pole wall. There are situations where sub-soil drainage of permeable walls may be required:
 - 1) Where walls have a back sloping below ground footing where water may be trapped.
 - 2) Where seepage from a retaining wall may cause a nuisance to an adjoining property owner.

- 3) Where seepage from a retaining wall in close proximity to a building site may be a nuisance or unsightly.
 - 4) Where a retaining wall is being built in an area of suspect stability and the removal of surface / ground water would be an advantage.
- b) Where subsoil drains are required, a subsoil drain comprising 110mm diameter Novaflow pipe shall be provided behind all walls. Subsoil drains shall be surrounded with 100mm minimum of free draining drainage metal. Drains shall be excavated into firm ground below the base of the wall and shall be linked together and extended to connect into an approved stormwater system.
 - c) Approved filter fabric material shall be placed between the drainage metal and in-situ or fill material.

4.4.14 Kerb and Swale Drain Crossings

- a) Kerb crossings shall be designed and constructed in accordance with SD 408 and 412.
- b) The minimum diameter of culverts under driveways where the driveway crosses the road swale drain shall be 300mm diameter.

4.4.15 Berms

- a) After the construction of the road and footpaths, and the installation of all services has been completed, the berm surfaces not occupied by pavements shall be levelled or graded to conform to the pavement edges and the adjoining properties, so far as is practical, allowing for the addition of topsoil to final grade.
- b) Topsoil to a firm minimum thickness of 100mm on clay surfaces and 150mm on sandy or gravelly surfaces shall then be spread so that a smoothly contoured surface is produced, free of ponding areas. The subgrade shall be capable of allowing root penetration and sustaining growth.
- c) The final topsoil surface shall be flush with the adjacent kerb and footpath and sown with approved seed mixtures. Special soils or conditions shall be treated to Council approval.

4.4.15.1 Grassing

- a) After topsoiling, the berms shall be sown with grass seed that conforms to the following mix proportions:
 - 1) 1.0kg chewing fescue
 - 2) 4.5kg dwarf rye grass

- 3) 0.5kg browntop
- b) The mixture shall be sown at a rate of 1kg to 40 square metres area.
- c) Prior to the sowing of the grass seed, fertiliser shall be spread and mixed with the topsoil. The recommended fertiliser is Super Phosphate applied at a rate of 30g per square metre. Alternative fertiliser and application rates may be used subject to prior consultation with the Council
- d) After two months dressing with Super Phosphate, a dressing with Sulphate of Ammonia applied at a rate of 30g per square metre shall be applied.

4.4.15.2 Street Trees

- a) Species are to be selected in accordance with Council's 'Street Tree Guidelines 2009'. All plants used shall be healthy vigorous and free of any defects that may be detrimental to plant growth and development. Council requires the use of locally sourced native species where appropriate.
- b) The trees shall be provided with root guards to prevent root damage to adjoining paved surfaces see SD 1201 and 1202. No trees or shrubs shall be planted within a 2.0m radius of any water valve or hydrant.
- c) Street trees planted within services free pavement areas of the inner city or commercial areas shall be provided in accordance with planter detail in SD 1202 and be protected by a tree guard.

4.4.15.3 Alternatives to Grassed Berms

Stone Surface

- a) This shall be crushed stone, uniformly graded with a nominal diameter of 20mm. The depth of the stone layer shall be 100mm. Crushed stone provides a considerably more suitable surface for walking compared to a round stone surface.
- b) Prior to placing the stone the excavated surface shall be compacted and a layer of weed cloth installed.
- c) The finished stone surface shall be uniform without any hollows or ridges and be flush with the top of the kerb and edge of footpath.

Ornamental Ground Cover

- d) The five varieties approved for use are:
 - 1) Purple Haze (Acacena Inermis Purpureum)
 - 2) Kina Red Heads (Acaena Inermis)

- 3) Bronze Feather Carpet (*Leptinella Trailii*)
 - 4) Mazus Radicans
 - 5) Mercury Bay (*Dichondra*)
- e) Planting shall be to the requirements of the plant retailer. The finished surface shall be uniform without any hollows or ridges and be flush with the top of the kerb and edge of footpath.

4.4.16 Road Marking

- a) All new edge lines, centrelines, continuity lines and limit lines shall be reflectorised with Type C glass beads to AS/NZS 2009: 2006 'Glass beads for pavement-marking materials' applied at 225g/m² and 220µm dry film thickness. A second coat is required after 6-8 months. A water based paint may be used for the second coat in these situations.
- b) Water based paint may be used for all other types of road marking, except, where road markings are required on any surface that is not chip seal or asphaltic concrete, in which case thermoplastic materials must be used.

4.4.17 Signage

- a) The location of all signs shall be shown on the Engineering Plans for approval by Council.
- b) All signs shall be installed by a contractor approved by Nelson City Council. The Developer shall liaise directly with the contractor regarding this work and all costs shall be met by the Developer.
- c) If the Designer wishes to incorporate special signs these shall be in addition to the standard nameplate, and be subject to specific approval by the Council. Supply and erection of any special signs shall be the responsibility of the Developer.

APPENDIX A

FORM 1—RAMM UPDATE SHEET - NEW OR RECONSTRUCTED ROADS																																						
RECORDED BY _____	(Name) OF _____	(Company)	DATE ____/____/____																																			
ROAD NAME _____																																						
(Distance in m) _____		(Circle one or two) _____ (Intersecting road name)																																				
START OF SECTION IS _____ m TO THE NORTH / SOUTH / WEST / EAST OF _____ INTERSECTION																																						
END OF SECTION IS _____ m TO THE NORTH / SOUTH / WEST / EAST OF _____ INTERSECTION																																						
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NEW OR EXISTING SUBGRADE																																						
1 THE SUBGRADE IS <input checked="" type="checkbox"/> RECONSTRUCTED <input checked="" type="checkbox"/> UNDISTURBED SUBGRADE COLOUR _____ SUBGRADE MAXIMUM STONE SIZE _____ mm IF SUBGRADE IS NEW, STATE: SUBGRADE LAYER THICKNESS _____ mm WHETHER SUBGRADE IS NEW OR EXISTING, SHOW THE SOIL TYPE: <table style="width:100%; border: none;"> <tr> <td style="width: 50%; border: none;"> MAJOR PORTION <input checked="" type="checkbox"/> GRAVEL <input type="checkbox"/> SAND <input type="checkbox"/> SILT <input type="checkbox"/> CLAY </td> <td style="width: 50%; border: none;"> SUBORDINATE PORTION <input checked="" type="checkbox"/> CLAYEY <input type="checkbox"/> SILTY <input type="checkbox"/> SANDY <input type="checkbox"/> GRAVELLY E.G., SILTY CLAY </td> </tr> </table>		MAJOR PORTION <input checked="" type="checkbox"/> GRAVEL <input type="checkbox"/> SAND <input type="checkbox"/> SILT <input type="checkbox"/> CLAY	SUBORDINATE PORTION <input checked="" type="checkbox"/> CLAYEY <input type="checkbox"/> SILTY <input type="checkbox"/> SANDY <input type="checkbox"/> GRAVELLY E.G., SILTY CLAY	2 SHOW SOIL STRENGTH: IF SUBGRADE IS MOSTLY CLAY, SILT OR SAND: <input checked="" type="checkbox"/> Very soft Exudes between fingers when squeezed <input type="checkbox"/> Soft Easily indented by fingers <input type="checkbox"/> Firm Indented only by strong finger pressure <input type="checkbox"/> Stiff Indented by thumb pressure <input type="checkbox"/> Very stiff Indented by thumbnail <input type="checkbox"/> Hard Difficult to indent by thumbnail OR . . . IF SUBGRADE IS MOSTLY SAND & GRAVEL: <input checked="" type="checkbox"/> Loosely packed Can remove by hand or easily by shovel <input type="checkbox"/> Tightly packed Pick required for removal																																		
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4 NEW SUBBASE (AP65-AP75) SUBBASE LAYER THICKNESS _____ mm MAXIMUM STONE SIZE _____ mm SOURCE _____		5 NEW BASECOURSE (AP40) BASECOURSE LAYER THICKNESS _____ mm MAXIMUM STONE SIZE _____ mm SOURCE _____ BASECOURSE SPECIFICATION <input checked="" type="checkbox"/> TNZ M/4 <input type="checkbox"/> OTHER (SPECIFY): _____																																				
6 NEW SURFACE																																						
SURFACING CONTRACTOR _____																																						
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5. STORMWATER

5.1 INTRODUCTION

- a) Construction in accordance with the standards is intended to ensure that stormwater runoff is managed effectively and efficiently, stormwater runoff is minimised and is managed in a sustainable manner.
- b) The purpose of this section is to provide design guidance and minimum standards for the design and construction of stormwater management infrastructure.
- c) Effective stormwater management is important to minimise inundation, flooding and property damage and to avoid degradation of aquatic environments.

5.2 OBJECTIVES

- a) The Council is seeking to have a stormwater system that is capable of accommodating stormwater from rainfall events in an efficient and sustainable way whilst ensuring that the cultural, economic, ecological, recreational values and natural structures of waterways are recognised and enhanced.

5.3 PERFORMANCE CRITERIA

The design of a stormwater system shall include the following:

- a) Provide for the collection and/or control of stormwater, allowing for ultimate future development potential¹ within the catchment or adjoining catchments.
- b) Stormwater generated by a 2% Annual Exceedance Probability (AEP) (1 in 50 year) storm event shall be accommodated within the primary and secondary stormwater management system in a way that does not cause any significant damage to people and property.
- c) Stormwater generated by more frequent, but significant rainfall events of 6.67% AEP (1 in 15 year) shall be accommodated within the primary stormwater management system in a way that does not cause damage to or nuisance effects on people and property.
- d) Stormwater infrastructure is constructed in a manner that results in a robust, durable network, and which is able to be efficiently maintained.
- e) Stormwater is managed and disposed of in a way that avoids, remedies or mitigates adverse effects on water quality, and the aquatic environments that affect the habitats of flora and fauna.

¹ Development potential means the likely future development within the Services Overlay taking into account the Council's Strategic City Development Plan and the LTCCP, and the provision of services in a manner that integrates with and does not foreclose this likely future development.

- f) Stormwater infrastructure is designed and constructed in a way that maintains or enhances the amenity and ecological values of the locality and makes use of available natural features and processes on site wherever possible.
- g) Create a multifunctional landscape where the design integrates with other aspects of site planning and provides multiple benefits.
- h) The stormwater infrastructure network is cost-effective and efficient in delivering the required level of service over the entire life-cycle of the network (benefits to the environment shall be factored when assessing Low Impact Design Methods).
- i) The management of stormwater meets the needs and expectations of the community in terms of the LTCCP and Council's Sustainability Policy.
- j) All stormwater is managed in compliance with resource consent(s) for the discharge of water onto land or into water, or the discharge can be accommodated within an existing consented system, in accordance with the NRMP.

5.4 KEY REFERENCES

- a) Table 5-1 sets out external standards and other documents that are relevant to the management of stormwater. These apply and must be taken into account in the design and construction of any stormwater management asset in Nelson City. Where an Act or Standard is referenced this shall be the current version including any associated amendments.

Table 5-1 Minimum Standards for Stormwater Design, Materials, Construction and Maintenance

Number/Source	Title
AS/NZS 1254	PVC pipes and fittings for stormwater and surface water applications
AS/NZS 2032	Installation of PVC pipe systems
AS/NZS 2566	Part 1: 1998 Buried flexible pipelines – Structural design Part 1 Supp 1: 1998 Buried flexible pipelines – Structural design – Commentary Part 2 – Buried flexible pipelines - Installation
AS/NZS 4058	Pre-cast concrete pipes for (pressure and non-pressure)
AS/NZS 3725	Design for installation of buried concrete pipes
NZS 3109	Concrete construction
NZS 3121	Specification for water and aggregate for concrete
NZS 4442	Welded steel pipes and fittings for water, sewage, and medium pressure gas
NZS 4404	Land development and subdivision

Number/Source	Title
NZ Building Act	Clause E1 "Surface Water"
	New Zealand Pipe Inspection Manual 3rd edition
Auckland Regional Council TP 10	Design Guideline Manual Stormwater Treatment Devices
Auckland Regional Council TP 124	Low Impact Design Manual for the Auckland Region
NZWERF	On-site stormwater management guideline
SNZ HB 44:2001	Subdivision for people and the environment

5.5 GENERAL DESIGN REQUIREMENTS

5.5.1 Design Methodology

a) There are a variety of ways that the stormwater management performance criteria may be achieved. Council intends to pursue a more sustainable approach to stormwater management which includes the use of Low Impact Design (LID) approaches where appropriate.

b) Unless otherwise approved the design of the stormwater system shall be in accordance with one or more of the current versions of the following publications:

- 1) NZS4404 Land Development and Subdivision
- 2) The Building Industry Authority's (E1 Surface Water)
- 3) TP10 (Stormwater Management Devices; Design Guidelines Manual)
- 4) TP124 (Low Impact Design Manual)
- 5) An approved catchment/stormwater computer modelling system

5.5.2 Allowance for Climate Change

a) Information published in March 2009 by the Ministry for the Environment (MfE,) on climate change 'Preparing for Coastal Change' indicates that:

- 1) Extreme rainfall events for the Nelson/Tasman area are predicted to increase by about 16% by 2090. Therefore for a mid-range scenario, a 1-in-100 year event now could become a 1-in-50 year event by the end of the century.
- 2) A base value sea-level rise of 0.5m relative to the 1980-1999 average be used, along with an assessment of potential consequences from a range of possible higher sea-level rise

values. At the very least, all assessments should consider the consequences of a mean sea-level rise of at least 0.8m relative to the 1980-1999 average. For longer planning and decision timeframes beyond the end of this century, it is recommended an additional allowance for sea-level rise of 10mm per year beyond 2100.

5.5.3 Stormwater Disposal Requirements

- a) The type of primary system installed will be dependent on factors such as quantity, quality, aquatic resource protection, topography, soil type, location and space constraints.
- b) The design requirements specified in this document and the documents referred to above will provide the design elements required for each of the options.
- c) Alternative (LID) methods will be considered by Council. Each situation will be assessed on a case by case basis but will need to provide the minimum stormwater control standards stipulated in this document.

5.5.3.1 Stormwater to soakage only in suitable areas

- a) Due to the unstable nature of Nelson hill soils, it is expected that in most situations a combination of alternative (LID) methods coupled with conventional (piped) systems will be the most appropriate for hillside developments and sites with unsuitable soils.
- b) Where disposal of stormwater to soakage is proposed then detailed site specific geotechnical investigation, including comprehensive soakage testing, must be undertaken to assess the suitability of the site for stormwater disposal by soakage.
- c) All proposals for on-site stormwater disposal by soakage must be supported by clearly legible, detailed calculations, drawings and field soakage test results. On-site disposal systems must be designed to have no adverse effects on ground stability or on downstream properties and shall be designed and constructed in accordance with the requirements of the Building Act 2004 and the Building Code. Refer to Verification Method E1/VM1: 9.0 Disposal to Soakage. (New Zealand Building Code Compliance Document E1, Surface Water.)
- d) The developer shall undertake detailed calculations to demonstrate that the proposed soakage system is suitable for the disposal of stormwater from a 6.67% AEP event. In addition, overland flow paths shall be provided in accordance with Table 5-1 to cater for events exceeding the capacity of the primary system and occasions when the primary drainage system fails.

NOTE: Rain gardens and similar bioretention devices are not soakage devices and should not be proposed for that purpose. Rain gardens shall be provided with an under-drain and overflow mechanism connected to a suitable stormwater outfall.

5.5.3.2 Discharge into the Public Stormwater Network

- a) The Council currently provides a public stormwater network to most areas of the city, however it does not cover the whole city and in some areas the system is already at capacity.
- b) Where a public stormwater network is accessible from the site the developer shall determine whether the stormwater network has sufficient capacity and ascertain from Council whether there are any other known constraints.
- c) Where there are capacity constraints on the existing public stormwater network the developer may seek to remove all the constraints on and downstream of their property, or else must provide on-site detention to attenuate peak flows to pre-development levels.
- d) Overland flow paths shall be provided in accordance Table 5-1 to cater for events exceeding the capacity of the primary system and occasions when the primary drainage system fails.

5.5.3.3 Discharge into a stream or watercourse

- a) In areas where no public stormwater network is available, but a stream or watercourse is accessible from the site, the stormwater may be drained to the water course provided that the following conditions are met:
 - 1) A suitable outfall and dissipating structure shall be constructed at the outlet to ensure no localised erosion of the watercourse occurs. This structure shall be specifically designed in such a way as to blend in with the immediate natural surroundings.
 - 2) The direction of the discharge shall be aligned with the natural downstream flow as much as practicable so as to prevent erosion of the opposite stream bank. In situations where erosion of the opposite bank is unavoidable, appropriate mitigation measures will be required.
 - 3) No obstructions are to be placed in a watercourse that will impede the natural flow unless these are installed as part of an approved stormwater management system.
 - 4) Individual properties which border onto a stream should discharge their stormwater in a dispersed manner, via a well vegetated flow dispersal device, into the stream to avoid causing erosion.
 - 5) Any stormwater peak flow attenuation, volume control or water quality requirements specified in the Nelson Resource Management Plan, proposed plan changes or approved Council policies shall be met.
 - 6) Where the downstream primary stormwater drainage system consists of lined channels only (i.e. no natural streams or

watercourses) and the stormwater constraints relate solely to a lack of capacity in the primary drainage system, the discharge from the site for the 6.67% and 50% AEP runoff events shall be attenuated to the predevelopment flows.

- b) Overland flow paths shall be provided in accordance with Table 5-1 to cater for events exceeding the capacity of the primary system and occasions when the primary drainage system fails.

5.5.3.4 Discharge to a Council owned reserve

- a) Where appropriate the provision of recreational open space and stormwater management can be combined within a development, see 12.2.2.2 f) of the Reserves and Landscaping section.

- b) In situations where a property borders onto a Council owned reserve and the natural flow of stormwater is in the direction of the reserve it may be appropriate to discharge stormwater to the reserve provided that this does not adversely affect the amenity value or function of the reserve in any way or create any geotechnical or flooding liability issues for the NCC Parks Department. There is no automatic right to discharge stormwater to a Council owned reserve, but it may be allowed subject to the following:

- 1) Stormwater from all impervious areas on the lot should be mitigated on site by way of dual purpose rainwater tanks (reuse and detention) and bioretention to ensure that total runoff volumes and peak flow rates up to the 6.67% AEP event are mitigated to as close to the pre-development levels as possible.
- 2) The stormwater should be discharged in a dispersed manner within the lot via a well vegetated flow dispersal device. If suitable vegetation does not already exist, this will need to be planted according to a planting plan to be approved by the NCC Parks Department.
- 3) The receiving reserve area should be well vegetated or grassed, not susceptible to erosion and have no geotechnical constraints. Where requested by the Council, a report by a suitably qualified professional geotechnical engineer may be provided to support any application to discharge stormwater to a reserve area.
- 4) Alternatively, the mitigated stormwater discharge may be piped to an appropriate outfall point within the reserve approved by the Parks Department for that purpose. The Parks Department may, at its discretion, require that any such pipe be installed by thrusting techniques to minimise damage and disruption to the reserve.
- 5) The stormwater discharge shall not compromise any existing or planned structures or parks assets and shall not impede access or reduce the amenity value of the reserve.

- 6) Overland flow from the reserve shall not create, or exacerbate existing, flooding or erosion problems.
- 7) Prior approval shall be obtained in writing from the NCC Parks Department.

5.5.3.5 Discharge to the road (bubble-up sump)

- a) Stormwater discharge to a road carriageway via a bubble-up sump as a primary means of disposal is not an acceptable solution for stormwater disposal from new developments in "Greenfields" areas. However the use of roads as overland flow paths is acceptable.
- b) In some areas there is a public stormwater drainage system which serves the road network and some properties currently discharge their stormwater onto the roads and ultimately into the road drainage network. This system was generally not designed for the additional stormwater flows and there is no right to utilise the road for drainage purposes. As a principle, all sites should minimise discharges of stormwater onto the city's roads.
- c) In infill development where there is no other means available for stormwater disposal and where there is sufficient capacity in the road drainage system, then properties may be permitted to discharge stormwater to a road as per SD 522 provided the following conditions are met:
 - 1) The lot area is less than 1,000m².
 - 2) Street sumps are at 100m centres or less, and the road is less than 9m wide with a road grade no steeper than 1 in 8.
 - 3) There are no more than five bubble-up sumps between successive street sumps.
 - 4) The street has a uniform centre-crowned carriageway cross-section with a minimum kerb height of 125mm.
 - 5) Downstream private driveways that fall away from the road have adequate 'lips' at the back of the channel and the initial portion of the crossing is shaped to prevent kerb and channel water from flowing down the driveway.
 - 6) The downstream infrastructure capacity is checked and found to be satisfactory.
 - 7) The construction of the bubble-up sump is carried out to the requirements of SD 522.
 - 8) A Corridor Access Request (CAR) is obtained for the excavation works within the road reserve (see section 8-Trenching and Reinstatement)

- d) Under exceptional circumstances, situations not meeting one or more of the above criteria may be considered, subject to approval by the Council.

NOTE: Stormwater discharge to a road kerb via a kerb outlet is generally not permitted, see section 5.9.10 b).

5.5.4 Primary and Overall System Capacity

- a) The primary system for stormwater shall be designed to cope with the runoff from the design storm as outlined below.
- 1) The stormwater system may include:
 - pipe systems
 - lined open channels
 - swale drains
 - open channels; or
 - alternative methods (LID)
 - b) The secondary system (flowpath) is the route taken by stormwater when the primary system is unable to cope either because of blockages or because the hydraulic capacity of the primary system is exceeded by a larger-than design storm.
 - c) In designing the stormwater system, both the primary and secondary system (overall system capacity) should be identified to ensure the stormwater management system provides a minimum standard of flood protection according to the following criteria:

Table 5-2 Stormwater System Capacity Requirements

Stormwater System Type	Primary System Capacity	Overall System Capacity
Conventional pipe system design	6.67% AEP (Q15, 15 year return period)	2% AEP (Q50 ,50 year return period)
Low impact design (LID)	6.67% AEP	2% AEP
Minor streams*	6.67% AEP	2% AEP
Major streams and rivers**	2% AEP (Q50 ,50 year return period)	1% AEP (Q100 ,100 return period)

*A minor stream is one where it has a width, top of bank to top of bank, of less than 3.0m. For clarification, the bank-to-bank width for streams is generally at mean annual flood flow (Q2.3). This area may include areas of vegetation which go under water at various storm events (consistent with Esplanade provisions of the RMA).

** Major streams and rivers (wider than 3.0m at the top of bank) including: - Reservoir Creek, Saxton Creek, Orphanage Creek, Orchard Creek, Poormans Valley Stream, Arapiki Stream, Jenkins Creek, York Stream, Maitai River, Brook Stream, Oldham Creek, Todds Valley Stream, Wakapuaka River and its tributaries, Whangamoia River and its tributaries.

5.5.5 Rainfall Intensity

- a) For urban stormwater design the Nelson City Council Urban Design Rainfall Intensity Curves Table 5-3 shall be used. These curves are based on an analysis of actual rainfall data for Nelson which were encapsulated into a High Intensity Rainfall Design System (HIRDS) in 2008. Allowance for climate change has been incorporated. The rainfall intensity curves shown in Table 5-3 and SD 502 have been increased by 16% (from 2008 data) to allow for increasing temperature and extreme rainfall predictions for Nelson to 2100.

5.5.6 Runoff Coefficient

- a) The following standards apply to the calculation of run-off:
 - 1) Determination of catchment run-off is the key basis for stormwater network design, and must be assessed carefully for each site. Designers are referred to Verification Method E1/VM1 of the Building Code for guidance on the determination of run-off coefficients. These coefficients are reproduced in Table 5-5.
 - 2) In all cases the assumptions used (and the basis of these assumptions) in the calculation of run-off shall be clearly stated. Specifically, the calculation of impervious area and runoff coefficients shall be based on site specific data and account for the ultimate development of the site.

5.5.7 Time of Concentration

- a) In large or flat catchments the critical rainfall intensity is likely to vary for different sections of the network and should be determined using the time of concentration at the particular point being considered.
- b) The time of concentration shall be calculated in the determination of critical rainfall duration for a given network, and the assessment of this shall include the calculation of time of entry (including surface flow) and the time of pipe or channel flow.
- c) Calculation of the time of concentration may be made explicitly, through the use of manual calculations, or via a hydrological / hydraulic model.
- d) Designers are referred to Section 2.3 of Verification Method E1/VM1 of the Building Code for guidance in the calculation of the time of concentration. Note the time of concentration should be no less than 10 minutes.
- e) Where the stormwater system includes detention facilities, Designers must consider the dynamic effects of attenuation through the facility to work out the critical duration this will cause and the greatest flooding during design storm events. Design of the area downstream of the detention facility will also be critical to mitigate erosion and downstream flooding.

Table 5-3 Nelson City Council Urban Design Rainfall Intensity (mm/hr)

Annual Exceedance Probability (AEP)	Return Period (years)	Duration (minutes)									
		10	20	30	60	120	360	720	1440	2880	4320
							(6 hr)	(12 hr)	(24 hr)	(48 hr)	(72 hr)
50%	2	51.5	38.3	32.2	24.0	15.9	8.3	5.5	3.6	2.2	1.6
10%	10	79.3	58.1	48.5	35.6	23.1	11.6	7.5	4.8	2.9	2.1
6.67%	15	89.6	65.3	54.4	39.7	25.5	12.7	8.2	5.3	3.1	2.3
5%	20	96.7	70.3	58.5	42.6	27.3	13.5	8.6	5.5	3.3	2.4
2%	50	127.4	91.9	76.1	54.9	34.7	16.7	10.6	6.7	4.0	2.9
1%	100	160.8	114.8	94.7	67.7	42.3	20.0	12.5	7.8	4.6	3.4

Table 5-4 Nelson City Council Urban Design Rainfall Depth (mm)

Annual Exceedance Probability (AEP)	Return Period (years)	Duration (minutes)									
		10	20	30	60	120	360	720	1440	2880	4320
							(6 hr)	(12 hr)	(24 hr)	(48 hr)	(72 hr)
50%	2	8.6	12.8	16.1	24.0	31.8	49.5	65.5	86.8	103.8	115.3
10%	10	13.2	19.4	24.2	35.6	46.2	69.5	89.9	116.3	139.0	154.2
6.67%	15	14.9	21.8	27.2	39.7	51.1	76.2	98.0	126.0	150.4	166.7
5%	20	16.1	23.4	29.2	42.6	54.5	80.9	103.6	132.8	158.3	175.5
2%	50	21.2	30.6	38.0	54.9	69.4	100.5	126.9	160.4	191.1	211.6
1%	100	26.8	38.3	47.3	67.7	84.6	120.3	150.2	187.7	223.2	247.1

Table 5-5 Recommended Runoff Coefficients for Design

Natural surface types	C	Developed surface types	C
Bare impermeable clay with no interception channels or run-off control.	0.70	Fully roofed and/or sealed developments	0.90
		Steel and non-absorbent roof surfaces	0.90
Bare uncultivated soil of medium soakage.	0.60	Asphalt and concrete paved surfaces	0.85
Heavy clay soil types: – pasture and grass cover – bush and scrub cover – cultivated	0.40	Near flat and slightly absorbent roof surfaces	0.80
	0.35	Stone, brick and pre-cast concrete paving panels – with sealed joints	0.80
	0.30		– with open joints
Medium soakage soil types: – pasture and scrub cover – bush and scrub cover – cultivated	0.30	Unsealed roads	0.50
	0.25	Unsealed yards and similar surfaces	0.35
	0.20		
High soakage gravel, sandy and volcanic soil types: – pasture and scrub cover – bush and scrub cover – cultivated	0.20	Land use types	
		Industrial, commercial, shopping areas and town house developments	0.65
		Residential areas in which impervious area is less than 36% of gross area	0.45
	0.15	Residential areas in which impervious area is less than 36% of gross area	0.55
Parks, playgrounds and reserves: – mainly grassed – predominantly bush	0.30	Slope correction factor	
	0.25	Slope	Adjustment factor
		5-10%	subtracting 0.05
	10-20%	no adjustment	
	20% or steeper	adding 0.05	

5.5.8 Calculation of Runoff

- a) The determination of the necessary capacity for the purpose of design should be based on the following design parameters:

- 1) Calculation of runoff for stormwater network design shall be determined using an appropriate, recognised, design methodology. In the first instance the determination of design flows lies with the Designer of the proposed network, however

Council reserves the right to require adoption of Council calculations at the Engineering Manager's discretion.

- 2) Calculation of runoff using the Rational Method will generally be accepted. Alternative runoff methodologies may be approved by the Engineering Manager on application. In all cases all underlying assumptions used in the calculation should be stated.
 - 3) The Rational Method formula is: $Q = CIA \times 2.78$
 - 4) Where
 - Q = runoff in litres per second
 - C = runoff coefficient (See Table 5-5)
 - I = rainfall intensity in millimetres per hour (See Table 5-3)
 - A = area of catchment in hectares
 - 5) Fixed runoff models (such as the Rational Method) will not generally be accepted for detention dam design or inundation assessment.
 - 6) In larger network design, or where the proposed works integrate into an existing stormwater network, the determination of design flows may be most efficiently determined using a hydrological or hydraulic model.
 - 7) When the design process includes the use of a hydrological or hydraulic model, all underlying assumptions (such as runoff coefficients, time of concentration and catchment areas) should be clearly stated so that a manual check of calculations is possible. Council reserves the right to request a copy of the model for review.
- b) The system capacity for the design of stormwater networks in Nelson are shown in Table 5-2.

5.5.9 Stormwater Consents

- a) In addition to other requirements relating to permanent discharges of stormwater to a natural watercourse or the sea and onto land, the consent holder shall be responsible for obtaining any consent(s) relating to the construction or ongoing operation of the development.
- b) The Developer is responsible for obtaining all necessary consents for the discharge of stormwater. These include, but may not be limited to, Council consents for the discharge, both during and after construction, and the permissions from landowners where additional stormwater is being discharged to their properties as a result of development.

- c) The Developer must consult with NZTA where there is the potential for additional stormwater to be discharged to land administered by NZTA, or designated by NZTA under the RMA 1991, as a result of the development. Where it is confirmed that additional discharges of stormwater will enter land administered by NZTA, or designated by NZTA under the RMA 1991, as result of the development, the Developer must obtain the written approval of NZTA.

5.5.10 High Groundwater Level

- a) In areas of high or potentially high groundwater, designers shall provide a method for allowing excess groundwater into the stormwater system in a controlled manner. Such a solution may incorporate perforated inlet pipes together with drainage rock and geotextile.
- b) Ground water lowering is not permitted where this practice may present a risk of subsidence.

5.6 MINIMUM GROUND/FLOOR LEVEL REQUIREMENTS

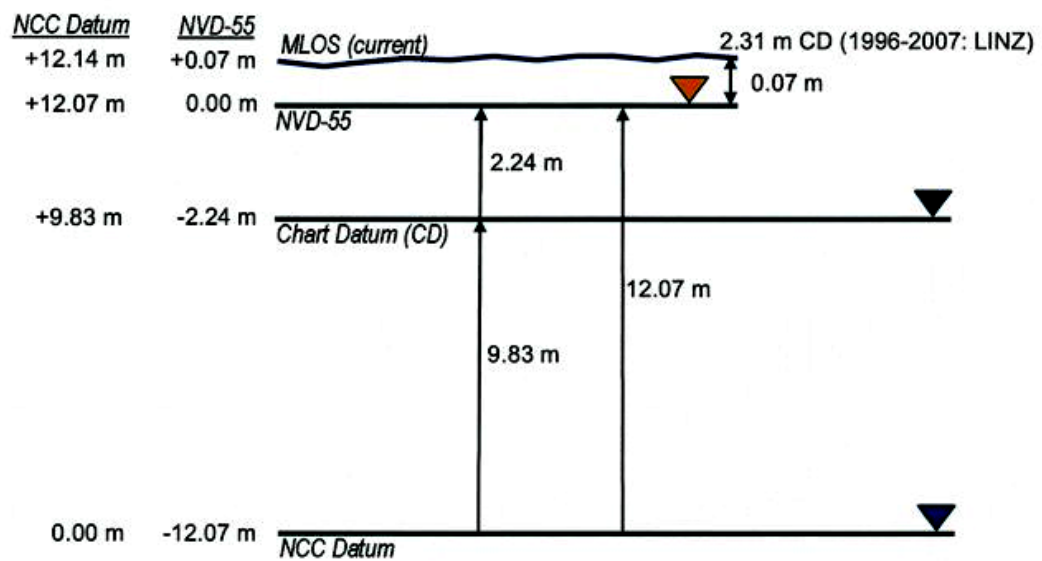
- a) It is imperative that properties (assets) and, in most instances, land be protected from inundation from stormwater, high tides or a combination of both and including potential climate change characteristics.
- b) The higher of the following minimum ground level requirements for tidal and stormwater inundation shall be used as the basis for the absolute minimum ground level for green field and, where practical, infill development.

5.6.1 Datums

- a) Nelson City historically defined a drainage datum that was set well below low tide to ensure Reduced Levels were always positive values even for pipe networks in the ground. The NCC Datum is 9.83 m below the Chart Datum (approximately the Lowest Astronomical Tide) at Port Nelson, as shown in Figure 5-1.
- b) In recent years (1996-2007), the actual mean level of the sea (MLOS) has been at an average of 12.14 m above NCC Datum or 2.31 m above Chart Datum (CD) as determined by Land Information NZ (LINZ).²
- c) The LINZ local vertical datum, Nelson Vertical Datum-1955 (NVD-55), was set up in 1955 based on sea level measurements from 1939 to 1942. Since that time, sea levels have risen, with MLOS now at 0.07 m relative to NVD-55. NVD-55 is 2.24 m above Chart Datum at Port Nelson.

² <http://www.linz.govt.nz/hydro/tidal-info/tide-tables/tidal-levels/index.aspx>

Figure 5-1 Nelson City: conversions between the various local vertical datums.



Not to scale

5.6.2 Sea Outfall Design Level Criteria

- a) For the purpose of pipe and open channel design the hydraulic grade line at the sea outfall shall start at 14.00m (Surveyed to NCC datum).

5.6.3 Minimum Ground Levels (Tidal Inundation)

- a) See Table 5-6 below. Also, refer to the appropriate zone section of the Nelson Resource Management Plan for rules relating to subdivision, earthworks, building on low lying sites, and Inundation Overlays.

Table 5-6 Minimum Ground and Floor Level Requirement Related to Tide Levels to NCC Datum

Tide Levels		RL Surveyed to NCC Datum	
Maximum Predicted Spring Tide		14.40	
Maximum Tidal Surge Expected		0.60	
Sea Level Rise at year 2050		0.30	
<i>Tidal Surge Level at Year 2050</i>		<i>15.30</i>	
	Ground Level	Concrete Floor	Timber Floor
<i>Tidal Surge Level at Year 2050</i>	<i>15.30</i>	<i>15.30</i>	<i>15.30</i>
Safety Margin	0.05	0.20	0.35
Minimum Finish Level to Year 2050 excluding Monaco and Wood Area served by stormwater Pump Station	15.35	15.50	15.65
Monaco 200mm wave set	0.20	0.20	0.20
Minimum Finish Level to Year 2050 for Monaco (including 200mm wave set)	15.55	15.70	15.85
Minimum Finish Level to Year 2050 for Wood Area served by stormwater Pump Station	15.20	15.35	15.50

Note: - The minimum ground level requirements in relation to tide levels and predicted sea level rise is currently being reviewed. An amendment to this section of the LDM is expected to be made before 2011.

- In addition to the absolute minimum levels above, floor levels shall also be in accordance with the requirements of the Building Act.

5.6.4 Minimum Ground Levels (Stormwater Inundation)

- a) See section 5.6.3.
- b) Where building platforms are raised above adjoining ground levels, these shall not significantly impede overland flow or locally raise flood risk. To obtain subsequent floor levels refer to the Building Act.
- c) Where possible and practicable, secondary flood routes shall be via roads, public walkways or right of ways rather than through private lots.
- d) To reduce the rate of catchment stormwater flowing into the site either as backflow via stormwater connections or as surface runoff inundation, the site shall be contoured as necessary to ensure that:

- 1) Where practicable, the minimum finished level is greater than the crown level of the road/street to which the piped stormwater from the allotment is drained.
- 2) Stormwater shall not flow from the road reserve into the lot (either as backflow via stormwater connections or as surface run-off).
- 3) No fill shall be placed which interferes with the natural run-off from neighbouring land. Where filling of the site obstructs the natural run-off from an adjoining property then provision shall be made for the drainage of that property.
- 4) There is continuous fall towards the road/street that the site is draining to. Provision shall be made for potential development and filling of any intermediate sites.

5.6.5 Freeboard to Finished Ground Level

- a) Freeboard is a provision for flood level design estimate imprecision, construction tolerances and natural phenomena (e.g. waves, debris, aggradations, channel transition and bend effects) not explicitly included in the calculations.
- b) The minimum freeboard from the hydraulic grade level of the primary system capacity, as determined by Table 5-7 to the finished ground level (i.e. sump or manhole lid level) shall be 400mm.

5.6.6 Freeboard to Finished Floor Level

- a) The minimum freeboard from the hydraulic grade level of the overall system capacity, as determined by Table 5-7, to the finished floor level (or structure over a stream) shall be as follows:

Table 5-7 Freeboard to Finished Floor Level

Type of Structure	Freeboard above Overall System Capacity
Non-habitable residential buildings, garage floors etc	0.2m
Commercial and industrial floors	0.3m
Habitable dwelling floors	0.5m
Major communal facilities related to supply of electricity, telecommunications and water supply and wastewater disposal systems	0.6m
Bridges and buildings over Streams (freeboard to underside of structure)	0.7m

- b) In addition to the absolute minimum floor levels above, floor levels shall also be in accordance with the requirements of the Building Act.

5.7 HYDRAULICS

5.7.1 Pipelines (Gravity and Pressure)

- a) Pipe sizes and grades shall be calculated using standard hydraulic formulae (Manning, Colebrook-White), or an approved hydraulic calculator based on the above.
- b) A pipe roughness equivalent to one of the following shall be adopted to account for velocity head within the pipe line, gravel and grit deposits and other insitu variables such as construction performance and pipeline deterioration with age.

	Pipe Roughness
Mannings formula	n = 0.013
Colebrook-White formula	ks = 1.5mm
Mears Water Flow Calculator	Rough Concrete

- c) In addition, appropriate allowances shall be made for changes in direction, inlet and outlet losses and obstacles. The following table gives typical energy loss coefficients (k) (excluding changes in hydraulic grade line due to changes in velocity head which should also be allowed for).

Energy loss $h_e = K v^2/2g$ (h in metres, v in m/s)	
Type	k
Sharp pipe entry (from reservoir)	0.5
90° manhole (depending on radius)	0.5 to 1.0
Velocity head loss at outlet	1.0

- d) For short culverts and intake structures, refer Ministry of Works and Development Culvert Manual, Volume 1, CDP 706/A.

5.7.2 Calculation of Flow in Steep Pipelines

- a) Where a pipe gradient exceeds 1-in-10 an allowance for the bulking of the flow due to air entrainment shall be made. This allowance is made by increasing the area of the pipe for the additional volume of air in the flow. The air-to-water ratio may be calculated from the formula:

$$\frac{\text{Air}}{\text{Water}} = \frac{kV^2}{gR}$$

- b) Where:

- K = coefficient of entrainment (dimensionless)
= 0.004 for smooth pipes
= 0.008 for cast-in-situ concrete culverts
- V = velocity (m/s)
- R = hydraulic radius (m)
- g = acceleration due to gravity (9.81 m/s)

5.7.3 Sumps – Collection of Water from Side-Channels

- a) Sumps shall be located to ensure that the total system design flow can enter the pipe system and that surface flows across intersections are minimised. In hill areas the total system design flow will include run-off from any upslope hillsides that are not specifically drained. In many cases this will mean the use of closely spaced sumps or Toothed Connectors to ensure that the flow to which the piped system is designed can actually get into the system.
- b) Unless specific capacity of a sump intake is known or derived from first principles, the design capacity shall be as follows. Allowance has been made for partial blockage.

Sump	Location	Design Capacity (litres per second)
Single back entry	Installed in kerb and channel with a continual falling grade less than 1 in 8	30
Single back entry	installed in a low sag position in kerb and channel	75
Single back entry with toothed connector	In kerb and channel where grades exceed 1 in 8	40

5.7.4 Open Channels

a) Mannings formula $Q = \frac{AR^{2/3} S^{1/2}}{n}$ is usually satisfactory

- Q = flow m³ / s
- R = hydraulic radius (m)
- S = slope of surface
- A = water section area, m²

b) Typical Mannings n values are:

Concrete	0.011 to 0.017
Channels – with weeds	0.025 to 0.04
Frame and slab	0.035

c) Extra freeboard should be allowed in steep channels where roll waves can occur.

5.8 RETICULATION LAYOUT AND ALIGNMENT

a) The layout of the stormwater system shall take into account the requirement to minimise surface water infiltration of the foul sewerage system.

b) Generally deep pipelines exceeding 2.5m deep shall be avoided. Over depth pipelines are difficult to access in the future for maintenance and renewal works.

c) Where possible and practical, existing open waterways should be retained on their existing alignment in order to reduce works within the waterway to a minimum.

5.8.1 Drains in Roads

a) Main drains shall be aligned within public areas such as roads wherever possible providing stormwater is dealt with generally in its own catchment area.

b) Drains in roads shall be aligned parallel to kerb lines within the carriageway to ensure they do not clash with other services or occupy the full carriageway width. Adequate clearance from other services and kerb lines shall be maintained to allow for:

- 1) Excavation on existing services
- 2) The future relaying of the drains
- 3) The provision of additional future services

- c) In curved roads, drains shall generally follow the road alignment in straight lines between manholes on such alignment that they do not occupy the full carriageway width.

5.8.2 Drains Through Private Property

- a) The catchment area to be served by main drains aligned through private property shall be kept to a minimum.
- b) In planning the layout of drains through private property consideration shall be given to preserving access to drains for:

- 1) Maintenance purposes
- 2) Preserving the route for relaying the drains in the future
- 3) Avoiding likely positions for buildings, garages, carports and retaining walls
- 4) Secondary flood paths

- c) The preferred alignments of drains on private property shall be:

- 1) Within R.O.W.s or driveways
- 2) Outside probable building envelopes
- 3) Clear of fence lines and kerb lines
- 4) Adjacent to boundaries
- 5) Parallel to boundaries

- d) Where main drains must be aligned through private property, easements in favour of the Council may be required.

5.8.3 Easements Over Drains

- a) Where as part of a subdivision or development proposed pipes greater than or equal to 300mm diameter will be located in private property an easement shall be required in favour of the Council. The minimum width of easement shall be 3.0m.
- b) The standard wording required on Land Transfer Plans shall be:

"Memorandum Easement in Gross shall be provided in favour of NCC to convey stormwater in a pipe and to provide unrestricted access along the line of the pipe for maintenance and renewal work."

- c) Similar easements may be required over private common drains in favour of the lots served. Pipelines deeper than 2.5m may require easement widths greater than 3.0m to allow for wider than normal trench widths needed to access the pipe in the future.

5.8.4 Crossing Other Services

- a) Diagonal crossings of other services, including kerb lines and boundaries or fence lines, at acute angles less than 45 degrees shall be avoided wherever possible.

5.8.5 Building over or alongside a common private or public stormwater drain

- a) Building over or alongside any Common, Private or Public Stormwater Drain is only a Permitted Activity if it complies with the rules in the appropriate zone section of the Nelson Resource Management Plan.
- b) The engineering requirements for building over or alongside drains are as follows:

1) Structures:

- Must be located no closer than 1.0 metre measured horizontally from the centreline of any public or common private stormwater pipe or drain where the pipe or pipe equivalent (in the case of a drain) is less than or equal to 300mm in diameter.
- Must be located no closer than 1.5 metres measured horizontally from the near side of any public or common private stormwater pipe or drain where the pipe or pipe equivalent (in the case of a drain) is greater than 300mm in diameter.
- Which are balconies, may overhang the line of the pipe or drain, provided the balcony is cantilevered and its height above ground level is not less than 1.8m.
- Which are located within 3 metres measured horizontally from the near side of the pipe or drain must have the base of the foundations deeper than a line drawn at 30 degrees from the horizontal from the invert (bottom) of the pipe or drain (or between 30 degrees and 45 degrees if the design has been certified by a suitably qualified engineer).

2) Carports may be constructed over pipes or drains (but not watermains or other pressurized pipelines) provided that:

- The foundations are located in accordance with 1) above; and
- The fixture to the ground/floor is a bolt-down type design which permits quick and easy removal of the structure; and
- The carport is not closed in; and
- The floor is not concreted to a depth greater than 150mm; and

- An encumbrance is registered on the certificate of title for the property acknowledging the location of the pipe or drain under the building and reminding future owners that the above requirements apply and that access to the pipe or drain for maintenance and repair (and reinstatement afterwards) must be made available at the building owner's cost.

c) As an alternative to 1 and 2 above, structures may be located over common private or public drains, if they comply with Table 5-8 (Acceptable Techniques for Building Over Stormwater Pipes or Drains).

Table 5-8 Acceptable Techniques for Building Over Stormwater Drains

Technique A Applicable in the following zones: Industrial, Suburban Commercial, Open Space and Recreation, and Inner City	Technique B Applicable in the following zones: Industrial, Suburban Commercial, Open Space and Recreation, Inner City, and Residential
Structures may be located over common private or public stormwater drains or pipes, if:	Structures may be located over common private or public stormwater pipes, if:
<ul style="list-style-type: none"> • There are no changes in direction or junctions in the portion built over; and • The pipe is proven to be in good condition by internal inspection or a water test; and • The floor is constructed with lift out sections, and all foundations are designed to allow the entire drain or pipe to be readily exposed for maintenance and replacement work; and • Where the diameter of the pipe is 300mm or less, the design and use of the structure is such that an appropriate sized excavator could readily gain access along the line of the pipe for maintenance and replacement work, or appropriate access is available for hand digging; or • Where the diameter of the pipe is greater than 300mm, the design and use of the structure is such that a 12 tonne excavator and truck could readily gain access along the line of the pipe for maintenance and replacement work. 	<ul style="list-style-type: none"> • The diameter or width of the pipe is 150mm or less; and • The length of pipe built over is no more than 6 metres; and • There are no changes in direction or junctions in the portion built over; and • The length of pipe built over is relaid using a continuous length of pipe without joints, sleeved inside a 225mm diameter class 4 concrete pipe; and • There is practical access and the foundations are designed to allow the pipe to be readily exposed at both ends of the sleeve for maintenance and replacement work; and • There is a minimum 6-metre clear length at one end of the sleeve to allow replacement of the pipe.

d) Detailed Engineering Drawings of the proposed work are required.

5.9 PIPED SYSTEM SPECIFICATIONS

5.9.1 Pipe Design

- a) All systems shall be designed to accept flows from above a proposed development, and shall be of sufficient capacity to provide for flows from maximum probable development.
- b) Pipe capacity matching that of the pre-developed state, will only be accepted if appropriate mitigation measures (such as detention structures or on-site detention) approved by Council are constructed by the developer.
- c) Any mitigation measures must be designed so that flows in the entire downstream network are attenuated for the appropriate design event(s). Refer to the detailed requirements for detention basins/ponds in this standard.
- d) Table 5-9 sets out the minimum specifications for public stormwater pipe design.

Table 5-9 Minimum Specification for Public Stormwater Pipes

	Concrete pipe	uPVC pipe
Permitted size	Minimum 225mm ID Thereafter in 75mm increments	Minimum DN 225mm ID Maximum DN 500mm ID
Minimum standard	NZS 4058	AS/NZS 1254
Material strength	Minimum Class 2 and in accordance with AS/NZS3725	Minimum SN 4 Specific design to AS/NZS2566 method for depth >5.0m, or traffic wheel loads >96 kN
Cover depth	Refer Table 5-10	Refer Table 5-10
Joints	Rubber ring jointed	
Pipe capacity	6.67% AEP (1 in 15 year)	
Flow velocity	Minimum 0.75m/s* Maximum 6.0m/s	
Pipe location (in preference)	Road reserve	
Clearance from other services	Minimum 200mm vertical Minimum 500mm horizontal (lesser clearance on approval of the Engineering Manager)	
* Gravel or silt traps may be required to be installed in low velocity flow situations.		

5.9.2 Calculation of Pipe Capacity

- a) Pipe sizes and grades shall be calculated using standard hydraulic formulae (Manning, Colebrook-White), or an approved hydraulic calculator or model.
- b) Piped stormwater systems should generally be designed to flow full or part full under gravity at design flows with pipes aligned soffit-to-soffit.
- c) Except at intake structures, it will not be permitted to reduce the diameter of pipe even where changes in grade would produce the required capacity in a smaller diameter of the downstream pipe. This is due to the potential for debris/sticks which could enter the system to block at the reduced orifice.
- d) A pipe roughness calculated using either the Mannings ($n = 0.013$) or Colebrook-White formulae ($k_s = 1.5\text{mm} - \text{up to } 450\text{mm dia} / k_s = 0.6\text{mm} - \text{over } 450\text{mm dia}$) shall be adopted, to account for gravel and grit deposits and other in-situ variables (such as construction performance and pipeline deterioration with age). Losses due to bends, manholes and sumps shall be incorporated into the design of pipe systems.

5.9.3 Pressurised Pipelines

- a) A pressurised stormwater system shall be subject to the Engineering Manager's approval. Stormwater pumping is not generally permitted. Any stormwater pump station design must be specifically approved by the Engineering Manager and generally be in accordance with Council's wastewater pump station design standards.
- b) Where a non-pumped pressurised stormwater system is deemed to be necessary (for a 6.67% AEP design storm) the hydraulic grade line shall be plotted on the longitudinal section. Reduced levels and the hydraulic gradient shall be quoted for the entire length of the pipeline. In no cases shall the hydraulic grade line be above finished ground level.

5.9.4 Pipe Cover

- a) Pipe systems shall be designed to ensure the minimum cover over the barrel in accordance with Table 5-10.
- b) Generally deep pipelines exceeding 2.5m deep should be avoided. Over-depth pipelines are difficult to access in the future for maintenance and renewal works.

Table 5-10 Pipe Cover Standards

Location of Pipe	Minimum Cover Required	
	Concrete Pipe	PVC Pipe
Areas subject to highway traffic loading e.g., within road carriageway.	600mm	750mm
Areas subject to light traffic loading outside road e.g. ROWs, driveways, car parks and berms.	450mm	600mm
Areas never subject to traffic loading.	300mm	450mm
Under continuous concrete encasement for full circumference (specific design required to mitigate expansion of pipe material).	300mm	300mm

- c) Minimum cover may be reduced providing the pipe is concrete encased for concrete pipes and concrete capped for PVC and subject to the Councils' approval.
- d) Where pipes with inadequate cover require concrete encasement or capping this shall be to the requirements of SD No 618 and the extent and thickness of concrete and concrete strength shall be specified on the drawings.
- e) To avoid reflective cracking of pavements and differential settlement concrete encasement and capping shall not be permitted to penetrate the basecourse or pavement construction.
- f) No concrete protection shall be placed around the pipe until the line has been inspected and approved by the Council.
- g) Reduced cover on pipes may be approved providing the appropriate class of pipe is specified and cover is according to the manufacturer's specification.

5.9.5 Pipe Access Openings

5.9.6 Manholes

- a) Where site conditions require close spacing of manholes, consideration will be given to the use of roding points or mini-manholes in between standard 1050mm diameter manholes.
- b) Manholes shall be provided at minimum intervals of 100m, at changes of grade, direction or pipe size and at junctions and end points of public stormwater pipes.
- c) A fall of no less than 50mm shall be provided through all manholes.
- d) All pipe soffits shall be matched to the soffit of the outgoing pipes incorporating the 50mm fall noted above when working with different pipe diameters.

Table 5-11e) Table 5-11 sets out the minimum specifications for manholes, mini-manholes and roding points.

5.9.7 Manholes

- e) Where site conditions require close spacing of manholes, consideration will be given to the use of roding points or mini-manholes in between standard 1050mm diameter manholes.
- f) Manholes shall be provided at minimum intervals of 100m, at changes of grade, direction or pipe size and at junctions and end points of public stormwater pipes.
- g) A fall of no less than 50mm shall be provided through all manholes.
- h) All pipe soffits shall be matched to the soffit of the outgoing pipes incorporating the 50mm fall noted above when working with different pipe diameters.

Table 5-11 Required Pipe Access Openings and Limiting Requirements

	Manholes	Mini-manholes	Roding Point
Locations where pipe access must be provided	Manholes to be provided at: change in grade change in direction change in size pipe junctions end of public pipe 100m max spacing	Mini Manholes to be provided at: private connections, out of areas subject to traffic loading.	Roding Point to be used at: Change in grade at top of steep sections.
Maximum pipe size	450mm (1050 mm dia) 750mm (1350 mm dia) 1075mm (1500 mm dia) 1200mm (1800 mm dia)*	225mm ID	225mm ID
Maximum depth	2.5m	1.0m for public pipe	2.5m
Maximum deflection angle	90° for pipe to 375mm 60° for pipe >375mm	45°	
Maximum distance between centres	100m	100m	50m
Approved materials	Concrete	PVC, PE Concrete	uPVC
Standard Drawing	602 – 609 and 507	605	610 and 611
* Factory-made "T" manholes will be permitted for pipes of 1350mm diameter and over, subject to the approval of Council.			

5.9.8 Mini-manholes

- a) Shallow concrete mini-manholes shall be in accordance with the requirements set out in SD 605.
- b) Prefabricated PVC or PE mini-manholes shall only be used on approval by Council.

- c) Mini-manholes are not to be used in areas subject to vehicular traffic, except where formed in residential driveways or rights-of-ways open to light domestic vehicles. In this instance they shall be located out of usually trafficked areas.

5.9.9 Roding Point

- a) The use of roding points shall be limited to changes in pipe grade or alignment, at the top of steep banks where installation of a manhole or mini-manhole would not be practicably feasible.

5.9.10 Sumps

- a) Sumps shall be to Nelson City Council standard (i.e., 900mm x 450mm) and constructed in accordance with SD 510 and in accordance with the requirements of Table 5-12.
- b) The standard sump to be incorporated with all kerb and channel or mountable kerb and channel is the Back Entry Sump as detailed on SD 510 - 514.

Table 5-12 Required Sump Locations and Limiting Requirements

	Standard Back Entry Sumps	Standard Back Entry Sumps with toothed connectors	Double Back Entry Sump
Approved locations	At each tangent point of the channel on the upstream side of road intersections where the grade is flatter than 1:10. At any low spot in a channel. Serving any right-of-way. Bubble sump in channel (TDC approved only).	At each tangent point of the channel on the upstream side of road intersections where the grade is steeper than 1:10. Where the channel upslope of the sump is steeper than 1 in 10. Where area of the catchment warrants the provision of adequate stormwater entry.	Where the length of kerb and channel draining to a low point is excessive. At a low point at the head of a cul-de-sac or street where secondary flow paths flow through private property.
Minimum lateral pipe size	225mm ID	225mm ID	300mm ID
Standard Drawing	510 - 514	508 and 509	Use 510
Maximum depth	1300mm		
Maximum distance between sumps*	Standard kerb: 100m Mountable kerb: 60m (Subject to specific design on a case-by-case basis)		
Approved materials	Concrete		
Note: - Closer spacing of sumps may be required depending on the rate of runoff expected. Sumps shall not be positioned at vehicle crossings or pram crossings.			

- c) Sumps draining private right-of-ways can be provided with a minimum lateral pipe size of 150mm ID subject to suitable catchment design and a secondary flow path being directed to the road carriageway.
- d) Where a sump unavoidably coincides with a vehicle crossing (and back entry is not feasible) an additional standard (back entry) sump or a side entry shall be constructed on the upstream side of the crossing and the pipe extended into the sump.
- e) The tolerance for the location, alignment and level of a sump shall be as follows:
 - 1) Lateral alignment of the sump top shall be within a maximum of plus or minus 10mm of the design line of the kerb and channel.
 - 2) The skew of the sump top in relation to the kerb and channel alignment shall be within 10mm of being parallel.
 - 3) The sump shall be placed within 20mm of being vertical.
 - 4) The maximum depth of a sump shall be 1300mm as per SD 510.
 - 5) The finished level of the sump shall ensure compliance with the tolerance requirements for kerb and channel finished level as per the roading network section.
- f) The vertical alignment of kerb and channel shall be designed to ensure that no low point requiring a standard sump will coincide with any kerb and channel curve of less than 50m radius (except at the turning heads of cul-de-sacs).
- g) Sumps which are located in tidal areas or in areas subject to flooding may require non-return systems as shown on SD 516 to prevent backflow up the line. Other designs will be assessed on a case-by-case basis.
- h) Sump connections may be made to the stormwater pipe by use of saddle connections as in the following sections, where this is physically possible.

5.9.11 Individual Site Connections

- a) Connections to each site shall meet the following standards:
 - 1) In all subdivisions a stormwater connection of a minimum 100mm diameter shall be provided to each property and terminate at least 1.0m inside the boundary of each lot. (This does not apply to sections fronting existing legal streets where the wastewater network are available in the street and are within 15m of the lot boundary and provided that the drain will not cross any lot other than the one being served) The pipe end shall be painted green to denote that it is a stormwater

pipe and each connection shall be marked by a 75mm x25mm marker stake suitably identified.

- 2) On generally flat land, sloping at 1-in-50 or less, each connection shall be capable of serving the entire building area of the section by gravity.
 - 3) On land steeper than 1-in-50 every effort shall be made to serve the entire section. Where this proves to be impossible and the servicing of the site is limited the area on each lot capable of being serviced shall be shown on the Engineering Drawing.
- b) Kerb entries are generally not permitted in the Nelson City Council area. Where specific approval is given by Council for stormwater disposal via kerb entries, then these may only be installed using approved kerb entry adapters. Where cover is inadequate to permit the use of PVC pipe, or hot mix is to be laid over the pipe, then pipes under footpaths and berms should be 100mm diameter galvanised steel.
 - c) In some areas and special cases (i.e. free-running gravels and sands), on application and subject to Building Code requirements soakage disposal may be an approved option. Note these may be required to be over-designed to cater for the lack of a secondary flow path.
 - d) On-site requirements for stormwater management systems, such as special sumps and filters, are governed by the Building Act and its regulations.

5.9.12 Contaminated Stormwater

- a) Stormwater discharges to the Nelson City Council stormwater network must comply with the requirements of the Nelson City Council Stormwater Bylaw. Those that discharge to freshwater bodies must comply with the requirements of the NRMP and require resource consent.
- b) When requested by the Nelson City Council Manager Infrastructural Assets, the operator of any industrial or trade processes shall prepare a site or operation specific Pollution Prevention Plan as defined by the Nelson City Council Stormwater Bylaw.

5.9.13 Discharge from Oil and Silt Traps

- a) Effluent that contains a combination of detergent and/or degreasing agents with oil and/or silt shall be directed to the wastewater after first passing through a silt and oil trap built to SD 520. To ensure stormwater does not enter the wastewater system the area being served by the silt and oil trap must be roofed and have a low bund around the perimeter with a minimum height of at least 50mm.
- b) Any proposal to make such a discharge to the wastewater system shall require a Trade Waste application.

- c) In some locations a gravity connection to the wastewater may not be possible and the discharge may have to be pumped into the wastewater system. This shall require specific design and approval.
- d) Bunded areas around fuel storage areas should discharge to the stormwater via a suitably designed oil interceptor with an appropriate shut off valve system to contain fuel spills.
- e) Where it is considered that there is a high risk of yard runoff being contaminated with oil and silt, an oil and silt trap shall be required with a connection to the stormwater system. This shall require specific design and approval. An appropriate mechanically or electronically operated wastewater diversion system may be required to be incorporated. Stormwater shall not be allowed to discharge to the wastewater system.
- f) Building consents are required for all works.

5.10 SECONDARY SYSTEM OF OVERLAND FLOWPATH

- a) A secondary system of overland flowpath is to be designed to safely convey excess stormwater to maintain the overall capacity requirements as specified in Table 5-2 without undue nuisance.
- b) Where possible, secondary systems shall be located on land that is, or is proposed to become public land. If located on private land, the secondary system shall be protected by legal easements in favour of Council.
- c) Acceptable solutions include:
 - 1) Temporary ponding and/or flow on local and collector roads.
 - 2) Where roads are designed as part of a secondary flow path, adequate access and egress should be provided to affected properties. Light vehicles should be able to pass along the road in a 50 year ARI event, and large 4WD in a 100 year ARI event. Ponding should be limited to a 100mm maximum height at the centreline.
 - 3) Flow across private property must be in a defined channel or swale, clear of existing or future building sites and protected by an easement in favour of Council and a Consent Notice which prohibits ground reshaping and the erection of any barriers to the secondary flows.
 - 4) Fencing shall not be permitted across overland flowpaths unless it is approved by Council.
- d) Piped secondary systems are discouraged due to the risk of blockages. These may only be used where no other option exists and are subject to approval of the Engineering Manager.

5.11 OPEN CHANNEL DESIGN

- a) Where natural open drain systems or artificially formed channels (open drains) are to be incorporated in the stormwater drainage system, they shall be located within a drainage reserve of sufficient width to contain the full design flood flow together with a freeboard of appropriate engineering design.
- b) The flow characteristics of open drains shall be based on the likely long term stream condition in terms of density of vegetation and take due account of the possibility of blockage under peak flood conditions.
- c) Designed open channels must have a “natural” appearance, incorporating natural flow regimes including planting, that encourage and support native plants, fish, invertebrate and bird habitat. A comprehensive design and Resource Consent may be required by Council to fulfil these design criteria.
- d) Where natural open drain areas form part of the stormwater drainage system they shall be cleared of all unsuitable plant growth and replanted to an appropriately approved landscape design (See section 12 Reserves and Landscaping). These works shall include protection of the low flow channel against scour and erosion of the bed where necessary. Access from public carriageways shall be provided for maintenance purposes.
- e) The natural flow conditions of the open drain should not be changed by the discharge of stormwater resulting from development or a new discharge to the stream. Flow rate characteristics of the open drain should be maintained to avoid erosion of the open drain embankments. Catchment or detention factors that may lead to an increase in the temperature of the stormwater (e.g. large sealed areas) also need to be considered.

5.11.1 Access

- a) Reserves, as required by 5.11a), shall have maximum batters of 1 vertical to 5 horizontal and when access for maintenance is required, shall include:
 - 1) An all weather surface
 - 2) 4m wide berm able to be accessed by a 8.2t axle weight vehicle for its entire length
- b) Drawings of the proposed access shall be submitted to Council for approval prior to commencing construction of the access

5.11.2 Drainage Reserves

- a) To encourage the best use of the Drainage reserves the drainage reserves shall be linked with other reserves and other public open spaces, to accommodate off road pedestrian and cycle access. Access points for public use and maintenance shall be provided at regular intervals along the system together with footpath and pedestrian bridges, as may be defined in the resource consent.

5.11.3 Piping of Watercourses

- a) The piping of natural watercourses should be avoided. Continuously flowing and ephemeral water courses should be retained as natural drainage features where practicable.
- b) Retention of existing open channels is preferred and the design and layout of a development will therefore need to factor in access and maintenance requirements.
- c) Where piping of watercourses is necessary, the following standards shall apply:
 - 1) Resource consent will be required
 - 2) Should a watercourse be piped (such as in an intensively developed area), a subsoil drain shall be laid at the invert level of the pipe and connected to manholes, to ensure groundwater levels are not forced to rise. Where pipe routes differ from the original stream course, sufficient protection from seepage in the original stream bed shall be provided.
 - 3) Secondary flow paths shall be provided. These shall be shown on the Engineering Drawings and protected by easements.
 - 4) Where a continually flowing or ephemeral stream is culverted or piped, allowance shall be made for fish passage, and provision of an in-stream environment. As a minimum, pipes and culverts shall be increased in size above that normally required and shall be embedded such that the invert is 50mm below the stream bed.

5.12 PIPED INLET STRUCTURES

5.12.1 General Design Requirements

- a) Every inlet to a piped stormwater system shall be provided with a suitable inlet structure and grill. Refer to SD 503 for details of the Standard Stormwater Inlet Structure.
- b) In general, the minimum height of headwall above the design stream flow should be 300mm. Barriers complying with Building Act may be required if the drop is greater than 1m.

- c) In general, structures are to be constructed in reinforced concrete and where possible be modified to provide an aesthetically pleasing appearance suitable to the particular site.
- d) Where appropriate intakes are to be constructed to allow fish passage to enable the fish to migrate further upstream.
- e) Refer to SD 510 and 512 for details of the Standard Sump. (For use as a minor intake only and where the risk of blockage is minimal.)
- f) Under no circumstances shall a grill be placed flush over the intake/inlet of a stormwater pipe.
- g) Pipeline and culverts requiring an inlet structure shall take account of the inherent hydraulic losses associated with flow transition to ensure the inlet is appropriately sized to convey the design flow without heading up and overtopping.

5.12.2 Secondary Intakes, Deep Trap Sumps and Catchpits

- a) Apart from the requirements for inlet structures and grills as detailed on SD 503, modified intakes may be required at specific locations to provide additional protection to the pipe inlet against the risk of blockage by solids and floating debris, see SD 504 - 506.
- b) SD 504 and 505 provides details of general examples of deep trap sumps and railway iron trash racks and catchpits. Each case will require specific design to suit the site with regard to peak flows, secondary intakes, expected debris and access for maintenance. Final details shall be submitted to the Council for approval.

5.12.3 Temporary Intakes

- a) In the case of a temporary intake, the structure shall be adequate for the estimated period before the permanent extension. Temporary intakes and outlets shall be designed to cope with individual requirements including fish passage.

5.12.4 Access to Intake Structures

- a) An all weather access track for trucks and wheeled excavators shall be provided to the location of all intakes, deep trap sumps and catchpits. The access shall consist of a 3m minimum width all weather surface no steeper than 1 in 5 with an easement or right of way in favour of NCC for pipe systems 300mm diameter or greater.
- b) Where the piped system is less than 300mm diameter the Engineering Manager may approve an access suitable for pedestrian and plant only. Under no circumstances though, will approval be given for an access steeper than 1 in 2. An easement may be required to protect the access-way.
- c) There must be sufficient space provided adjacent the intake structure for operation of plant to work at the intake.

5.13 SURFACE CUT-OFF CHANNELS

- a) Approved cut-off channels may be required parallel and adjacent to the uphill boundaries of upper sections to protect them from surface water runoff. When required, these shall be located within the upper boundary of the property to be protected and covered by suitable easements.
- b) In this case a consent notice shall be placed on the section outlining that the property owner is responsible for maintaining the cut-off channel.

5.14 CULVERTS UNDER FILL

- a) Culverts shall be of sufficient strength to support all designed super imposed loads in accordance with NZS/AS 3725 and culvert design manuals. Note – minimum 375mm diameter for rural access crossings.
- b) Culverts shall have adequate wingwalls, headwalls, aprons, approved grills, traps and/or pits to prevent blockage, scouring and erosion.
- c) Inlets shall be designed to ensure adequate intake capacity and provide headwalls no lower than maximum surcharge levels.
- d) Sufficient erosion protection shall be provided in the event of flow over an embankment.

5.15 SUB-SOIL DRAINS

- a) The recommendations of NZS 4431: 1989, Code of Practice for Earthfill for Residential Development shall be followed except where otherwise specified in the Nelson City Council Land Development Manual.
- b) Sub-soil drains are not to be considered as part of the surface water drainage system.
- c) To avoid the appearance of seepage in dry weather, sub-soil drains shall not discharge to the kerb and channel or road surface.

5.16 LOW IMPACT DESIGN (LID)

5.16.1 General

- a) As far as practicable all development should apply the principles of Low Impact Design (LID) and the application of "Best Management Practices" to reduce stormwater runoff volumes and peak flow rates and to improve the quality of stormwater runoff entering the receiving environment.

- b) Due to the unstable nature of Nelson hill soils, it is expected that in most situations a combination of alternative (LID) methods coupled with conventional (piped) systems will be the most appropriate for hillside developments and sites with unsuitable soils.
- c) Where disposal of stormwater to soakage is proposed then detailed site specific geotechnical investigation, including comprehensive soakage testing, must be undertaken to assess the suitability of the site for stormwater disposal by soakage.
- d) The desired outcomes of using a LID approach to stormwater management include:
 - 1) A more natural approach towards stormwater management.
 - 2) A reduction in stream erosion.
 - 3) Preservation and if possible the enhancement of river and marine water quality.
 - 4) An integrated approach towards residential design.
 - 5) The methods and detailed design of stormwater management systems support the amenity of the area and are appropriate for adjacent land uses, in particular with town centres.
- e) The above principles are best considered during the initial planning, design and construction stages of the project. Good planning and design early in the development process maximises the cost-effectiveness of LID.
- f) Guidance on the implementation of LID can be obtained from the following sources:
 - 1) ARC TP10 Design Guideline Manual Stormwater Treatment Devices
 - 2) ARC TP124 Low Impact Design Manual for the Auckland Region 2000
 - 3) NZWERF On-site stormwater management guidelines
 - 4) SNZ HB44:2001 Subdivision for People and the Environment
- g) The Council encourages a holistic approach towards LID including combinations of the following in a "Treatment Train" approach:
 - 1) Minimising site disturbance
 - 2) Revegetation
 - 3) On-site stormwater mitigation
 - 4) Larger, communal off-site stormwater mitigation

5.16.1.1 On-site stormwater mitigation

- a) The Council's preferred methods for on-site stormwater mitigation are those methods which provide multiple benefits. These include:
 - 1) Rainwater harvesting using single or dual purpose rainwater tanks
 - 2) Bioretention using rain gardens, tree pits, stormwater planting and bioretention swales
- b) Other methods of on-site mitigation include:
 - 1) Permeable paving
 - 2) Green roofs
 - 3) Flow attenuation device
 - 4) Infiltration devices (soak pits)
 - 5) Proprietary filtration devices
 - 6) Oil and grease separators
 - 7) Sand filters
 - 8) Detention tanks

5.16.1.2 Off-site stormwater mitigation

- a) Off site stormwater mitigation includes stormwater mitigation which treats multiple freehold lots and which usually vests in the Council as public infrastructure. Preferred methods include:
 - 1) Bioretention – filter strips with planted swales, tree pits, rain gardens.
 - 2) Wetlands
 - 3) Ponds
- b) Other devices could include:
 - 1) Detention basins/ponds
 - 2) Proprietary filters
 - 3) Sand filters

5.16.2 Planting Associated with Stormwater Devices

- a) Refer to 12.4.4 of the Reserves and Landscaping Section and ARC TP10 for further information.

5.16.3 On-Site Retention of Stormwater

- a) Water is a valuable resource and land owners are encouraged to retain and reuse stormwater collected on their site.
- b) Retention of stormwater can be achieved via holding tanks on site. The lower two-thirds of a tank can be used for stormwater reuse and the top one-third of the tank for detention and slow discharge to Council's reticulation system if available. SD 526 gives a working example for stormwater retention design. For further details, refer to Auckland Regional Council's Technical Publication 10.

5.16.4 Detention Basins/Ponds

- a) Detention basins/ponds that are to be vested in Council must have the prior approval of the Engineering Manager. Detention basins/ponds may be needed for the control of stormwater flows should downstream systems be substandard.
- b) Detention basins/ponds must be designed and constructed to a standard acceptable for it to be incorporated into local purpose reserve areas where possible. See 12.2.8 of the Reserves and Landscaping section.
- c) If detention basins/ponds are approved they should be designed to the requirements of Auckland Regional Council's Technical Publication 10, and including the following criteria:
- d) Detention basin design shall mitigate any actual or potential adverse effects by addressing the following points:
 - 1) side slope stability and safety considerations;
 - 2) ease of access and maintenance, including mowing and silt cleanout;
 - 3) shape and contour for amenity value;
 - 4) the effectiveness of the inlet and outlet structure;
 - 5) secondary overflow options;
 - 6) dam or bank failure;
 - 7) silt traps;
 - 8) fish passage, habitats and birdlife enhancements;
 - 9) road frontage of not less than 30m width;
 - 10) pedestrian links to other reserves;
 - 11) safety fencing;
 - 12) vegetation islands, shading.

- e) Detention basins/ponds shall comply with the requirements of the Reserves and Landscaping section of the Manual and to the approval of the Nelson City Council Divisional Manager Community Services prior to vesting as 'reserve'.
- f) The 50%, 20%, 6.67% and (where required) 2% AEP design storm peak flood flow from the developed catchment shall be no greater than would have occurred from the undeveloped catchment at the critical downstream location(s) in the network. This requirement may result in design for a number of duration rainfall events. Where necessary, additional storage volume shall be provided to mitigate potential effects of any additional total flow from the development.
- g) A freeboard of 400mm minimum shall be provided above the maximum design storage level to the spillway crest.
- h) The spillway shall be capable of passing the Probable Maximum Precipitation (that the catchment would discharge into the structure) without risk of overtopping the structure or eroding the spillway.
- i) In locations where the majority of the flow into the structure would be via overland flow and open channels, then a stormwater intake structure will be required. An acceptable 'indicative only' example is shown on SD 503. The intake structure must be designed and constructed to provide an aesthetically pleasing appearance suitable to the particular site.
- j) In locations where the majority of the flow into the structure would be via piped systems the systems shall be extended through the dam basin with surcharging capabilities to allow:
 - 1) Multi-use (recreational) options for the dam basin area
 - 2) Peak flood flows to surcharge out of the pipe system into the storage basin
 - 3) Stored water to drain away once the flood peak has passed
- k) In all cases a secondary intake shall be provided. An 'indicative-only example' is shown on SD 504 Type C. The top of the intake shall terminate 400mm below spillway crest level. The intake structure must be designed and constructed to provide an aesthetically pleasing appearance suitable to the particular site.
- l) An all weather access track shall be provided from legal road reserve to the basin and intake structures. The track shall be no steeper than 1 in 7 (steeper gradients up to 1 in 5 may be permitted if provided with permanent sealed surface), have a physical width of not less than 3.0m and be provided with stormwater control.

- m) A design and construction certificate shall be provided for each structure by a suitably experienced, Chartered Professional Engineer stating that the dam has been designed and constructed in accordance with the appropriate standards.

5.16.5 Vegetated Swales

- a) In some cases, swales can be used to provide an alternative to a piped system. The following criteria shall be used in the design of these systems:

- 1) Longitudinal Slope 1 – 5%
- 2) 100mm maximum water depth above vegetation
- 3) 2m maximum bottom width
- 4) 30m minimum length
- 5) 3:1 maximum side slope
- 6) in conjunction with reticulated drainage

- b) Further design information can be found in Auckland Regional Council's Technical Publication 10.

5.16.6 Rain Gardens

- a) The minimum requirements for a rain garden are:

- 1) An under drain must be used
- 2) Minimum 50mm gravel cover over the under drain
- 3) Must include a ponding area
- 4) Filter Fabric must be used on at least the side walls (open weave in stable soils and impervious in unstable soils)

- b) Further design information can be found in Auckland Regional Council's Technical Publication 10.

5.16.7 Operation, Monitoring and Maintenance

- a) The long-term effective operation of on-site and off-site LID devices depends not only on sound design and construction, but also on applying routine and sound operation and maintenance practices. The design and construction of any stormwater management practice shall take into consideration the future ownership, access and maintenance requirements and shall ensure that maintenance can be carried out with little or no disturbance to the surroundings or neighbouring properties.

- b) An Operation and Maintenance Manual for stormwater management devices, public or private, shall be provided to Council for approval at the time of application for resource consent. The manual shall include information about what, when and how a proposed system will be maintained to ensure its ongoing effectiveness in achieving stormwater management functions and how the device will be protected from any ongoing development or building works in the area. As a guide, Table 5-13 below sets out the minimum monitoring and maintenance requirements and frequencies for LID systems.

Table 5-13 Maintenance and Monitoring Requirements for LID systems

Device	Item	Frequency
All	Inspection by a Certified professional	5 years
Swale/Filter Strip	Clear debris, litter from entry and contributing areas	As required, at least quarterly
	Mow grass to keep height between 50mm and 150mm	As required, at least quarterly
	Check that there is a thick growth of grass or other approved thin stemmed vegetation. Reinststate vegetation as necessary, remove undesirable vegetation	As required, at least quarterly
	Check that flow is evenly dispersed, remedy concentrated flow or erosion damage by revegetation, earthworks or installation of level spreaders or additional check dams	As required, at least quarterly
	Removal of accumulated sediments, restore vegetation as required	As required, at least annually
Infiltration Trench	Clear debris, litter from entry and contributing areas	As required, at least quarterly
	Evaluate performance during a rainfall event	6 monthly
	Remove accumulated sediments, clear excessive vegetation and repair damaged areas	Annually
	Remove small section of upper trench and inspect upper layer of filter material for sediment deposits. If clogged, restore to original condition	2 yearly
Rain Garden	Clear debris, litter from rain garden and contributing areas	As required
	Remove noxious or invasive weeds and plants	As required but inspect at least quarterly
	Check plant height and density, prune excessive vegetation, replace plants if necessary	As required, but at least 6 monthly

Device	Item	Frequency			
	Check that the surface dewaters between storms: 220mm of ponded water depth should empty within 1 or 1.5 days depending on design (residential, commercial/industrial). If longer, check for surface clogging, remove sediment. Replace planting soil medium if required	6 monthly			
	Outlet/overflow spillway: check condition, scour erosion, blockage	6 monthly			
	Sediment accumulation: remove if more than 30mm depth, re-establish plants after sediment removal	Annually			
	Rain garden integrity: check device has not been blocked or filled in	Annually			
	Replace mulch	Every 2 to 3 years			
Porous Pavement	Evaluate performance during a rainfall event	6 monthly			
	Remove sediments and debris that can potentially clog pores	Annually			
	Repair damaged areas in paving surface	Annually			
Proprietary Devices	Design specific	Design specific			
Rain Tank		After storm	Quarterly	Annually	2 yearly
	Spouting and downpipes: check for problems such as debris/blockages and leaks and rectify	✓	✓	✓	✓
	First-flush diverter device: check for blockages; empty debris/sediment	✓	✓	✓	✓
	Tank water quality: check for clarity and odour		✓	✓	✓
	Tank structure: check for leaks and rectify			✓	✓
	Tank cleaning: empty the tank and clean out any sediment accumulations and growths				✓

c) The manual must include estimated costs of ongoing maintenance and address the following matters where they are applicable:

- 1) A comprehensive description of ongoing maintenance procedures required to ensure that the system/s operates effectively and efficiently;
- 2) Clearly defined ownership and management responsibilities for every part of the given system, including the resource consent holder(s);

- 3) For devices located on private property (individual lots or right of ways) a consent notice or other suitable encumbrance shall be registered on the property/ies stipulating the specific requirements and obligations of the landowner regarding ongoing operation and maintenance works and costs;
- 4) For lots adjacent devices within roads or other public areas, a condition shall be included with the building site certification for the lot (prior to 224 certification) requiring sediment control devices (such as construction entrances and silt fences) to be shown on the building plans submitted for building consent and requiring that these devices be erected and maintained by the applicant prior to commencement of building works or earthworks on the lot to prevent runoff of sediment. A detail of the sediment control devices shall be provided by the Developer with the building site certification.
- 5) Raise public awareness by erecting and maintaining signs within the subdivision informing builders, contractors and tradespersons about the onsite stormwater systems and the importance of ensuring vehicles and sediment are kept away from the devices;
- 6) The developer shall produce brochures for prospective landowners informing them of the onsite stormwater devices and their obligations as landowner. These brochures shall be made available through sale and agreement transactions and at the time of building consent approval;
- 7) Specification of accessibility to all points of the stormwater system;
- 8) An assessment of the durability of each device/system and/or materials used;
- 9) Specification of any resource consent conditions, and description of how they will be achieved;
- 10) Sufficient information to describe how the proposed device integrates into the existing infrastructure;
- 11) The replacement value of any system devices, including the method of replacement; and
- 12) Lifecycle costing of the given system.

5.17 PIPE SYSTEM CONSTRUCTION AND INSTALLATION

5.17.1 Excavation Works

The following standards and conditions apply to the excavation in preparation for pipework laying:

5.17.1.1 Trench width

- a) The Minimum trench width shall be 300mm wider than the external diameter of the collar of the pipe being laid.
- b) The trench shall be of sufficient width to permit with freedom the installation of all trench support and to allow the laying and jointing of pipes and placing of bedding and pipe surround materials. See SD 617 and 523.

5.17.1.2 Base of excavation

- a) No construction or work upon the excavation bottom shall commence until the natural bottom of the excavation has been inspected and accepted by the DPA.
- b) The foundation of the trench is to be checked for stability of the soil by the DPA. Generally a plate compactor is to be run over the trench floor to bind the surface and identify any obvious weak spots. Where the bottom of an excavation is unable to provide a firm foundation with minimum bearing capacity of 50kPa (e.g., clay soils that can easily be penetrated 40mm with a thumb or in sand or gravel that makes a footprint more than 10mm deep) at the required level without abrupt irregularities, engineering advice should be sought on how to provide a satisfactory foundation (see AS/NZS 2032:2006, clause 5.3.6). The DPA shall order the use of additional granular bedding material as specified in AS/NZS 3725:2007 for concrete pipes, or AS/NZS 2566.2:2002 for PVC and other flexible pipe systems.

5.17.1.3 Trench support

- a) The Contractor shall provide trench support to comply with the requirements of the Occupational Safety and Health service of the Department of Labour. The Contractor shall ensure that the sides of the trench are sufficiently supported so that cracking of the surrounding ground does not occur.
- b) Where trench support extends below the invert of the pipeline or structure special precautions may be required, including leaving part of the support in place, to ensure the foundation of the pipe or structure is not weakened.

5.17.1.4 Trench in an existing watercourse

- a) Where the trench is in an existing watercourse, drain, or gully, etc, the Contractor shall strip all vegetation and organic material from the sides and bottom before placing foundations or backfill.

5.17.1.5 Dewatering

- a) Excavations shall be kept free of water during construction.

- b) In no circumstances shall stormwater or ground water be allowed to drain into any existing wastewater drain, and pipe ends shall be plugged to prevent such ingress.
- c) Discharge of stormwater or groundwater to existing stormwater drains or the pipes already laid will be permitted providing adequate silt traps prevent debris and suspended matter from entering drains. Should deposits in existing stormwater drains or the pipes already laid occur as a result of the operations of the Developer or the Contractor such deposits shall be cleared forthwith at the Developer's or the Contractor's cost as the case may be.
- d) Ground water lowering may be permitted except where this practice may present a risk of subsidence.
- e) The Contractor or Developer shall cause as little damage or interference to property or persons as possible in disposing of water from the works, and shall be responsible for any damage or interference, which may be caused. This shall include any damage to the structure of any road.

5.17.2 Bedding of Pipes and Pipe Protection

5.17.2.1 Metal bedding

Note: Includes bedding, haunch support and side support material as defined by NZS 2566.2:2002 and AS/NZS 3725: 2007.

- a) Metal Bedding shall be in accordance with SD 617 and 523. (For concrete pipes, "Type H2" bedding in accordance with AS/NZS 3725:2007 shall be used.)
- b) The bedding material shall be:
 - 1) In a sand environment - Sand
 - 2) For PVC and flexible pipes - AP20 as per SD 401, or as per AS/NZS 2566.2:2002, Appendix G
 - 3) For concrete pipes - AP20 as per SD 401, or as per AS/NZS 3725:2007, Table 6
- c) Bedding shall be placed and raked-in so as to provide support for the pipe uniformly along the whole length of the barrel with chases provided for sockets, couplings and other appurtenances. For PVC and flexible pipes the bedding shall not be compacted and the centre of the bedding shall not be walked on either during or after placement. For concrete pipes only the centre strip of the bedding shall not be compacted (see SD 523).
- d) The pipes shall be laid and brought to true alignment and level before installing the metal haunching, side support and covering the pipes.

5.17.2.2 Pipe embedment

- a) The metal haunching and side support shall be placed uniformly along and around the whole length of the pipe barrel, couplings and other appurtenances in a manner to ensure uniform density of side support (including haunch support) and overlay with no distortion, dislodgement or damage to the pipeline.
- b) Following placement, the embedment material shall be compacted in layers to uniformly support the pipe. When choosing compaction equipment, the number of passes and the thickness of layer to be compacted, account shall be taken of the material to be compacted and the pipe to be installed.
- c) Compaction equipment or methods that produce horizontal or vertical earth pressures that may cause damage to, or excessive distortion of, the pipe shall not be employed.
- d) Metal haunching and side support shall be compacted to the manufacturer's requirements and as a guide, a minimum Clegg Impact Value of 35 under vehicle loaded areas or 25 under non traffic loaded areas shall be achieved at any point on any haunching constructed of AP20.

5.17.2.3 Installation of geotextiles

- a) Where there is a possibility of migration of fines between the native soil and the pipe surround soil, the DPA shall require the metals to be protected by an approved geotextile filter fabric that overlaps by at least 300mm.

5.17.2.4 Concrete surround for concrete pipes

- a) For concrete pipes the DPA may order concrete surround in accordance with SD 618 under the following conditions:
 - 1) In areas subject to vehicle traffic where the cover of the pipe barrel is, or will be, less than that required for the class of pipe as specified by the pipe manufacturer.
 - 2) In areas other than those covered above, where the cover over the barrel of the pipe is or will be less than 300mm, irrespective of the type or class of pipe.

Note: Flotation of the pipe during placement of concrete surround shall be prevented. PVC pipes shall not be concrete surrounded.

5.17.2.5 Concrete protection slab for PVC pipes

- a) Where cover over PVC pipes is less than the minimum stated in Table 5-10 including temporarily under construction traffic, a concrete protection slab shall be constructed in accordance with SD 618.

5.17.2.6 Water-stops and trench groundwater

- a) Where permeable bedding such as 'bedding chip' 'drainage metal' or 'sand' is used, water-stops and trench drainage shall be constructed to prevent unwanted movement of groundwater along the trench and pipe bedding. Also see section 5.17.2.3.
- b) Water-stops shall be constructed to the requirements of SD 615. Trench Drainage shall be constructed to the requirements of SD 614.
- c) Manholes can be considered to be water-stops provided they are constructed appropriately.
- d) Where water stops are required, they should be provided at the following intervals:

Pipe Grade	Maximum Spacing
1 in 15 or steeper	12m
1 in 25	15m
1 in 50	30m
1 in 100	60m

Note: Intermediate grades (and spacing) are determined by interpolation

5.17.3 Pipe Installation

- a) To help with future identification the end caps and inside of the end of all new stormwater laterals must be painted with green acrylic paint and marked with a 75mm x 25mm ground treated marker stake suitably identified and partly painted green. (Note: wastewater laterals are to be marked red.)
- b) A laser shall be used by the Contractor for fixing line and grade, for setting the pipes to line and level, and for jointing on all major pipelaying work where possible.
- c) The maximum deviation in level of pipe invert when laid shall be 5mm from design level.
- d) The maximum horizontal deviation from a straight line shall be 10mm.
- e) Pipes shall not be laid on bricks, blocks and wedges or other temporary or permanent supports except when concrete surround is to be placed.
- f) Joints shall be flexible and watertight.
- g) Pipes shall be kept clear of dirt or debris, and any pipes that contain such matter shall be required to be cleaned out. Internal pipe walls shall be kept clean and free of all dirt, rubbish and water. Spigots, sockets, rubber rings, etc, shall be thoroughly cleaned before jointing.

5.17.4 Installation by Trenchless Technology

- a) Gravity pipes and pressure rising main pipes may be installed by trenchless methods (subject to specific approval), including:
 - 1) Horizontal Directional Drilling (HDD);
 - 2) Pipe bursting;
 - 3) Pipe jacking/Pipe ramming;
 - 4) Auger boring/Guided boring;
 - 5) Slip lining;
 - 6) Pilot bore microtunnelling;
 - 7) In-line replacement/Pipe eating/Pipe reaming with HDD rig.
- b) Pipes may include fusion welded PE, or rubber ring joint PVC with restraint joints specifically designed for trenchless installation.
- c) Gouging or notching of the pipe shall not exceed 10% of the pipe wall thickness for pressure pipe and 20% of the pipe wall thickness for gravity pipe. Pipe shall not be bent to a radius less than 35 times the pipe OD for PE pipes or 600 times the pipe OD for PVC pipes.
- d) The trenchless installation methodology selected must be compatible with, and capable of achieving the required pipeline gradient.
- e) The specified allowable load on the pipe shall not be exceeded during pulling.
- f) Where gouging or notching exceeds the above limits or if buckling of the pipe occurs, that length of pipe shall be removed and a new section welded in at the nearest join.
- g) The Contractor shall overtop the pipe by one lineal metre for each length of pulled pipe that is the greater of one manhole length or 200m. The excess pipe length shall be supplied to the DPA for a visual inspection.

5.17.4.1 Pipe installation by pipebursting

- a) The new pipe shall be HDPE with a minimum wall thickness of 10mm, or PE100, SDR17 as a minimum wall thickness for any pipe size.
- b) Where the pipe is to replace a live pipeline, the line to be burst shall be inspected by CCTV to locate all laterals and to check for any obstructions. Live laterals shall be confirmed by the use of dye.

5.17.4.2 Pipe installation by slip lining

- a) The pipe sleeve shall be MDPE with a minimum wall thickness of 5mm, or PE80, SDR21 as a minimum wall thickness for any pipe size
- b) The host pipe shall be cleaned to provide a clear pipe diameter that passes the new polyethylene pipe without gouging or notching the pipe.
- c) The Contractor shall not detrimentally affect the host pipe when cleaning it.
- d) Prior to any attempt to pull in the new pipe a plug, no less than the outside diameter of the new pipe, shall be passed through the host pipe to ensure there is sufficient clearance.

5.17.4.3 Pipe installation by directional drilling

- a) This method shall only be used in specific circumstances where approved by the Engineering Manager. The new pipe shall be HDPE with a minimum wall thickness of 10mm, or PE100, SDR17 as a minimum wall thickness for any pipe size.
- b) The constructed pipe alignment shall not vary more than 100mm horizontally from the design alignment and the tolerance on the vertical alignment shall not exceed the specified amount except where the grade of the pipe is specified, in which case it shall be ± 5 mm from the design grade.
- c) The Contractor shall accurately monitor the position of the drilling head to achieve the above requirements.
- d) The Contractor shall be liable for damages to any underground services.

5.17.5 Manhole Installation

The following standards apply to the installation of manholes:

5.17.5.1 Concrete manholes

- a) Manholes shall be constructed in accordance with SD 602 – 609 and 507.
- b) All concrete manholes shall be made water tight by effective sealing of manhole section joints with mastic sealant and around pipe entries, where applicable, using epoxy mortar inside and out.
- c) The connection of PVC pipes to concrete structures, such as manholes and sumps, shall be with a PVC starter and finisher with a 'gritted' external surface.
- d) The connection of PE pipes to concrete structures shall be in accordance with SD 607.

- e) All PVC pipes entering or leaving a manhole shall have one flexible joint within 200mm of the manhole and a second flexible joint within 1200mm of the manhole.
- f) The channel through the manhole shall be formed from in-situ concrete properly formed to grade and radius sweeps. The channel shall be finished with a smooth, regular half circle invert with falls as specified in SD 602. Benching shall be steel float finished to give a regular smooth surface.

5.18 TESTING

5.18.1 Closed-Circuit Television (CCTV) Inspection

- a) All pipelines to be vested in Council ownership shall pass a closed circuit television (CCTV) inspection, carried out at an appropriate time agreed by Council or at the completion of the works.
- b) A professional operator with proof of experience in operating such devices shall carry out the CCTV inspection using a pan and tilt camera, in accordance with the technical specifications of the NZ Pipe Inspection Manual (published by the New Zealand Water & Wastes Association).
- c) The operator shall pan around every joint and check every lateral connection and defect.
- d) The video footage in DVD format, and the accompanying CCTV log sheets for each stormwater length (as per the template in the NZ Pipe Inspection Manual), showing the features and condition of all inspected manhole lengths, shall be provided to Council. Video footage supplied without log sheets will not be accepted.
- e) All pipelines shall be free of debris and flushed within 24-hours prior to inspection. Inspections of non-cleaned pipelines are not acceptable.
- f) A pipeline will fail its inspection if:
 - 1) The pipe is horizontally misaligned or deformed by more than 5% of the pipe diameter.
 - 2) The pipe has visible dips or ponding of water.
 - 3) The pipe has visible defects, such as open or displaced joints, defective or protruding laterals, cracked barrels or similar defects.
- g) Other testing as considered appropriate may be required by Council to ensure Council's future infrastructure will meet its projected life cycle.

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6. WASTEWATER

6.1 INTRODUCTION

- a) The purpose of this section is to outline Council's requirements for the provision of wastewater reticulation.
- b) It is important that wastewater disposal matters are adequately addressed within all developments, regardless of size and scale. The standards in this section provide a basis for the design and construction of a reticulated wastewater system, to dispose of wastewater in a Council-provided treatment facility.

6.1.1 Objectives

- a) The Council is seeking to have a wastewater system that is capable of collecting and treating wastewater in an efficient, safe and sustainable way whilst ensuring that the cultural, ecological and recreational values of waterways and the marine environment are recognised and enhanced.
- b) Where the Council's wastewater network is available to service developments then each lot should be provided with a connection and each development should be provided with a piped wastewater system connecting to the Council's network. (See also, section 6.2.1 a)
- c) Development of alternative (on-site) wastewater systems that comply with AS/NZS 1547 are acceptable in the Rural (not including the Services Overlay areas) and Conservation Zones providing the appropriate provisions of the NRMP are met.

6.1.2 Performance Criteria

The design of a wastewater system shall include the following:

- a) Meet the relevant standards and criteria of the Nelson Resource Management Plan.
- b) Provide for the collection of wastewater, allowing for ultimate future development potential¹ within the catchment or adjoining catchments.
- c) Minimise health and safety related risks.
- d) Be compatible with the existing wastewater system.
- e) Prevent stormwater ingress (inflow and infiltration) into the system and prevent sewage egress out of the system.

¹ Development potential means the likely future development within the Services Overlay taking into account the Council's Strategic City Development Plan and the LTCCP, and the provision of services in a manner that integrates with and does not foreclose this likely future development.

- f) Where the Council wastewater system is available, provide a connection for each lot.
- g) On-site systems (where permitted) comply with the requirements of AS/NZS 1547. Key References

6.1.3 Key References

- a) Table 6-1 sets out the New Zealand, Australian and British Standards and publications that apply to the design and construction of wastewater systems except where modified by the current NCC Land Development Manual. Where an Act or Standard is referenced this shall be the current version including any associated amendments.

Table 6-1 Minimum Standards for Wastewater Design, Materials and Construction

Number/Source	Title
AS/NZS 1260	PVC-U Pipes and fittings for drain, waste and vent application
AS/NZS 2032	Installation of PVC pipe systems
AS/NZS 2566	Part 1: 1998 Buried flexible pipelines – Structural design Part 1 Supp 1: 1998 Buried flexible pipelines – Structural design – Commentary Part 2 – Buried flexible pipelines - Installation
AS/NZS4158	Thermal bonded polymeric coatings on valves and fittings for water industry purposes
AS/NZS 4998	Bolted unrestrained mechanical couplings for waterworks purposes
AS/NZS2280	Ductile iron pipes and fittings
AS/NZS 4441	Oriented PVC (PVC-O) pipes for pressure applications.
AS/NZS1477	PVC Pipes and fittings for pressure applications
AS/NZS 4058	Pre-cast concrete drainage pipes (pressure and non-pressure)
AS/NZS 3725	Design for installation of buried concrete pipes
AS/NZS 4130	Polyethylene (PE) pipes for pressure applications
AS / NZS 5065	Polyethylene and polypropylene pipes and fittings for drainage and sewerage applications
BS 3412	PE materials for moulding and extrusion
AS/NZS 2033	Installation of polyethylene pipe systems
NZS 3109	Concrete construction
NZS 3121	Specification for water and aggregate for concrete
NZS 4404:2010	Land development and subdivision engineering
AS/NZS 1547	On-site domestic-wastewater management
NZS 4404	Land Development and Subdivision

Number/Source	Title
Dept of Building and Housing	Building Act 2004
	New Zealand Pipe Inspection Manual 3rd edition
	Occupational Safety and Health Service of the Department of Labour

6.2 RETICULATION DESIGN

6.2.1 General

The following general matters apply to the design of wastewater reticulation:

- a) Wastewater disposal shall be provided to every allotment by means of a connection to a reticulated wastewater system wherever possible. This does not apply to sections fronting existing legal streets where the wastewater network is available in the street and is within 15m of the lot boundary and provided that the drain will not cross any lot other than the one being served.
- b) Development of alternative (on-site) wastewater systems that comply with AS/NZS 1547 are acceptable in the Rural (not including the Services Overlay areas) and Conservation Zones providing the appropriate provisions of the NRMP are met.
- c) All systems shall be designed to accommodate the flow from upstream of the subdivision or development and shall be of sufficient capacity to provide for maximum flow from possible future development.
- d) The Designer shall minimise retention of wastewater in piped systems and potential for wastewater to become anaerobic and produce gases by:
 - 1) making use of adequate grades for self cleansing and slime control;
 - 2) avoiding use of wastewater pumping stations where possible;
 - 3) ensuring adequate ventilation of stale wastewater; and
 - 4) avoiding any unnecessary turbulence at junctions and changes in grades, particularly where rising mains enter gravity system at drop junctions.
- e) Increased use of an existing wastewater sewer may require upgrading of a downstream network to prevent overloading.
- f) Under no circumstances shall a wastewater sewer be connected to a stormwater drain.

- g) A main wastewater sewer shall be provided for the full length of each new road/street, unless approved otherwise by Council.
- h) Ventilation of pipelines/manholes may be required.
- i) To be classified as a public wastewater sewer, a pipeline should have been inspected, approved, and designated as such by Council. Council responsibility does not extend to private pumping systems and rising mains, which remain the responsibility of the users they serve.

6.2.2 Private Connections

- a) In all new subdivisions, a 100mm diameter wastewater drain shall be provided to at least 1.0m inside the boundary of every lot (or body of each lot if served by ROW) with an Inspection Tee installed on the road side of the boundary or before it connects to the communal line (See also, section 6.2.1 a)). The maximum depth of the access point shall be 900mm (increased depth may be permitted where there is a clash with other services or to improve serviceability of a site). Wastewater laterals, pipes and end caps shall be painted red, (stormwater shall be painted green). See SD 612 for the Inspection Tee at the boundary. The end of each lateral shall be marked by a 75mm x 25mm ground-treated marker stake suitably identified and partly painted red.
- b) Pipes shall be deep enough to provide gravity service.
- c) Each connection shall be adequate to serve the section and to have a self-cleansing velocity flowing full.
- d) To minimise the potential for a wastewater overflow into private property, the minimum lid level of any gully trap for all new dwellings shall not be less than 150mm above the lid level of the manhole on the public wastewater sewer immediately upstream of the lateral connection. The only exception to this requirement would be on hillsides or sloping land where compliance is not practical.
- e) In some locations a gravity connection to the wastewater sewer may not be possible and the discharge may have to be pumped to the wastewater system. This will require specific design and approval.

6.2.3 Trade Waste

- a) The discharge of trade waste into a wastewater sewer is subject to the current NCC Trade Waste Bylaw.
- b) Contaminated stormwater effluent that contains a combination of detergent and/or degreasing agents with oil and/or silt shall be directed to the wastewater sewer after first passing through a silt and oil trap built to SD 520 or an oil and water separator complying with ARC TP10.

- c) Any proposal to discharge contaminated stormwater to the wastewater network shall require a Trade Waste application.
- d) To ensure uncontaminated stormwater does not enter the wastewater system any area being served by the silt and oil trap must be roofed and have a low bund around the perimeter with a minimum height of at least 50mm. If this is not possible, an appropriate mechanically or electronically operated wastewater diversion system may be required to be incorporated. Stormwater shall not be allowed to discharge to the wastewater system.
- e) For premises where food is prepared, a grease trap shall be provided. The grease trap shall be to the requirements of G13 of the New Zealand Building Code and application to Council for a Trade Waste Consent will be required. In addition the premises will be required to enter into a contract with an approved liquid waste contractor to have the trap cleaned out at least 3 monthly.
- f) Building consents are required for all works together with a monitoring programme.

6.2.4 Reticulation Layout and Alignment

- a) Consideration shall be given to minimising the possibility of surface water infiltration of the wastewater system by ensuring that access chambers and inspection points are not be located in secondary flood routes. In particular wastewater manholes shall not be located adjacent to kerb and channel or at low points in the finished ground surface.

6.2.4.1 Wastewater reticulation in roads

- a) Wastewater mains shall be aligned within public areas such as roads wherever possible.
- b) Wastewater reticulation in roads shall be aligned parallel to kerb lines within the carriageway to ensure that they do not clash with other services or occupy the full carriageway width. Adequate clearance from other services and kerb lines shall be maintained to allow for:
 - 1) Excavation on existing services.
 - 2) The future relaying of the drains.
 - 3) The provision of additional future services.
- c) In curved roads, pipelines shall generally follow the road alignment in straight lines on such alignment that they do not occupy the full carriageway width.

6.2.4.2 Wastewater reticulation through private property

- a) The catchment area to be served by public wastewater mains aligned through private property shall be kept to a minimum.

b) In planning the layout of wastewater reticulation through private property consideration shall be given to preserving access to the pipelines for:

- 1) Maintenance purposes.
- 2) Preserving the route for relaying the pipelines in the future.
- 3) Avoiding likely positions for buildings, garages, carports and retaining walls.

c) The preferred alignments of drains on private property are:

- 1) Within R.O.Ws. or driveways
- 2) Outside probable building envelopes
- 3) Clear of fencelines and kerblines
- 4) Adjacent to boundaries
- 5) Parallel to boundaries

6.2.4.3 Easements over drains

a) Where as part of a subdivision or development existing and/or proposed public wastewater pipes will be located in private property an easement shall be required in favour of the Council. The minimum width of easement shall be 2.0m.

b) The standard wording required on Land Transfer Plans shall be:

"Memorandum Easement in Gross" shall be provided in favour of NCC to convey sewage in a pipe and to provide unrestricted access along the line of the pipe for maintenance and renewal work."

6.2.4.4 Crossing other services

a) Diagonal crossing of other services, including kerb lines and boundaries or fence lines, at acute angles less than 45 degrees shall be avoided wherever possible.

6.2.4.5 Building over or alongside a common private or public drain

a) Building over or alongside any Common-Private or Public Wastewater drain is only a Permitted Activity if it complies with the rules in the appropriate zone section of the Nelson Resource Management Plan.

b) The engineering requirements for building over or alongside drains are as follows:

1) Structures

- Must be located no closer than 1.0 metre measured horizontally from the centreline of any public or common

private wastewater pipe or drain where the pipe or pipe equivalent (in the case of a drain) is less than or equal to 300mm in diameter.

- Must be located no closer than 1.5 metres measured horizontally from the near side of any public or common private wastewater pipe or drain where the pipe or pipe equivalent (in the case of a drain) is greater than 300mm in diameter.
- Which are balconies, may overhang the line of the pipe or drain, provided the balcony is cantilevered and its height above ground level is not less than 1.8m.
- Which are located within 3 metres measured horizontally from the near side of the pipe or drain must have the base of the foundations deeper than a line drawn at 30 degrees from the horizontal from the invert (bottom) of the pipe or drain (or between 30 degrees and 45 degrees if the design has been certified by a suitably qualified engineer).

c) Carports may be constructed over pipes or drains provided that:

- The foundations are located in accordance with b) 4) above; and
- The fixture to the ground/floor is a bolt-down type design which permits quick and easy removal of the structure; and
- The carport is not closed in; and
- The floor is not concreted to a depth greater than 150mm; and
- An encumbrance is registered on the certificate of title for the property acknowledging the location of the pipe or drain under the building and reminding future owners that rules (2), (3) and (4) (above) apply and that access to the pipe or drain for maintenance and repair (and reinstatement afterwards) must be made available at the building owner's cost.

d) As an alternative to (b) and (c) above, structures may be located over common private or public drains, if they comply with Table 6-2.

Table 6-2 Acceptable Techniques for Building over Wastewater Drains

Technique A Applicable in the following zones: Industrial, Suburban Commercial, Open Space and Recreation, and Inner City	Technique B Applicable in the following zones: Industrial, Suburban Commercial, Open Space and Recreation, Inner City, and Residential
<p>Structures may be located over common private or public wastewater drains or pipes, if:</p> <ul style="list-style-type: none"> • There are no changes in direction or junctions in the portion built over; and • The pipe is proven to be in good condition by internal inspection or a water test; and • The floor is constructed with lift out sections, and all foundations are designed to allow the entire drain or pipe to be readily exposed for maintenance and replacement work; and • Where the diameter of the pipe is 300mm or less, the design and use of the structure is such that an appropriate sized excavator could readily gain access along the line of the pipe for maintenance and replacement work, or appropriate access is available for hand digging; or • Where the diameter of the pipe is greater than 300mm, the design and use of the structure is such that a 12 tonne excavator and truck could readily gain access along the line of the pipe for maintenance and replacement work. 	<p>Structures may be located over common private or public wastewater pipes, if:</p> <ul style="list-style-type: none"> • The diameter or width of the pipe is 150mm or less; and • The length of pipe built over is no more than 6 metres; and • There are no changes in direction or junctions in the portion built over; and • The length of pipe built over is relaid using a continuous length of pipe without joints, sleeved inside a 225mm diameter class 4 concrete pipe; and • There is practical access and the foundations are designed to allow the pipe to be readily exposed at both ends of the sleeve for maintenance and replacement work; and • There is a minimum 6-metre clear length at one end of the sleeve to allow replacement of the pipe.

Detailed Engineering Drawings of the proposed work are required.

6.3 PIPE DESIGN

6.3.1 Gravity Pipe Material

The following specifications apply to all pipe work that makes up Council's wastewater reticulation:

- a) Wastewater sewers should generally be rubber ring jointed PVC pipes and fittings complying with AS/NZS 1260 and laid in 6.0m lengths. Pipe stiffness should be in accordance with Table 6-3.
- b) PE (polyethylene) pipe complying with AS/NZS 5065 may be used in specific circumstances (e.g. for sleeving or relining existing wastewater sewers and in wastewater rising mains) with the approval of the Engineering Manager. PE wastewater pipes shall be black.

Table 6-3 Pipe Stiffness Required for uPVC Pipe for Gravity Applications

uPVC Pipe	Public Sewers	Wastewater	Private Sewers	Wastewater
DN 100mm	SN 10		SN 6	
DN 150mm	SN 8		SN 4	
DN 175mm and larger	SN 4		SN 4	
depths greater than 5.0m	Specific design to AS/NZS2566 design method			
wheel loads > 96 kN	Specific design to AS/NZS2566 design method			

6.3.2 Pressure Sewer (Rising Main) Pipe Material

- a) Wastewater pressure sewers should generally be rubber ring jointed PVC-O pipes complying with AS/NZS 4441, or PVC-U pipes complying with AS/NZS 1477, or PE 80 or PE 100 pipes complying with AS/NZS 4130. All pressure sewers should be subject to specific design for cyclic dynamic stresses (fatigue), in selection of pipe pressure class.

6.3.3 Calculation of Flow

- a) In the majority of cases 150mm diameter reticulation wastewater drains may be provided without calculation provided that the Council can be satisfied that not more than 150 sections will be served by this reticulation.
- b) The design flow comprises domestic wastewater, industrial wastewater, infiltration and direct ingress of stormwater.

6.3.3.1 Residential Flows

The parameters for calculating the design flow from residential catchments are:

- a) Average dry weather flow (ADWF) = 225 litres per day per person
- b) Number of people per dwelling = 2.5
- c) Dry weather diurnal peaking factor (PF) = 2
- d) Dilution/infiltration factor for wet weather = 3
- e) Therefore the peak wet weather flow (PWWF) is equivalent to 6 times the ADWF

6.3.3.2 Area/Zoning Coefficients

- a) For catchments of mixed zones or where the number of potential dwellings is not known, wastewater flows shall be calculated using

the area/zoning coefficients given below in Table 6-4. The 'area' is that area within a zone comprising lots, roadways, esplanade reserves and neighbourhood parks. Major reserves such as Isel Park and Neale Park shall be excluded.

- b) Where more than one zone contributes to the wastewater drain to be designed the wastewater discharge from each zone shall be calculated using the individual zone area multiplied by the appropriate discharge per hectare as for the total catchment area (not the individual zone area).
- c) The total catchment discharge is the sum of the individual zone discharges as calculated above.

Table 6-4 Wastewater Area/Zoning Coefficients

Sewage Discharge Coefficients (Litres Per Second Per Hectare)					
Residential Zone	Total Catchment Area (hectares)				
	0 to 2	Over 2 to 8	Over 8 to 80	Over 80 to 200	Over 200
Low Density	0.81	0.69	0.58	0.45	0.32
Normal Density	0.94	0.81	0.68	0.53	0.38
High Density	1.08	0.96	0.84	0.65	0.47

NOTE:

- a) The catchment area is defined as the total gravity catchment upstream of the point being considered.
- b) Several trunk gravity mains discharging into one pump station should be considered as separate catchments.
- c) Discharge rates from pump stations may be accumulated but their catchment areas should not be accumulated.
- d) Industrial and commercial areas should be treated as Residential Normal Density unless a greater rate of discharge is known.
- e) The zones referred to in this table are as defined in the Nelson Resource Management Plan.

6.3.4 Pipe Size

- a) The minimum permissible diameter for a new public wastewater drain aligned longitudinally in the road reserve shall be 150mm.
- b) The minimum permissible diameter for all other new public wastewater drains is 150mm except as detailed below.
- c) When an Infill Subdivision, Development or Cross Lease Subdivision (hereinafter referred to as Infill Development) occurs in an area served by an existing 100mm diameter public Wastewater drain it shall be upgraded to 150mm diameter to the lesser requirement as follows:

- 1) To the point in the wastewater drain where there are a maximum of five residential units being served by the 100mm diameter public wastewater drain.
 - 2) To the point of connection of the property being developed.
- d) Where a 100mm diameter public wastewater drain is required to be upgraded to 150mm diameter or where it is proposed to lay 100mm diameter public wastewater drain, an Engineering Drawing including the longitudinal section shall be provided.
- e) Where Infill Development results in existing private drain becoming public wastewater drain the existing pipe shall be either:
- 1) Pressure tested to prove that it is sound or
 - 2) Re-laid.
- f) In addition, surface opening access points shall be required at every change in direction or change in grade in a 100mm diameter public wastewater drain. In general the minimum access point shall be a roding point but inspection bends, mini-manholes or standard 1050mm diameter manholes may be required in appropriate circumstances.

6.3.5 Grades and Velocities

- a) All wastewater sewers shall be designed to utilise velocity and flow characteristics to improve hydraulic performance and minimise settlement of solids and future maintenance costs.
- b) Data presented in Table 6-5 approximates a pipe roughness equivalent to $k_s = 1.5\text{mm}$ for the "Colebrook White" formula or "rough concrete" for the Mears Water Flow Calculator.
- c) The same roughness factor shall be adopted for all pipe materials to account for sewer slimes, grit deposits and other in situ variables such as construction performance and pipeline deterioration with age.

Table 6-5 Minimum Velocity and Grade Requirements

Internal Diameter	Residential Units Served	Minimum Grade	Minimum Velocity Flowing Full
150mm	1–5	1.25% - 1-in-80	1.0m/s
150mm	6–10	1.00% - 1-in-100	0.9m/s
150mm	11–19	0.80% - 1-in-125	0.8m/s
150mm	20–150	0.67% - 1-in-150	0.75m/s
>150mm	Specific design	Specific design	0.75m/s

- d) Submission of catchment flow plans and calculations will be required on submission of the design plans for all reticulation serving more than 150 residential (or equivalent) units, or where the minimum grades and flows do not comply with Table 6-5.
- e) Where velocity limits cannot be complied with, additional works may be required in order to obtain satisfactory operation of the system.
- f) The recommended minimum grade for a 100mm wastewater sewer is 1-in-60, which allows for improved hydraulics and minimises future maintenance cost on the line. Flatter grades, not less than 1 in 120, may be permitted where steeper grades are not practical.

6.3.6 Pipe Cover

- a) Generally shallow wastewater drains, less than 1.2m in depth, shall be avoided. Shallow wastewater drains limit the area which may be adequately serviced and limit the surcharge capacity in the case of blockage before overflow occurs.
- b) Pipe systems shall be designed to ensure the following minimum cover over the barrel:

Table 6-6 Minimum Cover

Location of Drain	Minimum Cover PVC Pipe
Areas subject to highway traffic loading e.g. within road carriageway	750mm
Areas subject to light traffic loading outside road e.g. ROWS, driveways, carparks and berms	600mm
Areas never subject to traffic loading	450mm
Under continuous concrete protection (see SD 618)	300mm

- c) Minimum cover may be reduced providing the pipe is concrete encased for concrete pipes and concrete capped for PVC and subject to the Council's approval.
- d) Where pipes with inadequate cover require concrete protection this shall be constructed in compliance with SD 618
- e) To avoid reflective cracking of pavements and differential settlement concrete protection shall not be permitted to penetrate the basecourse or pavement construction.
- f) No concrete protection shall be placed around the pipe until the line has been inspected and approved by the Council. Pipeline testing shall be undertaken after the concrete protection has been completed.

- g) Reduced cover on pipes may be approved without additional concrete protection providing the appropriate class of pipe is specified and cover is according to the pipe manufacturer's specification.
- h) Wastewater sewers shall generally be no deeper than 2.5m below finished ground levels. Where sewers are required at a depth greater than 2.5m, design calculations and manufacturers specifications shall be provided to show that the proposed pipeline will withstand the additional loading imposed by the depth of cover without deformation or damage.

6.3.7 Manholes

These standards and conditions apply to the design and material specifications for manholes.

6.3.7.1 Concrete manholes

- a) Manholes shall conform to SD 602 - 609 unless other detailed drawings are approved by Council.
- b) Manholes must be designed to resist uplift especially in areas where high ground water is experienced.
- c) One piece manholes (riser and base) are preferred to minimise infiltration. Where there is a likelihood of groundwater accumulating around the manhole and where drainage of the wastewater trench, as per SD 614 is unable to be provided, an approved prefabricated plastic manhole such as the Smart Pit™ shall be installed. See section 6.3.7.2.
- d) Manholes are to be located in the road carriageway, preferably at the centreline of the road but no closer than 2.0m to kerb and channel, to minimise inflow from stormwater flowing down the road/street. Manholes maybe permitted on the grass berm or footpath provided that the fall is towards the road kerb and channel.
- e) Manholes will be required in the following locations:
 - 1) At least every 100m of pipe run (i.e. to ensure there is no greater than 100m of pipe length between manholes);
 - 2) At change of pipe diameter;
 - 3) At junctions of main drains, and
 - 4) At the head of a main drain.
- f) A fall of no less than 50mm shall be provided through manholes where the gradient is 1 in 20 or flatter.
- g) If manhole cover slabs other than "Humes" or "Hynds" pre-cast concrete cover slabs are to be used then the appropriate certification must be submitted to Council showing that the cover slabs will withstand loadings of 0.85HN (51kN).

- h) The opening of a manhole (other than a mini-manhole) shall have a minimum clear opening diameter of 600mm.
- i) Access covers and frames for standard 1050 diameter manholes or larger shall be heavy duty ductile iron manhole covers and frames with Class D strength classification to AS 3996 and complying with SD 608.
- j) Manhole rungs or ladders shall not be installed in manholes.
- k) Shallow mini-manholes shall be in accordance with the requirements set out on SD 605 or a proprietary PVC or polypropylene moulded product approved by Council.

6.3.7.2 Thermoplastic manholes

The Council permits the use of manholes from Thermoplastics in place of concrete manholes in any of the following situations:

- a) Where there is a high groundwater level or there is a likelihood of groundwater accumulating around the manhole.
- b) Where drainage of the wastewater trench, as per SD 614 is unable to be provided.
- c) High corrosive environment.
- d) Where access for construction plant is limited or where heavy structures are not recommended due to ground stability issues.

6.3.8 Roding Point

Roding points shall be used in the following circumstances:

- a) At change of direction or grade. Maximum spacing of 50m. (Note: buried, pre-formed inspection bends may be used in lieu of roding points where the change in direction or grade is closer than 20m from a roding point or manhole)
- b) At the head of a wastewater system.
- c) At the top of steep banks where a standard manhole would be impractical.

For details of Roding Points see SD 610 and 611.

6.3.9 Inspection 'T'

- a) An Inspection 'T' as per SD 612 shall be installed on all private laterals within road reserve. The inspection 'T' shall be positioned 150mm from the road boundary.

6.4 PUMPING STATIONS

6.4.1 Pump Station Design

- a) Pump stations shall comply with NCC requirements and these specific designs are updated on a regular basis. Design will be dependent on a number of factors and should be discussed with the Council at an early stage.
- b) New pumping stations will only be accepted by Council when all other practical options have been ruled out (filling of sites is a normal practical option to gain the required gravity fall so that pump station sites can be avoided).
- c) Design of the pumping station shall enable operation of the station in compliance with industry health and safety requirements having particular regard to safety from falling aspects on site.
- d) Pumping stations shall be of the wet-well type, fitted with approved types of submersible pumps that meet whole of life economies taking in capital cost, power consumption, likely parts and maintenance cost during design life.
- e) Pumping stations shall be located where occasional adverse effects of smell and/or noise will have minimum impact and not within 20m of a residential dwelling. Pump stations shall not be located in low lying areas with potential for surface flooding or Q50 flood inundation.
- f) In all pumping stations the following design specifications apply:
 - 1) Sufficient duty pumping capacity shall be available to handle the design peak flow rate from the catchment area that has been calculated for projected growth extending out to 25-years.
 - 2) A minimum of two pumps on stainless steel guide rails with stainless steel lifting chains shall be installed, with one acting as duty pump and the other on automatic standby. The duty sequence is to be alternate start on variable speed drives in accordance with Nelson City Council control system standards. The standby pump shall be equal in capacity to the duty pump.
 - 3) The wet well shall be of sufficient volume and shape so as to limit the frequency of pump starts, allow cooling of pumps, minimise build up of sludge and to minimise potential odours. The dimensions of the wet-well shall be such that under maximum flow conditions the number of starts for the pumps shall not exceed the pump manufacturer's recommendations.
 - 4) A minimum of four hours on-site emergency storage, not including reticulation storage shall be provided based on the design average dry weather flow volume measured above the overflow to storage, or high level alarm level (measured by Multitrode or ultra sonic level detector). The four-hour

storage facility shall be self draining and normally located in an underground approved structure within the site and covered with grassed topsoil or approved alternative top blending in with surroundings. The storage structure shall have a sealed access lid for inspections.

- 5) Wet well and valve chamber structures shall be first priority for consideration of emergency storage volume by oversizing to minimize expensive underground structures and control features on site.
- 6) Wet wells shall be provided with ventilation. An approved odour control system such as activated carbon odour control units shall be constructed adjacent to the pump station to mitigate odours. Other odour control devices may be approved on a case-by-case basis to be approved by Council.
- 7) Ground floor levels shall be at least 200mm above finished ground levels in order to exclude surface water entry.
- 8) All pump station site structures shall be designed for a minimum 50-year life complying with the building code.

6.4.2 Access and Services

- a) A 20mm diameter water supply with a standard 15mm brass hose tap must be provided in the immediate vicinity of the pump station. Supply shall be fitted with an approved reduced pressure zone (RPZ) backflow preventer and NCC approved water meter/isolating valve assembly. A water meter is required.
- b) Pumping stations and control buildings shall be sited on a separate lot or a drainage or utility reserve. The lot is to be vested in Council and shall have a sealed access road for maintenance vehicles. The site as a minimum should have screen planting on all common boundaries that will not exceed 2m in height on the South boundary.
- c) A means of lifting pumps and other heavy equipment, or alternatively access to enable mobile plant to perform this task is to be provided on site.
- d) An approved flow meter shall be installed on the outlet line from the pump station and connected to the telemetry system.

6.4.3 Electrical Equipment

An electrical pump control, alarm, and telemetry system is required on site. It shall be assembled and installed in accordance with Council's standard specification, as follows:

- a) A stainless steel control cabinet is required to house electrical equipment. Cabinets are to be fitted with a lock keyed to Council's security system.

- b) All electrical switch gear is to be located a minimum of 300mm above ground level. All electrical equipment is to be assembled and installed in accordance with these standards or the manufacturer's specifications.
- c) All equipment including metering must comply with the requirements of the Network Utility operator and supplier (power).
- d) Suitable alarm and system control interrogation and transmitting facilities shall be provided to enable the pumping stations to be connected to Council's telemetry system.
- e) Cable ducting from the pump station to the control cabinet must be sealed to protect against corrosive gasses travelling to the electrical switchboard.
- f) All electrical and pump station control gear including telemetry shall be housed within a weather proof, lockable, walk-in building to Council approval.
- g) Phase failure protection relays shall be provided for all pump motors unless that protection is incorporated into the electronic control for Soft Start or Variable Speed Drive units.
- h) Automatic control of the pump operation, together with a manual override facility is to be provided.
- i) A standard three-phase industrial power connection shall be supplied such that a portable generator can be connected when power failure occurs.
- j) Suitable lighting shall be provided for the pump station, cabinets and valve chambers with protective materials suited to the corrosive environment.
- k) Details on pump/motor components and electrical control equipment shall be incorporated into an Operation and Maintenance Instruction Manual enclosed in a hard copy A4 bound folder. Four copies shall be provided.
- l) The Manual shall include as-built plans of the pump station including electrical wiring and operational schematic diagrams. Four copies of the Manual shall be supplied to Council on handover of the completed pump station and associated works.

6.4.4 Private Pumping Stations

- a) Individual, private pump systems are permitted provided they meet the requirements of section 3.4.4 and the design and construction meets the requirements of the NZ Building Code (a Building Consent will be required) and the connection to the Council system is via an inspection chamber (This may require odour control) and a gravity pipe connection (Pressurised pipelines must be located entirely on private property).

6.4.5 Wastewater Pressure Rising Mains

- a) Wastewater rising mains shall meet the requirements for the construction of water mains. All pressure sewers shall be subject to specific design for cyclic dynamic stresses (fatigue), in selection of pipe pressure class. (Refer to Plastic Industry Pipe Association POP 101 and POP 010A and POP 010B). Refer also to materials selection in section 6.3.1.
- b) The location of all pumping or pressure mains shall be marked with an approved foil or wire banded tape, buried in the trench (see section 6.5.6.1).

6.4.6 Commissioning

- a) On completion of any pump station, and prior to handover to Council, a full commissioning test shall be carried out on all components of the pump station. This commissioning shall be in the presence of a representative of Council and of Council's operations and maintenance contractor.

6.5 CONSTRUCTION AND INSTALLATION

6.5.1 Excavation Works

The following standards and conditions apply to the excavation in preparation for pipework laying:

6.5.1.1 Trench width

- a) The Minimum trench width shall be 200mm wider than the external diameter of the collar of the pipe being laid.
- b) The trench shall be of sufficient width to permit with freedom the installation of all trench support and to allow the laying and jointing of pipes and placing of bedding and pipe surround materials.

6.5.1.2 Base of excavation

- a) No construction or work upon the excavation bottom shall commence until the natural bottom of the excavation has been inspected and accepted by the DPA.
- b) The foundation of the trench is to be checked for stability of the soil by the DPA. Generally a plate compactor is to be run over the trench floor to bind the surface and identify any obvious weak spots. Where the bottom of an excavation is unable to provide a firm foundation with minimum bearing capacity of 50kPa (e.g., clay soils that can easily be penetrated 40mm with a thumb or in sand or gravel that makes a footprint more than 10mm deep) at the required level without abrupt irregularities, engineering advice should be sought on how to provide a satisfactory foundation (see AS/NZS 2032:2006, clause 5.3.6). The DPA shall order the use of additional granular bedding material as specified in AS/NZS 3725:2007 for concrete pipes, or AS/NZS 2566.2:2002 for PVC and other flexible pipe systems.

6.5.1.3 Trench support

- a) The Contractor shall provide trench support to comply with the requirements of the Occupational Safety and Health service of the Department of Labour. The Contractor shall ensure that the sides of the trench are sufficiently supported so that cracking of the surrounding ground does not occur.
- b) Where trench support extends below the invert of the pipeline or structure special precautions may be required, including leaving part of the support in place, to ensure the foundation of the pipe or structure is not weakened.

6.5.1.4 Dewatering

- a) Excavations shall be kept free of water during construction.
- b) In no circumstances shall stormwater or ground water be allowed to drain into any existing wastewater drain, and pipe ends shall be plugged to prevent such ingress.
- c) Discharge of stormwater or groundwater to existing stormwater drains or the pipes already laid will be permitted providing adequate silt traps prevent debris and suspended matter from entering drains. Should deposits in existing stormwater drains or the pipes already laid occur as a result of the operations of the Developer or the Contractor such deposits shall be cleared forthwith at the Developer's or the Contractor's cost as the case may be.
- d) Ground water lowering may be permitted except where this practice may present a risk of subsidence.
- e) The Contractor or Developer shall cause as little damage or interference to property or persons as possible in disposing of water from the works, and shall be responsible for any damage or interference, which may be caused. This shall include any damage to the structure of any road.

6.5.2 Bedding of Pipes and Pipe Protection

6.5.2.1 Metal bedding

(Note: Includes bedding, haunch support and side support material as defined by NZS 2566.2:2002 and AS/NZS 3725: 2007.)

- a) Metal Bedding shall be in accordance with SD 617 and 523. (For concrete pipes, "Type H2" bedding in accordance with AS/NZS 3725:2007 shall be used.)
- b) The bedding material shall be:
 - 1) In a sand environment - Sand
 - 2) For PVC and flexible pipes - AP20 as per SD 401, or as per AS/NZS 2566.2:2002, Appendix G

- 3) For concrete pipes - AP20 as per SD 401, or as per AS/NZS 3725:2007, Table 6
- c) Bedding shall be placed and raked-in so as to provide support for the pipe uniformly along the whole length of the barrel with chases provided for sockets, couplings and other appurtenances. For PVC and flexible pipes the bedding shall not be compacted and the centre of the bedding shall not be walked on either during or after placement. For concrete pipes only the centre strip of the bedding shall not be compacted (see SD 523).
- d) The pipes shall be laid and brought to true alignment and level before installing the metal haunching, side support and covering the pipes.

6.5.2.2 Pipe embedment

- a) The metal haunching and side support shall be placed uniformly along and around the whole length of the pipe barrel, couplings and other appurtenances in a manner to ensure uniform density of side support (including haunch support) and overlay with no distortion, dislodgement or damage to the pipeline.
- b) Following placement, the embedment material shall be compacted in layers to uniformly support the pipe. When choosing compaction equipment, the number of passes and the thickness of layer to be compacted, account shall be taken of the material to be compacted and the pipe to be installed.
- c) Compaction equipment or methods that produce horizontal or vertical earth pressures that may cause damage to, or excessive distortion of, the pipe shall not be employed.
- d) Metal haunching and side support shall be compacted to the manufacturer's requirements and as a guide, a minimum Clegg Impact Value of 35 under vehicle loaded areas or 25 under non traffic loaded areas shall be achieved at any point on any haunching constructed of AP20.

6.5.2.3 Installation of geotextiles

- a) Where there is a possibility of migration of fines between the native soil and the pipe surround soil, the DPA shall require the metals to be protected by an approved geotextile filter fabric that overlaps by at least 300mm.

6.5.2.4 Concrete surround for concrete pipes

- a) For concrete pipes the DPA may order concrete surround in accordance with SD 618 under the following conditions:
 - 1) In areas subject to vehicle traffic where the cover of the pipe barrel is, or will be, less than that required for the class of pipe as specified by the pipe manufacturer.

- 2) In areas other than those covered above, where the cover over the barrel of the pipe is or will be less than 300mm, irrespective of the type or class of pipe.

Note: Flotation of the pipe during placement of concrete surround shall be prevented. PVC pipes shall not be concrete surrounded.

6.5.2.5 Concrete protection slab for PVC pipes

- a) Where cover over PVC pipes is less than the minimum stated in Table 6-6, including temporarily under construction traffic, a concrete protection slab shall be constructed in accordance with SD 618.

6.5.2.6 Water-stops and trench groundwater

- a) Where permeable bedding such as 'bedding chip' 'drainage metal' or 'sand' is used, water-stops and trench drainage shall be constructed to prevent unwanted movement of groundwater along the trench and pipe bedding. Also see 6.5.2.3.
- b) Water-stops shall be constructed to the requirements of SD 615. Trench Drainage shall be constructed to the requirements of SD 614.
- c) Manholes can be considered to be water-stops provided they are constructed appropriately.
- d) Where water stops are required, they should be provided at the following intervals:

Grade	Spacing
1 in 15 or steeper	12m
1 in 15	15m
1 in 25	30m
1 in 100	60m

Note: Intermediate grades (and spacing) are determined by interpolation

- e) Where necessary and practicable trench drainage as per SD 614 will be required to prevent groundwater infiltration at manhole connections. Note: This will not be necessary where prefabricate plastic manhole such as the Smart Pit™ are used (see sections 6.3.7.2 and 6.5.5.2).

6.5.3 Pipe Installation

- a) To help with future identification the end caps and inside of the end of all new wastewater laterals must be painted with red acrylic paint and marked with a 75mm x 25mm ground treated marker stake suitably identified and partly painted red. (Note: stormwater laterals are to be marked green.)

- b) A laser shall be used by the Contractor for fixing line and grade, for setting the pipes to line and level, and for jointing on all major pipelaying work where possible.
- c) The maximum deviation in level of pipe invert when laid shall be 5mm from design level.
- d) The maximum horizontal deviation from a straight line shall be 10mm.
- e) Pipes shall not be laid on bricks, blocks and wedges or other temporary or permanent supports except when concrete surround is to be placed.
- f) Joints shall be flexible and watertight.
- g) Pipes shall be kept clear of dirt or debris, and any pipes that contain such matter shall be required to be cleaned out. Internal pipe walls shall be kept clean and free of all dirt, rubbish and water. Spigots, sockets, rubber rings, etc, shall be thoroughly cleaned before jointing.

6.5.4 Installation by Trenchless Technology

- a) Gravity pipes and pressure rising main pipes may be installed by trenchless methods, including:
 - 1) Horizontal Directional Drilling (HDD),
 - 2) Pipe bursting,
 - 3) Auger boring/guided boring,
 - 4) Slip lining,
 - 5) Pilot bore microtunnelling,
 - 6) In-line replacement/pipe eating/pipe reaming with HDD rig.
- b) Pipes may include fusion welded PE, or rubber ring joint PVC with restraint joints specifically designed for trenchless installation.
- c) Gouging or notching of the pipe shall not exceed 10% of the pipe wall thickness for pressure pipe and 20% of the pipe wall thickness for gravity pipe. Pipe shall not be bent to a radius less than 35 times the pipe OD for PE pipes or 600 times the pipe OD for PVC pipes.
- d) The trenchless installation methodology selected must be compatible with, and capable of achieving the required pipeline gradient.
- e) The specified allowable load on the pipe shall not be exceeded during pulling.

- f) Where gouging or notching exceeds the above limits or if buckling of the pipe occurs, that length of pipe shall be removed and a new section welded in at the nearest join.
- g) The Contractor shall overtop the pipe by one lineal metre for each length of pulled pipe that is the greater of one manhole length or 200m. The excess pipe length shall be supplied to the DPA for a visual inspection.

6.5.4.1 Pipe installation by pipebursting

- a) The new pipe shall be HDPE with a minimum wall thickness of 10mm, or PE100, SDR17 as a minimum wall thickness for any pipe size.
- b) Where the polyethylene pipe is to replace a live pipeline, the line to be burst shall be inspected by CCTV to locate all laterals and to check for any obstructions. Live laterals shall be confirmed by the use of dye.

6.5.4.2 Pipe installation by slip lining

- a) The pipe sleeve shall be MDPE with a minimum wall thickness of 5mm, or PE80, SDR21 as a minimum wall thickness for any pipe size.
- b) The host pipe shall be cleaned to provide a clear pipe diameter that passes the new pipe without gouging or notching the pipe.
- c) The Contractor shall not detrimentally affect the host pipe when cleaning it.
- d) Prior to any attempt to pull in the new pipe a plug, no less than the outside diameter of the new pipe, shall be passed through the host pipe to ensure there is sufficient clearance.

6.5.4.3 Pipe installation by directional drilling

- a) This method shall only be used in specific circumstances where approved by the Engineering Manager. The new pipe shall be HDPE with a minimum wall thickness of 10mm, or PE100, SDR17 as a minimum wall thickness for any pipe size.
- b) The constructed pipe alignment shall not vary more than 100mm horizontally from the design alignment and the tolerance on the vertical alignment shall not exceed the specified amount except where the grade of the pipe is specified, in which case it shall be ± 5 mm from the design grade. (Note:- a larger variation in vertical alignment may be permitted for steeper grades)
- c) The Contractor shall accurately monitor the position of the drilling head to achieve the above requirements.
- d) The Contractor shall be liable for damages to any underground services.

6.5.5 Manhole Installation

The following standards apply to the installation of manholes:

6.5.5.1 Concrete manholes

- a) Manholes shall be constructed in accordance with SD 602 - 609.
- b) All concrete manholes shall be made water tight by effective sealing of manhole section joints with mastic sealant and around pipe entries, where applicable, using epoxy mortar inside and out.
- c) The connection of PVC pipes to concrete structures, such as manholes and sumps, shall be with a purpose made PVC starter and finisher with a 'gritted' external surface.
- d) The connection of PE pipes to concrete structures shall be in accordance with SD 607.
- e) All PVC pipes entering or leaving a manhole shall have one flexible joint within 200mm of the manhole and a second flexible joint within 1200mm of the manhole.
- f) The channel through the manhole shall be formed from in-situ concrete properly formed to grade and radius sweeps. The channel shall be finished with a smooth, regular half circle invert with falls as specified in SD 602. Benching shall be steel float finished to give a regular smooth surface.

6.5.5.2 Thermoplastic manholes

- a) Installation shall be to the suppliers requirements subject to the following conditions:
 - 1) The ground is firm and stable.
 - 2) The pipe size is small (i.e. pipes up to and including diameter NB 225mm).
 - 3) A manhole from thermoplastics shall consist of a factory manufactured benched base, a vertical riser(s), a suitable transition, as necessary, from the base to the riser (e.g. an adaptor), a cover slab, a throat, as necessary, from the cover slab to the lid at ground level, a frame and a cover. The components must be easy to assemble on site to form a watertight construction.
 - 4) Manholes from thermoplastics shall have a safety factor of at least 2 against flotation after backfilling (e.g. weight of backfill over horizontal ring fins and cover slab).
 - 5) All components of the manhole shall be designed by the manufacturer for the expected site loading including vehicle loads of 51kN (0.85HN) where in trafficable areas. A manufacturer's certificate shall be provided to this effect.

- 6) Depth to the invert of the outlet from the lid shall not exceed 3.0m.

6.5.6 Pumping/Pressure Main Tracer Tape

The location of all pumping mains and gravity pressure mains (swallows) shall be marked with a foil tape buried in the trench.

6.5.6.1 Tape

- a) The tape shall be red, 50mm wide, and printed with "CAUTION PRESSURE SEWER MAIN BURIED BELOW" or similar message. All printing shall be encased to avoid in rub-off.
- b) The tape shall be either a woven reinforced acid and alkali resistant polythene plastic with a solid aluminium foil core which shall be visible from both sides. "Thor Tec™" tape is an accepted product. Alternatively the tape shall be a sinusoidal stainless steel wire encased in a polythene strip. "Waterwave" and "Wavelay" are acceptable products.

6.5.6.2 Installation

- a) The tape shall be buried above the centre line of the pipe within 300mm to 400mm from the finished surface. Refer SD 702.
- b) All joints in the tape (e.g. roll ends, accidental breaks and at tees) shall be made electrically conductive with purpose made splice clips installed to the specific manufacturer's instructions. Tying together of the tape ends is not acceptable as the polythene coating will prevent electrical conductivity.
- c) The tape shall be brought up inside the surface box risers at all manholes and air valves with a 300mm long tail so that pipe location equipment can be readily connected.

6.5.6.3 Tracer wire

- a) When a pumping main or swallow pipe is installed by a directional drilling technique or bored through the ground for a distance exceeding 20 metres, the pipe shall have a 'Tracer Wire' attached. This wire shall take the form of a continuous 2.5mm 2 multi strand (polythene sleeved) cable, strapped to the pipe wall by means of a minimum of two complete wraps of heavy duty adhesive tape, at a maximum of 3.0m intervals.

6.5.6.4 Tape or Wire Testing

- a) The tracer tape may be tested and checked at Practical Completion by Nelson City Council for continuity using an electric pulse induction system. The new pipeline will be tested between manholes, valves, etc where the tape is brought up inside the surface box risers. Nelson City Council will carry out this test only when all work associated with laying the wastewater main is complete.

6.5.7 Connection to Council Network

- a) Connection to existing wastewater mains shall not be made until all upstream work has been completed and inspected and approved by Council. Specifically, this shall include flushing and testing of all new pipework, manholes, and other wastewater facilities by the contractor and internal (CCTV) and external inspections by Council.
- b) No contractor is permitted to enter a live wastewater system without the approval of the Engineering Manager.

6.6 TESTING

6.6.1 Air or Water Pressure Test (Non pressure pipelines)

All non- pressure pipelines to be vested in Council ownership shall pass one of the following air or water pressure tests.

- a) Air Test – To AS/NZS 2032: 2006, section 7.3.3.
 - 1) Start test pressure of 50kPa, hold for 60 seconds with no make up pressure, the test passes if the test pressure does not fall below 35kPa.
 - 2) For safety reasons, plugs must be well braced into position as the failure of a plug could result in serious injury.
- b) Water Test – To AS/NZS 2032: 2006, section 7.3.2.
 - 1) Fill line to at least 1.0m head above ground level at the high end and not more than 5.0m at the low end. The pressure shall be maintained without leakage for at least 15minutes.
 - 2) All manholes shall be watertight and may require testing at the Council's direction. The test involves plugging and filling the manhole with water (including time allowed for absorption). During the test, the level of water in the manhole shall not drop more than 5 mm in 10 minutes.

6.6.2 Pressure Pipelines

- a) Refer Draft NZS 4404:2010 Appendix B Field Testing of Pressure Pipes.

6.6.3 Pipe Gauging

- a) All gravity pipelines to be vested in Council ownership may be required to be tested for short term vertical deflection using an appropriate proving tool ("rigid prover") and complying with AS/NZS 2566.2: 2002, Table 5.6, Section 6 and Appendix O – "Diametral Deflection Measurement"

6.6.4 Closed-Circuit Television (CCTV) Inspection

- a) All pipelines to be vested in Council ownership shall pass a closed circuit television (CCTV) inspection, carried out at an appropriate time agreed by Council or at the completion of the works.

- b) A professional operator with proof of experience in operating such devices shall carry out the CCTV inspection using a pan and tilt camera, in accordance with the technical specifications of the NZ Pipe Inspection Manual (published by the New Zealand Water & Wastes Association).
- c) The operator shall pan around every joint and check every lateral connection and defect.
- d) The video footage in DVD format, and the accompanying CCTV log sheets for each wastewater sewer length (as per the template in the NZ Pipe Inspection Manual), showing the features and condition of all inspected manhole lengths, shall be provided to Council. Video footage supplied without log sheets will not be accepted.
- e) All pipelines shall be free of debris and flushed within 24-hours prior to inspection. Inspections of non-cleaned pipelines are not acceptable.
- f) A pipeline will fail its inspection if:
 - 1) The pipe is horizontally misaligned or deformed by more than 5% of the pipe diameter.
 - 2) The pipe has visible dips or ponding of water.
 - 3) The pipe has visible defects, such as open or displaced joints, defective or protruding laterals, cracked barrels or similar defects.
 - 4) There is evidence of infiltration at joints or laterals.
- g) Other testing as considered appropriate may be required by Council to ensure Council's future infrastructure will meet its projected life cycle.

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7. WATER

7.1 INTRODUCTION

- a) The purpose of Council's water supply engineering standards is to provide design guidance and minimum standards for the design, construction and maintenance of water supply.
- b) Design and construction of all water supply works in accordance with these standards will ensure that water is supplied to communities effectively and in a way that is cost-effective in the long-term.

7.1.1 Objectives

- a) The Council is seeking to have a water supply system that will distribute water for consumption and fire fighting which meets the appropriate standards and level of service for these uses and delivered in an efficient, safe and sustainable way.

7.1.2 Performance Criteria

7.1.2.1 Hygiene

- a) A water supply facility shall:

- 1) Deliver water to the point of supply that complies with the Drinking-water Standards for New Zealand 2005 (Revised 2008).
- 2) Minimise the risks of contamination being introduced into the water.

7.1.2.2 Capacity and layout

- a) A water supply facility shall:

- 1) Have sufficient capacity to provide adequate flow and pressure to meet the anticipated demand over its lifetime. allowing for ultimate future development potential¹ within the catchment or adjoining catchments.
- 2) Meet the fire protection requirements of the NZ Fire Service Fire Fighting Water Supplies Code of Practice 2008.
- 3) Be located in such a way as to adequately service each lot, and provide reasonable access for maintenance.
- 4) Minimise adverse effects on, and be compatible with, the existing water reticulation network.
- 5) Minimise disruption to other parts of the network during maintenance by having adequate interconnections, valves, and separating trunk main supplies from local reticulation.

¹ Development potential means the likely future development within the Services Overlay taking into account the Council's Strategic City Development Plan and the LTCCP, and the provision of services in a manner that integrates with and does not foreclose this likely future development.

- 6) Where practical utilise mechanical, electrical, alarm and telemetry equipment which is compatible with existing equipment used by NCC.
- 7) Where the expected life of any component is less than that of the system of which it is a part, make provision for access and maintenance of that component.
- 8) Ensure that mechanical and electrical equipment is either designed for submergence, or located above the 100 year design flood level.
- 9) Minimise whole of life costs.

7.1.2.3 Structural integrity

a) A water supply facility shall:

- 1) Be constructed of materials compatible with the chemical properties of the water being conveyed, suitable for the intended duty with a minimum design life of 100 years, and having a proven performance record.
- 2) Minimise leakage, eliminate the ingress of contaminants, and the penetration of roots, using current best practice.
- 3) Provide electrical and mechanical equipment with a life span and quality of the best currently available technology.
- 4) Withstand all anticipated superimposed loads and network pressures (including those from transient surges that could reasonably be expected from pump failure, pump starts, and sudden valve closure).

7.1.3 Key References

- a) Table 7-1 sets out external standards that are relevant to the management of water.
- b) These apply and should be taken into account in the design and construction of any water supply asset in the Nelson City Council area. Where an Act or Standard is referenced this shall be the current version including any associated amendments.

Table 7-1 Standards and Publications Related to the Design and Construction of Water Supply Services

Standard	Comment
	Nelson City Council traffic management guidelines
SNZ PAS 4509	New Zealand Fire Service Firefighting Water Supplies Code of Practice
NZS 4404:2010	Land development and subdivision engineering
NZS/BS 21	Pipe threads for tubes and fittings
NZS/BS 750	Underground fire hydrants and surface box frames and fittings

Standard	Comment
AS/NZS1260	PVC-U Pipes and fittings for drain waste and vent applications
AS/NZS 1254	PVC pipes and fittings for stormwater and surface water applications
AS/NZS 4793	Mechanical tapping bands for waterworks purposes
AS1646	Elastomeric seals for water works purposes
AS/NZS1477	PVC Pipes and fittings for pressure applications
AS/NZS2032	Installation of PVC pipe systems
AS/NZS2033	Installation of polyethylene pipe systems
AS/NZS2280	Ductile iron pipes and fittings
AS/NZS2544	Grey iron pressure fittings
AS/NZS2566	Part 1:1998 Buried flexible pipelines – Structural design Part 1 Supp 1:1998 Buried flexible pipelines – Structural design – Commentary Part 2 – Buried flexible pipelines - Installation
AS/NZS2638	Gate valves for water works purpose – resilient-seated
NZS4058	Specification for pre-cast concrete drainage and pressure and non-pressure pipes
NZS3109	Concrete construction
NZS3121	Specification for water and aggregate for concrete
BS3412	Methods of specifying general purpose PE materials for moulding and extrusion
NZS 3501	Specification for copper tubes for water, gas and sanitation
AS3572	Glass filament reinforced plastics
NZS3604	Timber framed buildings
AS/NZS3725	Loads on buried concrete pipes
AS/NZS4020	Testing of products for use in contact with water
AS/NZS4087	Metallic flanges for water works purposes
AS/NZS4129	Fittings for PE pipes for pressure applications
AS/NZS4130	Polyethylene (PE) pipes for pressure applications
AS/NZS4158	Thermal bonded polymeric coatings on valves and fittings for water industry purposes
AS4181	Stainless steel clamps for water purposes
AS/NZS4331	Metallic flanges – Part 2: Cast iron flanges
AS/NZS 4441	Oriented PVC (PVC-O) pipes for pressure applications.
NZS4442	Welded steel pipes and fittings for water, sewage, and medium pressure gas
NZS4501	Code of practice for the location and marking of fire hydrants
AS/NZS4765	Modified PVC (PVC – M) pipes for pressure applications

Standard	Comment
AS/NZS 4998	Bolted unrestrained mechanical couplings for waterworks purposes
NZS/BS5163	Specification for predominantly key operated cast iron gate valves for water works purposes
AS 3571/AS 3572	Glass reinforced plastics (GRP) pipes joints and fittings
Department of Building and Housing	The Building Act 2004
DWSNZ	Drinking-water Standards for New Zealand

7.2 RETICULATION DESIGN

7.2.1 Level of Service

- a) Table 7-2 sets out the minimum levels of service required for urban water supply reticulation. Any proposed water supply system (or extension to an existing water supply system) shall be adequate to meet these levels of service at the time of design and the reasonably foreseeable future.
- b) Council may require water mains or water supply facilities to be installed to a higher specification (capacity or strength) in order to provide for future development. In such cases Council may by agreement:
 - 1) Negotiate with the developer and make a financial contribution to the cost of additional capacity over and above that required for the development; or
 - 2) Install the whole water supply reticulation or facility in anticipation of development, on terms requiring the developer to meet an appropriate proportion of the costs incurred by Council.
- c) All cost contributions should be agreed in writing with the Engineering Manager prior to construction. Agreement may be reached at a resource consent stage.

Table 7-2 Water Supply Levels of Service

Design Criteria	Level of Service Required
SNZ PAS 4509 - NZ Fire Service Fire Fighting Water Supplies Code of Practice	Full compliance in each and every part of the network
Connection	Each lot shall have an individual metered connection
Minimum flow at each connection	30 litres per minute for design flows as defined in Table 7-3
Minimum normal working residual pressure	300 kPa at ground floor level of each building site
Maximum static water pressure	900k Pa at ground level of each building site

Note:

Lots and buildings in the Rural area provided with private, on-site systems shall meet the requirements of RUr.28 of the NRMP.

7.2.2 Reticulation Design

- a) The Nelson water supply reticulation comprises differing pressure zones, supplied from various reservoirs and pressure reducing valves. The extent of a pressure zone is such that the Level of Service (Performance Criteria) can be achieved for each property included. It is dependent on the available head at the reservoir/pressure reducing valve and elevation of the properties.
- b) The Council's reticulation and asset plans should be carefully referred to when designing extensions to, or amendments to the existing water supply reticulation.
- c) All proposed reticulated water supplies must comply with the minimum levels of service shown in Table 7-2 for both normal demand flows and fire fighting flows.
- d) For residential development, network design and pipe sizes will normally be determined by fire fighting flows. As a minimum the Designer must demonstrate compliance with fire fighting requirements. Council, at its discretion, may also require demonstration of compliance for normal demand, or to a nominated higher standard.
- e) For commercial or industrial development, network design may be determined by normal demand flows or fire fighting flows and the Designer must demonstrate analysis of both scenarios.

7.2.3 Design Information

- a) The Council may provide details of the working pressure or pressures at the point or points of connection to the existing reticulation that may be used for design purposes. When such data is not available or at the Council's request, it will be the responsibility of the designing engineer to obtain the information through independent flow and pressure tests. The Council shall have the right to specify the diameters to be used for the

principal water mains within the development with regard to the Council's Strategic and Management Plans.

7.2.4 Permitted Head Losses

- a) The new water supply reticulation shall be designed to mitigate large fluctuations in residual pressure as demands vary and minimise the losses of pressure along the watermains. Head losses in the watermains shall not exceed approximately 20kPa/kilometre at peak domestic demand (i.e. 2 metres of head loss per 1000 metres of pipeline). Higher losses may be approved by the Council on a case-by-case basis.

7.2.5 Reservoir Head

- a) For design purposes the hydraulic head at a reservoir shall be taken with the reservoir being fifty percent full. The reservoir shall be located at an appropriate height so that properties at the highest location receive a pressure of 30 metres at the point of supply measured from the bottom water level of the reservoir and properties at the lowest location receive a pressure not more than 90 metres from the top water level of the reservoir at the point of supply without the use of a PRV valve.
- b) When the source of supply is a pressure-reducing valve the hydraulic head shall be the head the pressure-reducing valve is set to.

7.2.6 Normal Working Demand Flows

- a) The minimum flow and normal working residual pressure level of service criteria specified in Table 7-2 shall be satisfied for all reticulation when using the following demand flows.

Table 7-3 Design Demand Flows

Development Type	Design Flows
Residential	33 litres per head per peak hour 400 litres per head per day (peak day) 1,000 litres per dwelling per day (assuming 2.5 persons per dwelling)
Commercial & Industrial	Specifically assessed by the Designer

7.2.7 Firefighting Demand Flows

- a) All reticulation (and storage) design must fully comply with the requirements of the NZ Fire Service Fire Fighting Water Supplies Code of Practice (SNZ PAS 4509), hereafter called the Code of Practice.
- b) This Code of Practice sets out requirements for firefighting including:
- 1) firefighting flows,
 - 2) storage,
 - 3) residual pressure and

- 4) hydrant spacing.
- c) Table 7-4 and 7-5 below summarises the more general requirements of the Code of Practice for Normal Reticulation Design. Further specific reference to the requirements Code of Practice may be required for unusual situations.

Table 7-4 SNZ PAS 4509 Fire Fighting Flow, Pressure and Storage Requirements

Fire water class	Reticulated Water Supply				Non-reticulated water supply	
	Hydrant flow required within a distance of 135m (l/s)	Additional Hydrant flow required within a distance of 270m (l/s)	Maximum number of fire hydrants to provide flow	Residual water pressure at hydrants	Minimum water storage within a distance of 90m Time (firefighting) (min)	Volume (m3)
FW1	7.5	-	1	100 kPa	15	7
FW2	12.5	12.5	2	100 kPa	30	45
FW3	25	25	3	100 kPa	60	180
FW4	50	50	4	100 kPa	90	540
FW5	75	75	6	100 kPa	120	1080

Note: See the Code of Practice for additional notes and other specific requirements

Table 7-5 SNZ PAS 4509 – Water Supply Classes

Class	Description
FW1	Single family homes with a sprinkler system installed.
FW2	Single family homes without a sprinkler system installed and all other structures with a sprinkler system installed.
FW3, FW4, FW5, FW6 and FW7	Various classifications dictated by floor area and hazard category. Refer Table 1 of SNZ PAS 4509.

- d) Generally for compliance in residential areas under classification FW2 a flow of 12.5 l/s is required from each fire hydrant, with maximum hydrant spacing of 135.0m. Each hydrant is to be no closer than 6.0m and no further than 135.0m from the potential fire source.

7.2.8 Alteration of Existing Infrastructure

- a) Any alteration of the existing water supply reticulation (upgrading, relocation and lowering of watermains and other water supply element(s), required for compliance of the new development to the Council's standards shall be at the developer's cost. The connections to the existing reticulation shall be undertaken by a contractor approved by the Council at the developer's cost.

7.2.9 Depth of Water Mains

a) The following standards apply to the installation of water mains:

- 1) Compliance with SD 702.
- 2) Both principal mains and rider mains shall have the following cover, except in circumstances requiring special protection. Greater depth shall be provided if required by Council.
- 3) Under grass berms, the top of pipe is 600mm below finished surface (minimum) and 900mm (maximum) for water mains in residential areas. Top of pipe is 750mm (minimum) and 1000mm (maximum) below finished surface for water mains in commercial and industrial areas and for rural pipelines.
- 4) Under carriageways, the top of pipe is 750mm (minimum) and 1000mm (maximum) below finished surface level, measured at the lowest point of the carriageway.
- 5) The sections of watermain adjacent to a driveway/vehicle crossing shall be gradually deepened, to allow the specified cover under the driveway/vehicle crossing without the provision of vertical bends. Similar provision shall be made to give the specified cover over valve and hydrant spindles.
- 6) In berms, service connection pipes shall have a minimum cover of 350mm and maximum cover of 500mm. In the carriageway, right-of-way or accessway, service connection pipes shall have a minimum cover of 450mm and maximum cover of 750mm. At the meter box or rider main valve, the pipe is permitted to have lesser cover where it is raised to suit the fitting height.
- 7) Council will not accept public water supply pipes located through private property, other than rural pipeline supplies.

7.2.10 Building Over or Alongside a Public Watermain

- a) Building over or alongside any Public water main is only a Permitted Activity if it complies with the rules in the appropriate zone section of the Nelson Resource Management Plan.
- b) The engineering requirements for building over or alongside watermains are as follows:

1) Structures

- Must be located no closer than 1.0 metre measured horizontally from the centre line of any public watermain where the pipe is less than or equal to 300mm in diameter.
- Must be located no closer than 1.5 metres measured horizontally from the near side of any public watermain where the pipe is greater than 300mm diameter.

- Which are balconies, may overhang the line of the pipe provided the balcony is cantilevered and its height above ground level is not less than 1.8m.
- Which are located within 3 metres measured horizontally from the near side of the pipe must have the base of the foundations deeper than a line drawn at 30 degrees from the horizontal from the invert (bottom) of the pipe (or between 30 degrees and 45 degrees if the design has been certified by a suitably qualified engineer).

2) Pipe Specifications

- Table 7-6 sets out the general pipe size, material, and pressure specifications for principal and rider mains.

Table 7-6 General Pipe Specifications

	Principal Mains	Rider Mains
Pipe Size	Generally not less than 150mm ID Standard pipe sizes (see Section 7.3.1): DN 100 (with specific approval), DN 150, 200, 250, 300, 375, 450, 525 and 575mm ID.	Generally not less than DN 63 (50mm ID) With specific approval: DN 25, 32, 50 PE (20, 25, 40mm ID) provided that the minimum required supply per household can be met.
Acceptable Materials and Specification	PVC-U (Series 1 or Series 2 dimensions) PVC-M/PVC-O Series 1 or Series 2 (with specific approval) PE 80 Type B (MDPE) PE100 (HDPE) Concrete lined steel (arc butt welded) Concrete Lined Ductile iron Hobas GR (with specific approval)	PE 80 Type B (MDPE) PVC-U (DN 50mm internal diameter only Series 1 dimensions, not less than PN15) Copper (must be used for valve upstands, see SD 707)
Pressure class	No less than PN12 A higher class will be required in higher pressure zones	

7.3 PIPE SPECIFICATIONS

7.3.1 Pipe Size

- a) PVC and PE pressure pipes in New Zealand and Australia are usually referred to by their nominal diameter or "DN".

By Convention, PVC pipes are referred to by their nominal INTERNAL diameter (i.e. DN50, 100, 150 etc) and either Series 1 (metric sizes) or Series 2 (Imperial or CIOD sizes).

PE pipes are usually referred to and specified by their nominal OUTSIDE diameter (i.e. DN 63, 125, 180mm OD etc).

- b) These standards generally refer to pipe dimensions by internal diameter (ID).
- c) In any instance where an external diameter is shown on a drawing or specified it shall be annotated "OD". Dimensions in absence of either "ID" or "OD" shall be assumed by Council to refer to an internal diameter.
- d) Minimum and standard pipe sizes for principal and rider mains are shown in Table 7-6. PVC pipes should generally be specified in metric (Series 1) sizes, but imperial (series 2) sizes may be required in some instances for specific pipelines to achieve compatibility with Council's existing pipe system. Series 1 (metric) sizes or Series 2 (CIOD) sizes are listed in the relevant PVC pipe manufacturing standards.
- e) Principal mains shall be generally no less than 150mm ID. Table 7-7 sets out instances where smaller principal mains may be permitted, but subject to the levels of service specified in Table 7-2.

Table 7-7 Reduced Dimension Principal Mains

Size of Principal Main (generally uPVC Class D)	Maximum Length	
	Connected to larger main at one end	Connected to larger main at both ends
100mm ID	135m	400m

Rider mains shall be generally no less than 50mm ID. Table 7-8 sets out instances where smaller rider mains may be permitted, but subject to the levels of service specified in Table 7-2.

Table 7-8 Reduced Dimension Rider Mains

Size of Rider Main (minimum PE80 MDPE Class D)	Maximum Number of Domestic Service Connections (Home Units not Lots)	
	Connected to larger main at one end	Connected to larger main at both ends
20mm ID (25mm OD)	1	N/A
25mm ID (32mm OD)	5	10
40mm ID (50mm OD)	10	20
50mm ID (63mm OD)	15	32

7.3.2 Pipe Materials

- a) PVC-U pipes are acceptable in all normal circumstances for principal mains.
- b) PVC-M and PVC-O pipes may be approved on application. The installation shall be to AS/NZS2032 and AS/NZS2566 Part 2, with particular attention to the anchoring of valves and hydrants against displacement in operation. Refer SD 704 and 706.
- c) PE pipes shall be normally used in all rider mains.
- d) PE pipes may be appropriate for principal mains in special cases and shall require specific approval by the Engineering Manager. For PE pipes generally PE80B material is the standard used; however PE100 may be used where higher pipe strength is required or increased capacity is an important criterion. Pipes of differing compositions shall not be mixed within a common pipe length, (i.e. valve-to-valve). Installation of PE pipes shall be to AS/NZS2033 and AS/NZS2566 Part 2.
- e) Concrete lined steel pipes may be required in potentially unstable ground, for lengths of exposed pipe, or in other special cases, and shall be the subject of specific design. Suitable corrosion protection shall be provided. Steel pipes laid underground shall have an extruded blue or black HDPE external coating. Pipe laid above ground shall have a black HDPE coating or shall have an approved epoxy coating applied by a specialist applicator.
- f) Ductile iron pipes may be appropriate in special cases and shall require specific approval of Council. Ductile iron pipes shall be sleeved with a polyethylene sleeve, conforming to AS 3681.

7.4 PIPE JOINTS

7.4.1 Connection of Rider Mains to Principal Main

- a) Where a rider main is to be extended at right angles to a principal main, it shall normally be connected with a tapping band without ferrule (SD 707), where the size of the principal main and rider main allow this, otherwise a cast or ductile iron tee with a tapped blank plate shall be used (see SD 708).
- b) Where a rider main is to be extended along the same alignment beyond the end of the principal main, it shall normally be connected in a similar manner with an anchored blank end plate, and with a vertical socket and right angle (De-zincification resistant) bronze bend.

7.4.2 Unrestrained Mechanical Couplings

- a) Old style 'Gibault' joints have been superseded by new "universal" design bolted unrestrained mechanical couplings, conforming to AS/NZS 4998, for all pipes except PE where only end load restraint compression fittings, or heat fusion fittings, conforming to AS/NZS 4129, shall be used. Unrestrained mechanical couplings shall only be used with specific approval. This will generally be for connection to existing principal mains where no feasible alternative is available or repair to principal mains.

- b) Unrestrained Mechanical Couplings shall be category 2 (50 year life) to AS/NZS 4998:2009.

7.4.3 PVC Pipe Joints

- a) Joints for PVC pipes shall normally be integral thermoformed socket/spigot rubber ring type (Z joints or locked-in-place Bleuseal/Forsheda/Reiber style), with a biocidal lubricant. Elastomeric seal rings shall conform to NZS/BS2494 or AS1646. Solvent cement joints may be permitted where the necessary Z ring fitting is not manufactured. Unrestrained Mechanical Couplings (repair couplings) shall only be used to close a section of pipe where no other fittings are possible, or to adapt PVC pipe to existing *insitu* pipes, such as cast iron, asbestos cement, steel or ductile iron, or to connect PVC pipe to a purpose made ductile iron spigoted fitting.

7.4.4 PE Pipe Joints

- a) All PE pipe less than or equal to 100mm ID (125mm OD) shall be jointed by end load restraint mechanical seal ring compression joints to AS/NZS4129, appropriate for the type of pipe (e.g. "Plasson, "Philmac") and rated to PN16 maximum working pressure.
- b) Pipes greater than 100mm ID (125mm OD) may be jointed by the use of a butt welding or electrofusion technique. Electrofusion fittings shall conform to AS/NZS4129.
- c) The pipes shall be installed in accordance with AS2033 and AS/NZS2566.
- d) Certified tradespersons approved by Council, shall be employed with equipment specifically designed for the task. The contractor shall provide their own power source and earth leakage protection for the safety of their personnel.
- e) For electrofusion jointing only personnel trained and holding a current certificate of competency in the system to be used, will be permitted by Council to carry out the work.

7.4.5 Welded Steel Pipe Joints

- a) Welded joints in steel pipes shall be either butt joints, with an external welding band, spigot and socket joints, or as otherwise approved by Council. All welds shall be fillet welds of 7mm or larger, applied in the field.
- b) Flange joints shall be to AS/NZS40
- c) Where butt jointed pipes are used the ends shall be neatly butted where possible with a seal weld applied from the outside before the welding band is affixed. Steel pipes shall be cut to a neat and true line with an abrasive saw.
- d) After welding and testing (if required) all unprotected metal inside and outside shall be thoroughly cleaned by appropriate methods. The exposed steel shall be protected promptly and damaged protective coating repaired in an approved manner by the application of one of the treatments listed below:

- 1) Emer-tan rust converter; Emer-guard primer; Emer-clad membrane, or
- 2) Polyken Synergy™ which includes an appropriate primer coat, or
- 3) Carbomastic 15 primer; Servi-Wrap R15A membrane; Servi-Wrap Outerwrap.

- e) Joints shall be internally protected with a mortar lining to give a smooth internal bore. Materials for the mortar shall comply with the requirements of NZS3121. It is important to get a satisfactory mortar consistency to prevent the mortar from sagging or dropping out.
- f) The pipe joint shall be plugged with a suitable plunger prior to applying the mortar and then withdrawn evenly to smooth out the mortar joint.
- g) Epoxy mortar (suitable with potable water) shall be used for making good the mortar lining where pipes have been cut for mitred joints, or the fitting of flanges etc.

7.5 FITTINGS

7.5.1 Pipe Fittings

- a) The following standards apply to pipe fittings:

- 1) Ductile iron fittings such as tees, hydrant tees, crosses, tapers, hydrant risers, blank caps, plugs and bends shall conform to AS/NZS 2280, with thermo-bonded polymeric coating conforming to AS/NZS 4145. Ductile iron sockets for Elastomeric seal joints, used with PVC pipes shall be "deep socket" type.
- 2) Tapping bands used on PVC pipes shall be "full encirclement style" conforming to AS/NZS 4793.
- 3) Thermoformed PVC, elastomeric socket, long radius bends may be used with PVC pipes. Solvent cement bends and short radius (elbow) bends shall not be used.
- 4) On PE pipes DN 125 and larger, fittings shall be end load resistant electrofusion or butt fusion style, to AS/NZS 4129.
- 5) Flanges shall be to Table 9 of AS/NZS4331.2 and BS10. Fittings laid adjacent to other fittings shall have flanges.

- b) All bolts, nuts and washers shall be 316 stainless steel with molybond anti galling coating.
- c) Graphite greases, packing and compounds shall not be used in contact with stainless steel.
- d) Where dissimilar metals are used, purpose-made delrin thermoplastic inserts shall be installed in the flanges to prevent electrolytic action.

- e) Fittings which do not have bolts, nuts and washers which are 316 stainless steel and/or fittings which are not thermo bonded polymeric coated in accordance with AS/NZS 4158, shall only be used at the Engineering Manager's discretion where no alternative product is available. In this case these fittings shall be wrapped as detailed in SD 710 and 711.

7.5.2 Corrosion Protection

- a) These standards apply to the protection of flange and unrestrained mechanical couplings:
- 1) Protection shall normally be provided by the use of 316 stainless steel bolts, nuts and washers and fittings coated to AS/NZS 4158: 1996. Fittings which do not have bolts, nuts, and washers that are 316 stainless steel and/or fittings which are not thermobonded polymeric shall only be used with approval of the Engineering Manager.
 - 2) Where metallic pipes and fittings are not coated delrin thermoplastic inserts shall be installed in the flange to prevent electrolytic action. Steel, grey cast iron and ductile iron flanges shall be further protected by a wrapping system.
 - 3) Corrosion protection will be required (as follows) for all new flange and unrestrained mechanical couplings, where materials other than 316 stainless steel and coatings to AS/NZS 4158: 1996 are used.
 - 4) For flanges see SD 710. For Unrestrained Mechanical Couplings see SD 711.

7.5.3 Hydrants

- a) The following standards must be met in respect of supply hydrants:
- 1) Fire hydrants shall be installed on all principal mains in accordance with the requirements of the New Zealand Fire Service Code of Practice.
 - 2) Hydrants must be readily accessible for fire appliances and should generally be positioned near road/street intersections in conjunction with valves.
 - 3) A fire hydrant shall be located at each road/street intersection and not be positioned closer than 6.0m from any dwelling.
 - 4) In a cul-de-sac or other terminal streets, the last hydrant shall be at the head of the cul-de-sac.
 - 5) The distance between the hydrants and from the hydrants to the furthest building platform shall not exceed 135.0m.

- 6) A principal main shall be constructed and hydrant(s) placed within the private access way in order to ensure each building is within a distance of a fire hydrant as specified above. The width of the private access way shall be no less than 3.0m and sufficient to enable a fire appliance access to the hydrant. The main will be private from the road boundary to, and including, the fire hydrant
- 7) Should a fire hydrant be approved by Council within a private way, then Council will require an Easement In Gross in favour of Council over that line from the principal main to the hydrant.
- 8) Hydrants shall be screw-down type to NZS/BS750. Normally the short pattern shall be used, except where Council may approve or require the medium or tall pattern for extra flow capacity. Hydrants shall not be self-draining. Hydrants shall be blue nylon coated inside and out (location dependent) and be clockwise closing.
- 9) In some high risk areas hydrants shall be installed in pairs to provide better water flows.
- 10) Hydrant tees shall be flanged if laid next to other fittings. Otherwise flexible Z ring joints are permitted. Refer SD 706.
- 11) Hydrant risers shall be used or the water main laid deeper where necessary, in order to ensure that the top of the spindle is between 100mm and 200mm below finished surface level.
- 12) Hydrants shall be installed so the spindle cap and riser connection are in line with the water main below.
- 13) The manufacture and installation of hydrant boxes shall be to BS 750. Hydrant boxes shall be aligned in the direction of the water main. Heavy pattern hydrant boxes shall be used. All hydrant boxes (cover and frame) shall meet Class D strength to AS 3996. Covers must be 'anti-rocking'.
- 14) Hydrants shall be marked in accordance with SNZ PAS 4509 Appendix G. Hydrants shall be marked in accordance with NZS4501 with raised blue reflectorised markers together with painted triangle and painted fire hydrant box and circle as shown on SD 712 and 713.
- 15) Hydrant boxes shall be set on approved pre-cast concrete sections.
- 16) The top of the surface box shall be 5mm above the finished surface level in sealed carriageway and grassed surfaces. For areas to be planted, the top of the surface box shall be between 40mm and 60mm above the finished surface level and no closer than 1.5m to trees or shrubs.

7.5.4 Positioning of Valves

- a) Valves shall generally be placed on all the three legs of a tee intersection to optimise control of the water supply system and minimise the number of customers without water in case of a shut-down. Where practical, valves shall be located in berms.

- b) Sluice valves shall be flanged and bolted to each leg of the "tee" to form a single assembly. A hydrant will be included between the valves.
- c) Line valves shall be installed where the distance between other control valves exceeds 250m. For water mains over 200mm diameter, line valves shall be required every 450m and shall be positioned as agreed by Council. Rider mains shall have valves at both ends, located as close to the principal main as practical, but within the berm or footpath.

7.5.5 Depth of Valves

- a) The top of sluice valve spindles shall be 200-300mm below ground level, refer SD 704 and 705.
- b) The top of the hand wheel on a "Saunders" valve shall be 150 to 225mm below ground level.

7.5.6 Sluice Valves

- a) The valves on all principal water mains shall comply with NZS/AS 2638.2, Class PN16 (a class higher than 16 may be required in certain circumstances). Valves shall be resilient seated and anti clockwise closing with a stem sealed by "o" rings capable of being replaced under pressure. They shall have external and internal polymeric coating to AS/NZS4158.
- b) Specific design, subject to the approval of Council, shall be required for valves over 250mm NB.
- c) The valve shall be capable of bi-directional flow of water. Valves shall be set so that the spindle is truly vertical. Bolted joints shall be wrapped with a wrapping system, see SD 710 and 711.
- d) Sluice valves shall be installed in accordance with SD 704 and shall be marked as per SD 712 and 713.
- e) Approval of any particular sluice or gate valve shall be entirely at the discretion of the Engineering Manager.

7.5.7 Rider Main Valves

- a) Valves on rider mains shall be genuine "Saunders" A-type and "Valam" weir-type diaphragm valves with cast iron body, rubber diaphragm, and 316 stainless steel bolts.

7.5.8 Air Release Valves

- a) Water mains shall be laid to grade such that, for the purpose of the release of the air, a fire hydrant, an automatic air valve or a 20mm diameter ferrule and gate valve in a permanent surface box shall be installed at high points or in locations required by Council. They shall be installed so that ground water cannot enter the main at negative main pressure.

- b) Automatic air valves shall be testable 'Gillies' manufacture, single or double, large or small orifice, and of appropriate nominal bore. Automatic air valves shall be flanged and be mounted on flanged risers with an integral isolating valve accessible from ground level. Automatic air valves shall be installed within a standard manhole (marked 'AV') with positive drainage to an outlet such that ground water cannot enter the main at negative mains pressure.

7.5.9 Scour Valves

- a) Scour valves shall be either a fire hydrant or Saunders valve as for air release above and shall be installed at low points or to facilitate draining of a water main where required by Council.
- b) All dead end mains or rider mains shall be fitted with permanent scour valves complete with valve box.
- c) In areas where the scouring of mains is needed as a frequent operation, a connection to the stormwater kerb outlets, open channels or sumps shall be provided. The connection of a scour valve to stormwater pipes or manholes is not permitted.
- d) Where Saunders valves are used for a bleed or scour valve, a copper pipe ('Hockey Stick' shaped) fitted with a crox nipple shall be provided in each box.
- e) The box shall be similar to a fire hydrant box but shall be marked "AV" rather than "FH".

7.5.10 Butterfly Valves

- a) Butterfly valves shall only be used with the specific approval of the Engineering Manager. Butterfly valves shall be located in concrete valve chambers.

7.5.11 Non-Return Valves

- a) Non-return valves shall be installed at reservoir and tank outlets and at reservoir inlets and at the lower extremity of the tank reticulation zone.
- b) 50mm diameter swing check valves shall be 'Cambrian' bronze valve. Valves larger than 50mm diameter shall be 'Gillies' swing check valves, with external arm. Non-return valves shall be capable of being serviced without removal from the main. Cast iron swing check valves shall be fusion bonded thermoplastic coated or epoxy coated. All coatings shall be compatible with potable water and shall be coloured blue.
- c) Below ground swing check valves shall be within a standard manhole.
- d) "Wafer" check valves may be approved for specific applications.

7.5.12 Valve Boxes

- a) All valves shall be fitted with an approved square pattern cast iron surface box with the lid marked "SV" or "V" and a 150mm lid on a PVC riser pipe. Heavy duty lids shall be used.

- b) The riser pipe shall extend from the valve bonnet to 80mm below the finished surface and be placed vertically over the valve. The valve box shall be supported on a firm foundation so that no direct loading is transmitted from the box to the main or riser. See SD 704.
- c) The top of the surface box shall be 5mm above the finished surface level in sealed carriageway and grassed surfaces. For areas to be planted, the top of the surface box shall be between 40mm and 60mm above the finished surface level and no closer than 1.5m to trees or shrubs.
- d) If the distance between the finished surface level and the top of the valve is greater than 900mm, a valve key extension shall be fitted.
- e) Valve boxes shall be painted white with a 300mm wide kerb flash adjacent to the valve. See SD 712 and 713.

7.6 ANCHORAGE AND THRUST BLOCKS

- a) Cast in-situ concrete anchor blocks shall be provided on mains 50mm ID or greater, at all points where an unbalanced thrust occurs. This shall include all bends, tapers, valves, pressure reducing valves, tees and blank ends.
- b) For butt welded and electrofused PE pipework up to 150mm ID, anchor blocks are not required. Where PE pipes connect to other pipework or fittings with flexible joints, anchor blocks are required.
- c) The design of anchor blocks shall be based on "good ground" soil bearing capacity (as defined in NZS3604) or the ultimate bearing capacity of the site soils, whichever is lesser. A safety factor of between 1.5 and 2 shall be used in the design. Anchor block bearing area calculations shall be submitted with the engineering plans for checking and approval.
- d) The inner face of the block shall not be of a lesser thickness than the diameter of the fittings, and shall be so constructed as not to impair access to the bolts on the fittings. Concrete shall have a minimum compressive strength of 17.5mPa at 28 days.
- e) All concrete blocks shall be cast in-situ. Pre-cast concrete blocks are not permitted.
- f) A protective membrane of not less than three layers of 250 micron polythene sheet or similar shall be provided between the pipe (irrespective of the pipe material) and the concrete anchor and thrust blocks to prevent abrasive damage to the water main.
- g) Valves and hydrants on uPVC pipe lines require anchorage to resist torque when the valve is operated.
- h) Valves shall be anchored as shown on SD 704. A fish-tailed galvanised flat steel bar shall be attached to the bottom bolt on each flange of the valve and incorporated into a cast in-situ concrete pad 200mm deep, of the same width as the trench and extending 150mm beyond each anchor bar. Care shall be taken to ensure that all bolts can be removed for future maintenance and are not obstructed by concrete.

- i) Hydrant tees, when flanged, shall be anchored as valves. Refer SD 704. Hydrant tees with rubber ring joints shall be anchored by bedding the tee in a concrete pad 200mm deep, of the same width as the trench and not extending beyond the length of the tee. Care shall be taken to ensure that the flexible joints are not encased. Refer SD 706.

7.6.1 Thrust Block Design

- a) In designing water main thrust blocks, the following formula shall be used:

$$\text{Thrust Force } R = 15.7 H d^2 \sin(\theta/2)$$

R = thrust in kN

Where H = head of water in metres, i.e. 180m max
 d = diameter of pipe in metres
 θ = angle of deflection

Pipe dia - d	θ -11.25° bend	θ -22.5° bend	θ -45° bend	θ -90° bend
100	2.77	5.51	10.81	19.98
150	6.23	12.40	24.33	44.96
200	11.08	22.05	43.26	79.93

R – thrust in kN for each diameter and bend

- b) When the thrust force is known as above, the following formula can be used to ascertain the face dimensions – m² or weight of concrete – m³ to be used for the thrust block in the following table:

Case 1: Vertical Downward Thrust

$$A \text{ (m}^2\text{)} = \text{FOS} \times R \text{ (kN)} / q_u \text{ (kPa)} \text{ (but not less than 0.09m)}$$

q_u = Ultimate bearing capacity
 R = Thrust force
 FOS = Factor of safety = 2

Case 2: Vertical Upward Thrust

$$V \text{ (m}^3\text{)} = \text{FOS} \times R \text{ (kN)} / \gamma_c \text{ (kN/m}^3\text{)}$$

γ_c = Unit weight of concrete (24 kN/m³)
 FOS = 1.5

Case 3: Horizontal Thrust

$$A \text{ (m}^2\text{)} = \text{FOS} \times R \text{ (kN)} / [K_p \times \gamma \text{ (kN/m}^3\text{)} \times (h \text{ (mm)} - 100) / 1000]$$

K_p = Coefficient of passive pressure $(=(1+\sin\Phi)/(1-\sin\Phi) = (1+\sin35)/(1-\sin35) = 3.6)$
 γ = Unit weight of soil (19 kN/m³)
 h = depth of cover, 100mm subtracted for extra FOS
 FOS = 2.0

Table 7-9 is a guide only for design.

Table 7-9 Pipe Thrust Design

	Pipe diameter	Face area m² or m³	11.25° Angle of deflection	22.5° Angle of deflection	45° Angle of deflection	90° Angle of deflection
Vertical downward thrust	100	m2	0.09*	0.09*	0.09*	0.13
	150	m2	0.09*	0.09*	0.16	0.30
	200	m2	0.09*	0.15	0.29	0.53
Vertical upward thrust	100	m3	0.17	0.34	0.68	1.25
	150	m3	0.39	0.74	1.52	2.81
	200	m3	0.69	1.34	2.70	5.00
Horizontal sideways thrust	100	m2	0.12	0.23	0.45	0.83
	150	m2	0.26	0.52	1.02	1.88
	200	m2	0.46	0.92	1.81	3.34

Notes:

1. * Minimum thrust block size 300 x 300 x 300.
2. Table is a guide only.
3. Soil parameters are classed as "good ground" in accordance with NZS3604.
4. Test head 150m and factor of safety of 2 for all applications.

7.7 WATER SUPPLY CONNECTIONS

7.7.1 Point of Supply to Consumer

- a) The point of supply to each customer shall be determined in accordance with the NCC Water Supply Bylaw. Each individual dwelling or unit shall have a single point of water supply and a meter. Premises of multiple ownership including body corporate, strata title and leasehold/tenancy in common scheme shall be supplied and metered in accordance with the NCC Water Supply Bylaw.

7.7.2 Point of Metering

- a) The point of metering will generally be at the point of supply, other than for rear lots where the point of metering may be on private property in accordance with the NCC Water Supply Bylaw. Also see SD 701.

7.7.3 Diameter of Service Connections

- a) The standard connection sizes are 20mm NB, 25mm NB, 40mm NB, 50mm NB, 100mm NB and 150mm NB.
- b) The minimum size shall be 20mm internal diameter.

7.7.4 Service Connection Materials

- a) ISO dimension PE80 Type B pipes to NZS4130 are normally technically adequate.
- b) Council may require use of copper for specific operational reasons. Copper shall be to NZS3501. Joints shall be as for rider mains.

7.7.5 Individual Connections

- a) Water supply to cross leases and subdivisions will be treated on a common basis as follows:
- b) An individual connection shall be required for each dwelling via its own legal street frontage with the meter assembly located at the street boundary.
- c) For back sections an acceptable alternative will be a common pipe in the Right of Way (ROW)/Common Access serving only those dwellings with legal access onto the ROW/Common Access. Each dwelling shall have an individual connection from the common pipe with a meter assembly located at the edge of the ROW/Common Access. A meter assembly shall be located on the common pipe at the street boundary, where the pipe is 20mm or 25mm internal diameter. A genuine Saunders valve with stainless steel bolts shall be used where the pipe is 40mm to 50mm internal diameter.
- d) The supply pipe for one lot shall not pass through another lot unless there is physically no alternative (e.g. no water main in the street, insufficient water pressure in the main at the street boundary). In such a case an easement shall be required to protect the line of the supply pipe. Refer SD 701.
- e) In commercial and industrial subdivisions tapping bands and service connections may be omitted until the specific requirements of the consumer are known. In this case a condition will be placed on the lot outlining that the lot owner is responsible for the cost of installing the service connection at the time of Building Consent (or earlier if required by the lot owner).
- f) Where the Council requires the subdividing owner to lay the service connections, this shall be as far as and including the manifold and the meter box.
- g) These connections shall be temporarily supported on waratah or similar standards until after the electric power or any other reticulation between the water main and the boundary has been laid.
- h) Service connections shall be laid at right angles to the frontage. The service line between the ferrule and the meter box is to be laid as a single length of pipe with no joins or fittings or tight bends along its length. However, where the horizontal distance between the ferrule and the meter manifold is less than 1.0m, the ferrule shall be offset from the water meter by 0.5m and 2 x 90 degree fittings shall be used in the service connection to avoid pipe stresses.

7.7.6 Tapping Bands and Ferrules

- a) Where possible lateral connections and ferrules shall be located clear of driveway entrances.
- b) Each service connection to a principal main or a rider main shall be by means of a tapping band and a "Talbot" Bronze pushfit swivel ferrule with the flow of water controlled by a screwed brass plug.
- c) Tapping bands on PVC pipes shall be of an approved cast bronze complying with AS/NZS 4793, fully encircling the pipe to prevent over tightening and distortion of the pipe.
- d) Refer SD 709.
- e) Tappings on ISO dimension PE80 Type B pipes shall be by means of a vertical compression tee (with BSP female branch) and ferrule. Tapping saddles shall not be used on PE pipe.
- f) If the required service is larger than is possible to connect with a tapping band the main connection shall be by a tee or a tapped elongated joint having a vertically connected ferrule. For connections larger than 50mm NB the connection shall be by means of a tee and sluice valve.
- g) Tapping bands and ferrules on the water mains shall be fitted when the mains are first laid.

7.7.7 Meter Assembly for 20mm and 25mm ID Connection

- a) The service connection shall terminate adjacent to the street boundary with a Nelson City Council approved 20mm nominal bore water meter assembly and box.
- b) This shall consist of an "Acuflo" water meter manifold, isolating valve and double check valve housed in an "Everhard" or "Draper" DRA 20/1 underground meter box. Metal meter boxes are to be used for commercial and industrial accessways and in residential areas that will be traffic loaded.
- c) An approved water meter shall be fitted to the manifold. The meter shall be either a Sensus 620M or Elster (Kent) V210.
- d) The meter box shall be within 150mm of the street boundary on the street side of the boundary, clear of regular vehicle traffic movement.
- e) Where there is a service pipe in a Right of Way serving more than one property, the meter assembly shall be located in the Right of Way clear of regular vehicle traffic movements as if it was in the street.
- f) The pipework at the meter box shall have an earth cover of 260mm to 300mm depth over it. Refer SD 709.
- g) The meter box shall be placed on a firm base so that it will not be depressed below the finished surface by settlement or occasional vehicular traffic.

7.7.8 Meter Assembly for 32 - 40mm ID Connection

- a) For 32 - 40mm ID services a meter assembly consisting of genuine Saunders diaphragm valve with stainless steel bolts shall be used. The meter shall be either an Elster V100, Helix 4000, or Sensus 620. An approved backflow preventer shall be used with the meter, and housed in an approved meter box.

7.7.9 Meter assembly for larger than 50mm ID Connection

- a) Connections 50mm ID and larger shall consist of a tee and sluice valve on the main. The sluice valve shall be bolted to the tee.
- b) All service connections other than dedicated fire sprinkler or fire-fighting mains will be required to be metered.
- c) The meter shall be either a Meitwin 50 - 100 compound or Meistream and shall be installed at the boundary to the manufacturer's specification, and housed along with approved isolating valve and backflow preventer in a meter box of size and construction approved by the Council. If a reduced pressure zone backflow preventer is used, this shall be mounted above ground level.

7.7.10 Water Meters

- a) At the completion of works and prior to issue of the 224 certificate for developments the developer must supply a completed water meter location form (see Appendix A) to the Engineering Manager for approval. Water meters shall be fitted to all connections as follows:

Table 7-10 Approved Water Meters

Connection Size, DN (mm)	Meter Size (mm)	Meter Designation	Average Flow m ³ /hr	Maximum flow m ³ /hr	Meter Class	Meter Type	Meter Model
20	20	Qn 1.5	1.5	3.0	C	Manifold	Sensus 620 M or Elster (Kent) V210
25	20	Qn 1.5	1.5	3.0	C	Manifold	
25	25	Qn 3.5	3.5	7.0	C	In line	Elster V100 / Sensus 620
40/50	40	Qn 15	15/30	45/50	C	In line	Elster Helix 4000 (H4000) / Sensus MeiStream Plus
50	50	Qn 15	35	50	C	In line	Elster Helix 4000 (H4000) / Sensus MeiStream Plus

100	80 100	Qn 40 Qn 60	40 60	80 120	B/C* B/C*	Compound	Elster C 4000 / Sensus Meitwin
150	100	Qn 60	60	120	B/C*	In Line	Elster C 4000 / Sensus Meitwin
	150	Qn 150	150	300	B/C*		Elster Helix 4000 (H4000) / Sensus MeiStream Plus

*Note: For Compound meters; high flow meters Class B, low flow meters Class C.

- b) Meter connections larger than 25 mm diameter shall be subject to the approval of the Council. The applicant may be required to present hydraulic calculations supporting the choice of meter size to the Council for approval.

7.7.11 Backflow Preventers

- a) All new industrial and commercial properties shall have a backflow preventer installed on the owner's side at or as close as practical to the point of supply. The type and location of backflow preventers shall comply with the Building Act 1991, the Health Act 1956 as amended by the Health (Drinking Water) Amendment Act 2007, AS/NZS 2845.1 and the NCC Water Bylaw 217.

7.7.12 Reuse of Existing Service Connections

- a) A proposal to reuse an existing service will only be approved if the service is of adequate size and one of the following conditions applies:
- b) It can be established that the service is less than 40 years old or;
- c) The service is to continue supplying the same building that it was originally intended for, and no others.
- d) This policy applies only to the Council portion of the water service i.e. from the main up to and including the meter assembly.

7.7.13 Disconnections

- a) Redundant services shall be disconnected from the supply line. The service fitting shall be removed or plugged to the satisfaction of the Council.
- b) Meter box, manifold assembly and meter shall be removed. These remain the property of Nelson City Council and they shall be delivered to the Council representative.

7.7.14 Fire Sprinkler Supply

- a) A fire sprinkler supply, if installed, shall come off the Individual water supply after the NCC water meter assembly. This may require specific design. All above ground valves shall be suitably protected from vandalism or accidental damage.
- b) Fire sprinkler supply connections may require combination metering.
- c) Designs for fire sprinkler and reticulation shall allow for pressure reductions due to backflow prevention devices.
- d) Residential buildings that use a sprinkler system as a means of compliance with the New Zealand Fire Service Fire Fighting Water Supplies Code of Practice will require a Consent Notice to be registered on the land title setting out the requirements of the landowner for ongoing maintenance of the system and a condition entered in the NCC register accordingly.

7.8 PUMPING AND STORAGE

7.8.1 Pump Station Design

- a) Pump stations shall comply with NCC requirements and these specific designs are updated on a regular basis. Design will be dependent on a number of factors and should be discussed with the Council at an early stage.
- b) New pumping stations will only be accepted by Council when all other practical options have been ruled out
- c) Design of the pumping station shall enable operation of the station in compliance with industry health and safety requirements having particular regard to safety from falling aspects on site and confined space entry.
- d) In all pumping stations the following design specifications apply:
 - 1) Sufficient duty pumping capacity shall be available to handle the design peak flow within a pumping period of 12 – 15 hours.
 - 2) A minimum of two pumps shall be installed, with one acting as duty pump and the other on automatic standby. The duty sequence is to be alternate start on variable speed drives in accordance with Nelson City Council control system standards. The standby pump shall be equal in capacity to the duty pump.
 - 3) Ground floor levels shall be at least 200mm above finished ground levels in order to exclude surface water entry.
 - 4) All pump station site structures shall be designed for a minimum 50-year life complying with the building code.

7.8.2 Access and Services

- a) Pumping stations and control buildings shall be sited on a separate lot or a utility reserve. The lot is to be vested in Council and shall have a sealed access road for maintenance vehicles. The site as a minimum should have screen planting on all common boundaries that will not exceed 2m in height on the South boundary.
- b) A means of lifting pumps and other heavy equipment, or alternatively access to enable mobile plant to perform this task is to be provided on site.
- c) An approved flow meter shall be installed on the outlet line from the pump station and connected to the telemetry system.

7.8.3 Electrical Equipment

- a) An electrical pump control, alarm, and telemetry system is required on site. It shall be assembled and installed in accordance with Council's standard specification, as follows:
 - 1) A stainless steel control cabinet is required to house electrical equipment. Cabinets are to be fitted with a lock keyed to Council's security system.
 - 2) All electrical switch gear is to be located a minimum of 300mm above ground level. All electrical equipment is to be assembled and installed in accordance with these standards or the manufacturer's specifications.
 - 3) All equipment including metering must comply with the requirements of the Network Utility operator and supplier (power).
 - 4) Suitable alarm and system control interrogation and transmitting facilities shall be provided to enable the pumping stations to be connected to Council's telemetry system.
 - 5) Cable ducting from the pump station to the control cabinet must be sealed to protect against corrosive gasses travelling to the electrical switchboard.
 - 6) All electrical and pump station control gear including telemetry shall be housed within a weather proof, lockable, walk-in building to Council approval.
 - 7) Phase failure protection relays shall be provided for all pump motors unless that protection is incorporated into the electronic control for Soft Start or Variable Speed Drive units.
 - 8) Automatic control of the pump operation, together with a manual override facility is to be provided.
 - 9) A standard three-phase industrial power connection shall be supplied such that a portable generator can be connected when power failure occurs.

- 10) Suitable lighting shall be provided for the pump station, cabinets and valve chambers with protective materials suited to the corrosive environment.
- 11) Details on pump/motor components and electrical control equipment shall be incorporated into an Operation and Maintenance Instruction Manual enclosed in a hard copy A4 bound folder. Four copies shall be provided.
- 12) The Manual shall include as-built plans of the pump station including electrical wiring and operational schematic diagrams. Four copies of the Manual shall be supplied to Council on handover of the completed pump station and associated works.

7.8.4 Private Pumping Stations

- a) Individual, private pump systems are permitted provided the design and construction meets the requirements of the NZ Building Code (a Building Consent will be required) and the connection to the Council system is via a water meter and backflow protection.

7.8.5 Commissioning

- a) On completion of any pump station, and prior to handover to Council, a full commissioning test shall be carried out on all components of the pump station. This commissioning shall be in the presence of a representative of Council and of Council's operations and maintenance contractor.

7.8.6 Reservoirs

7.8.6.1 General

- a) The size of the reservoir shall be able to supply all newly created lots, future growth (available developable land) and fire fighting requirement. Subdividers/Developers are advised to consult the District Plan.
- b) The design shall show details of wall fittings, pipe penetration details through the wall and floor and details of pipe support and restrain. It shall be the responsibility of the designer to ensure that the proposed reservoir location is capable of receiving and transmitting uninterrupted telemetry signals from the Council's telemetry network.
- c) It is recommended that the design and construction plans be discussed with Council before these are formally submitted.
- d) All newly created sections are to be fed from publicly owned reservoirs in dedicated water supply zones, for minimum and maximum pressures to be achieved at the point of supply. This is to ensure all sections can be serviced on a sustainable basis with at least the minimum level of pressure and flow set by Council, as well as minimising the risk of contamination of the supply by maintaining minimum pressures in the supply network.
- e) Council aims to avoid small individual reservoirs, associated with new developments, in favour of larger reservoirs providing greater community benefit, especially for contingency storage.

- f) Publicly owned community service reservoirs must provide water to meet daily supply demands to ensure consistency and continuity of supply to customers.
- g) Publicly owned community service reservoirs must provide fire fighting storage reserves, in accordance with the requirements of the New Zealand Fire Service Fire Fighting Water Supplies Code of Practice, which requires minimum quantities of water to be held for fire fighting purposes.
- h) The capacity of the reservoir is such that it should hold 24 hours storage to enable an ongoing availability of water in the event of an emergency or burst pipes required taking into consideration future growth potential.
- i) The dimensions and shape of the reservoirs shall provide structural efficiencies, resist earthquake movements and economical to maintain.

7.8.6.2 Storage

- a) The minimum storage required is 600 litres per head, in addition to the fire storage provision required by the Fire Code.
- b) The proposed storage volume shall be approved by Council.

7.8.6.3 Technical requirements

- a) The design and construction shall be to the latest codes and standards.
- b) The reservoir shall be located at an appropriate height so that properties at the highest location receive a pressure of 30 metres at the point of supply measured from the bottom water level of the reservoir and properties at the lowest location receive a pressure not more than 90 metres from the top water level of the reservoir at the point of supply without the use of a PRV valve.
- c) Reservoirs shall have appropriately sized valve chamber to house inlet and outlet control valves, cross connection valve between inlet and outlet, auto shut off valves, flow meters, control and monitoring equipments etc.
- d) The outlet main from the reservoir shall be appropriately sized to supply the proposed zone during peak demand plus fire fighting supply without the need to supplement from another zone.
- e) The reservoir shall have all weather access road and parking space for a large truck and a small vehicle.
- f) Reservoir depth monitoring equipment shall be fitted.

7.8.6.4 Reservoir design

- a) Precast 25m³ reservoirs may be used up to a storage volume of 150m³. For storage volume greater than this a single reservoir should be constructed.
- b) Circular reservoirs are preferred although site requirements may dictate alternative shapes.

- c) Generally, only concrete reservoirs will be permitted. Alternative materials will require specific approval.
- d) The subdivider/developer shall carry out appropriate geotechnical investigation to design the foundation for the reservoir. A summary report of the geotechnical investigation shall be attached to the construction drawings. Where the ground condition is incongruous, foundation shall be designed to overcome the situation.
- e) Reservoir walls shall be cast in-situ reinforced or pre-stressed concrete or precast concrete.
- f) Where post tensioning the walls is employed, it shall be carried out by a specialist contractor. Upon tensioning the pre-stressing cable ducts shall be pressure-grout filled.
- g) Construction of the reservoir floor shall be with reinforced concrete.
- h) Non-shrink concrete additives may be used to control cracking and to minimise the need for construction joint.
- i) Sumps shall be positioned opposite to the inlet, with the floor graded to the low point. The sumps shall connect to the scour pipes and associated valves.
- j) For single reservoirs greater than 150m³, under floor drain system shall be placed below the reservoir floor. The trench for under reservoir drains shall be excavated to a true line and grade. The under reservoir drains are to be wrapped with durable geotextile and stone wrapped with clean durable stone. Perforated high density polyethylene pipe with 6.5mm diameter perforations, at 76mm centres shall be used for under reservoir drains. The upstream ends of all under reservoir drains are to be capped to prevent ingress foreign material. The under reservoir drain system shall discharge into a collector manhole draining to the stormwater system. The under reservoir drain system discharge points shall be clearly marked by means of permanent engraved signs to allow the source of any leakage through the floor to be identified.
- k) The joints at the base of the walls must allow positive restraint. Sliding or sideways movement of the wall at its base relative to the floor is not permitted.
- l) The structure shall be designed for a minimum service life of 100 years to all relevant standards and Codes.
- m) Suitable concrete mix and reinforcement covers shall be employed to provide the design life.
- n) The reservoir structure shall be a Category 1 structure as defined in Table 2.3.1 of NZS 4203 and designed for all Code loading requirement to withstand a water level of at least 450mm higher than the crest level, independent of surcharge due to earthquake.
- o) All materials used for water-stopping/water proofing (water bars, sealants, additives etc) shall be materials that are certified to be used in contact with drinking water. The materials used shall carry certification

as per AS/NS 4020. All materials used for water stopping shall be approved by the Council.

- p) Pipe penetration in the floor and wall shall be waterproofed.
- q) The roof shall be designed to withstand surcharge because of water level within the reservoir.
- r) Reservoir roofs shall be watertight and have sufficient fall to prevent ponding of rain water by draining rain water satisfactorily over the whole roof area.
- s) Precast column, beam and roof units are acceptable.
- t) The roof and access hatches must be watertight and vermin/insect proof.
- u) One hinged, sealed, raised airtight access hatch cover shall be provided above the roof level.
- v) Hatch covers are to be fabricated in bright finished aluminium chequer plate, with grade 304 stainless steel hinges and bolts and neoprene washers as insulator in between different types of metals.
- w) Bolts and nuts are to be locked with steel plates to prevent removal.
- x) Hand access lock box type locks shall be provided for hatch covers.
- y) The hatch shall be provided with an inclined ladder access to the interior of the reservoir.
- z) The hatch shall be designed in such a way that it can be operated safely and easily by one person, allow adequate headroom while descending the ladder and permit equipment to be lowered into the reservoir for general maintenance in the future.
- aa) For single reservoirs greater than 150m³ access ladders and safety rails shall be designed, constructed and installed in accordance with the relevant standards and codes. The internal access ladder shall be installed at a slope between 65° and 70° from the horizontal. The material to be used for internal metal work shall be corrosion free material and approved to be used in drinking water.
- bb) The design is to provide extending the safety rail above the roof when the hatches are opened for safe entry into the reservoir.
- cc) Fixings for safety harnesses shall be provided.
- dd) Provision shall be made at the hatch covers for installation of limit switches and associated cabling to indicate when the hatches are open.

7.8.6.5 Pipework

- a) The reservoir shall be constructed with inlet, outlet, scour and overflow pipework.
- b) The scour pipe shall be connected to the stormwater system through a manhole. The entry of scour pipe into the manhole shall be at a higher

elevation than the stormwater pipe from the manhole to prevent surcharging. It is the responsibility of the subdivider/developer to ensure the stormwater system could handle an overflow event at any time. Where this is not possible the responsibility of upgrading the stormwater system lies with the subdivider/developer.

- c) Pipework within the reservoir shall be appropriately supported and restrained.
- d) All metallic pipe support and restrain shall be 316 stainless steel.
- e) All pipes within the valve chamber and reservoir shall be disinfected and pressure tested to withstand a water pressure of 100m at the highest point of the pipework.

7.8.6.6 Valve chamber

- a) For reservoirs greater than 500m³ a valve chamber shall be attached to the reservoir at a suitable location to house all electrical and mechanical components required for the function of the reservoir.
- b) Entry into the valve chamber may be through a side door with external steps.
- c) The hatch or door shall have hand access lock box type lockable facility.
- d) The inlet, outlet, overflow and scour pipes within the valve chamber are to be fitted with stainless steel flanged EPDM rubber bellows joint connections.
- e) The valve chamber shall accommodate the following:
 - 1) Isolating valves for all pipes (inlet, outlet etc)
 - 2) Auto shutoff valve
 - 3) Magflow meters
 - 4) Reflux valves
 - 5) Air valves
 - 6) Cross connection between pumping main and outlet main with closed valve
 - 7) Sampling point
 - 8) Check valves
 - 9) Pressure tapping for reservoir level monitoring
 - 10) Electrical and controls
 - 11) Pump control equipment where necessary
 - 12) Continuous monitoring and telemetry

- f) The subdivider/developer shall arrange power supply to the reservoir as directed by the Council.

7.8.7 Security of Water Supply Facilities

- a) The following additional requirements will ensure the security of facilities:
- 1) Locks shall be provided on all doors, lids, chamber covers and gates that require limited access for operational or security purposes. All newly constructed facilities shall be keyed (master keyed) to Council security systems.
 - 2) Appropriate locks shall be ordered through Council's Utilities Asset Engineer and fitted to facilities prior to application for 224 certification. The developer shall be responsible for all costs associated with the supply and fitting of locks.
 - 3) Once Council locks are fitted to water supply facilities only Council or their maintenance and engineering consultancy staff shall have access to the equipment.
 - 4) Council's maintenance contractor will assume responsibility for routine maintenance of the asset but any work arising from failure of equipment or materials, or faulty workmanship will be on-charged to the Developer during the prescribed maintenance or guarantee period.

7.9 RETICULATION CONSTRUCTION AND INSTALLATION

7.9.1 Excavation Works

The following standards and conditions apply to the excavation in preparation for pipework laying:

7.9.1.1 Trench width

- a) The Minimum trench width shall be 200mm wider than the external diameter of the collar of the pipe being laid.
- b) The trench shall be of sufficient width to permit with freedom the installation of all trench support and to allow the laying and jointing of pipes and placing of bedding and pipe surround materials.

7.9.1.2 Base of excavation

- a) No construction or work upon the excavation bottom shall commence until the natural bottom of the excavation has been inspected and accepted by the DPA.
- b) The foundation of the trench is to be checked for stability of the soil by the DPA. Generally a plate compactor is to be run over the trench floor to bind the surface and identify any obvious weak spots. Where the bottom of an excavation is unable to provide a firm foundation with minimum bearing capacity of 50kPa (e.g., clay soils that can easily be penetrated 40mm with a thumb or in sand or gravel that makes a footprint more than 10mm deep) at the required level without abrupt irregularities, engineering advice should be sought on how to provide a

satisfactory foundation (see AS/NZS 2032:2006, clause 5.3.6). The DPA shall order the use of additional granular bedding material as specified in AS/NZS 3725:2007 for concrete pipes, or AS/NZS 2566.2:2002 for PVC and other flexible pipe systems.

7.9.1.3 Trench support

- a) The Contractor shall provide trench support to comply with the requirements of the Occupational Safety and Health service of the Department or Labour. The Contractor shall ensure that the sides of the trench are sufficiently supported so that cracking of the surrounding ground does not occur.
- b) Where trench support extends below the invert of the pipeline or structure special precautions may be required, including leaving part of the support in place, to ensure the foundation of the pipe or structure is not weakened.

7.9.1.4 Dewatering

- a) Excavations shall be kept free of water during construction.
- b) In no circumstances shall stormwater or ground water be allowed to drain into any existing wastewater drain.
- c) Discharge of stormwater or groundwater to existing stormwater drains will be permitted providing adequate silt traps prevent debris and suspended matter from entering drains. Should deposits in existing stormwater drains or the pipes already laid occur as a result of the operations of the Developer or the Contractor such deposits shall be cleared forthwith at the Developer's or the Contractor's cost as the case may be.
- d) Ground water lowering may be permitted except where this practice may present a risk of subsidence.
- e) The Contractor or Developer shall cause as little damage or interference to property or persons as possible in disposing of water from the works, and shall be responsible for any damage or interference, which may be caused. This shall include any damage to the structure of any road.

7.9.2 Bedding of Pipes and Pipe Protection

7.9.2.1 Metal bedding

(Note: Includes bedding, haunch support and side support material as defined by NZS 2566.2:2002 and AS/NZS 3725: 2007.)

- a) Metal Bedding shall be in accordance with SD 617.
- b) The bedding material shall be:
 - 1) In a sand environment - Sand
 - 2) For PVC and flexible pipes - AP20 as per SD 401, or as per AS/NZS 2566.2:2002, Appendix G

- c) Bedding shall be placed and raked-in so as to provide support for the pipe uniformly along the whole length of the barrel with chases provided for sockets, couplings and other appurtenances. For PVC and flexible pipes the bedding shall not be compacted and the centre of the bedding shall not be walked on either during or after placement.
- d) The pipes shall be laid and brought to true alignment and level before installing the metal haunching, side support and covering the pipes.

7.9.2.2 Pipe embedment

- a) The metal haunching and side support shall be placed uniformly along and around the whole length of the pipe barrel, couplings and other appurtenances in a manner to ensure uniform density of side support (including haunch support) and overlay with no distortion, dislodgement or damage to the pipeline.
- b) Following placement, the embedment material shall be compacted in layers to uniformly support the pipe. When choosing compaction equipment, the number of passes and the thickness of layer to be compacted, account shall be taken of the material to be compacted and the pipe to be installed.
- c) Compaction equipment or methods that produce horizontal or vertical earth pressures that may cause damage to, or excessive distortion of, the pipe shall not be employed.
- d) Metal haunching and side support shall be compacted to the manufacturer's requirements and as a guide, a minimum Clegg Impact Value of 35 under vehicle loaded areas or 25 under non traffic loaded areas shall be achieved at any point on any haunching constructed of AP20.

7.9.2.3 Installation of geotextiles

- a) Where there is a possibility of migration of fines between the native soil and the pipe surround soil, the DPA shall require the metals to be protected by an approved geotextile filter fabric that overlaps by at least 300mm.

7.9.2.4 Concrete protection slab for PVC pipes

- a) Where cover over PVC pipes is less than the minimum stated in section 7.2.9, including temporarily under construction traffic, a concrete protection slab shall be constructed in accordance with SD 618.

7.9.2.5 Water-stops and trench groundwater

- a) Where permeable bedding such as 'bedding chip' 'drainage metal' or 'sand' is used, water-stops and trench drainage shall be constructed to prevent unwanted movement of groundwater along the trench and pipe bedding. Also see section 7.9.2.3.
- b) Water-stops shall be constructed to the requirements of SD 615. Trench Drainage shall be constructed to the requirements of SD 614.

- c) Where water stops are required, they should be provided at the following intervals:

Grade	Spacing
1 in 15 or steeper	12m
1 in 15	15m
1 in 25	30m
1 in 100	60m

Note: Intermediate grades (and spacing) are determined by interpolation

7.9.3 Pipe Installation

- a) Pipes shall not be laid on bricks, blocks and wedges or other temporary or permanent supports.
- b) Pipes shall be kept clear of dirt or debris, and any pipes that contain such matter shall be required to be cleaned out. Internal pipe walls shall be kept clean and free of all dirt, rubbish and water. Spigots, sockets, rubber rings, fittings etc, shall be thoroughly cleaned before jointing.

7.9.4 Installation by Trenchless Technology

7.9.4.1 General

- a) Directional Drilling shall only be used in specific circumstances where approved by the Engineering Manager, but shall be limited to the crossing of busy roads (where disruption to traffic is an issue) and / or where it is essential that existing driveways / entrances remain open or undisturbed and in the vicinity of tree roots.
- b) Trenchless technology, including directional drilling for the installation of new water reticulation shall be limited to watermains with a diameter equal to or less than OD 63mm (ID 51mm). In specific circumstances it may also be used to install larger diameter watermains for example (but shall not be limited to) the crossing of busy roads (where disruption to traffic is an issue) and / or where it is essential that existing driveways / entrances remain open or undisturbed. These instances will be identified on the tender drawings.
- c) Pipe material used for trenchless applications shall be limited to PE to NZS 4130 and have a pressure rating of PN15 or greater.
- d) Depth of thrusts or drilling shall be the same as for general pipe-laying. The pipes shall be installed in a straight line or in a smooth curve. The alignment deviation – both vertical and horizontal – shall not exceed 150mm. Minimum NCC standard cover depths shall be achieved at all times.
- e) Where the new pipe crosses other services, a clearance of 200mm to those services shall be maintained.

- f) All precautions shall be taken to ensure that the end of the pipe to be passed through the bore is sealed to prevent the ingress of earth or other foreign matter into the pipe.
- g) The Contractor shall be liable for damages to any underground services.

7.9.4.2 Pipe Line Tracer Tape

- a) For water work a tracer tape system must be incorporated into the trenchless work. The tracer tape must comply with section 7.9.5.3.

7.9.5 Pumping/Pressure Main Tracer Tape or Wire

- a) The location of all pumping mains and gravity pressure mains shall be marked with a foil tape buried in the trench.

7.9.5.1 Tape

- a) The tape shall be blue, 50mm wide, and printed with "CAUTION WATER MAIN BURIED BELOW" or similar message. All printing shall be encased to avoid in rub-off.
- b) The tape shall be either a woven reinforced acid and alkali resistant polythene plastic with a solid aluminium foil core which shall be visible from both sides. "Thor TecTM" tape is an accepted product. Alternatively the tape shall be a sinusoidal stainless steel wire encased in a polythene strip. "Waterwave" and "Wavelay" are acceptable products.

7.9.5.2 Installation

- a) The tape shall be buried above the centre line of the pipe within 300mm to 400mm from the finished surface. Refer SD 702.
- b) All joints in the tape (e.g. roll ends, accidental breaks and at tees) shall be made electrically conductive with purpose made splice clips installed to the specific manufacturer's instructions. Tying together of the tape ends is not acceptable as the polythene coating will prevent electrical conductivity.
- c) The tape shall be brought up inside the surface box risers at all valves and hydrants with a 300mm long tail so that pipe location equipment can be readily connected.

7.9.5.3 Tracer wire

- a) When a pipe is installed by a directional drilling technique or bored through the ground for a distance exceeding 20 metres, the pipe shall have a 'Tracer Wire' attached. This wire shall take the form of a continuous 2.5mm 2 multi strand (polythene sleeved) cable, strapped to the pipe wall by means of a minimum of two complete wraps of heavy duty adhesive tape, at a maximum of 3.0m intervals.

7.9.5.4 Tape or wire testing

- a) The tracer tape may be tested and checked at Practical Completion by NCC for continuity using an electric pulse induction system. The new watermain/ridermain will be tested between any new valves, hydrants etc where the tape is brought up inside the surface box risers. Nelson City Council will carry out this test only when all work associated with laying the watermain/ ridermain is complete.

7.9.6 Connection to Council Network

- a) Connection to existing water main shall not be made until all new work (excluding the connection) has been completed and inspected and approved by Council. Specifically, this shall include testing, chlorinating and flushing of all new pipework, and fittings by the contractor.

Appendix A Water Meter Location Form



Nelson City Council
 P O Box 645
 Nelson 7040

To: Water Meter Officer
 Subdivision/Meter Location

Resource Consent No. _____ (If applicable)

The following table defines information required by the Nelson City Council for all new water meters.

In the Meter Type Column please indicate whether the meter is a Sensus 620M or Elster (Kent) V120 water meter. Indicate either S or E.

In the Meter Reading Column show the reading to the nearest whole cubic meter only (BLACK NUMBERS on the meter).

In the Location Column, indicate whether the measurement is from the right or left boundary when facing the lot from the road (R or L) Show one measurement to the meter from either the right or left boundary (measured along the front boundary) and one measurement to the meter from the front boundary (measured perpendicular to the front boundary).

Lot No	D.P No.	Street No.	Street Name	Meter Type S or E	Meter No.	Meter Reading (m3)	Reading Date	Location (Distance from)		
								R/L	Side Bdy (m)	Front Bdy (m)

(Use additional page if required)

Name: _____

Signature: _____ Date: _____

Address: _____

Appendix B Field Acceptance Pressure Testing for Water Supply Pipelines



FIELD ACCEPTANCE PRESSURE TESTING FOR WATER SUPPLY PIPELINES

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1.0 Introduction and General Comments

The acceptance pressure test requirements used for water supply pipelines have generally been too insensitive to date. It is believed that many pipelines have been allowed to pass with unacceptable leaks, generally through ineffective testing procedures and/or low acceptance requirements. The procedures detailed in this document represent the latest acceptance requirements and procedures from Australia and Europe.

Section 3 gives general pressure test requirements for all pressure testing and Sections 4, 5 and 6 give material-specific test methods in detail. Section 7.0 has a pressure test record and Section 8.0 has some general comments on the measurement of make-up water volume and pressure measuring equipment.

2.0 Terminology and Definitions

CLS: Concrete lined steel pipes, generally welded spiral wound steel with a cement mortar lining in accordance with NZS 4441.

Design Pressure (DP): The pressure that the designer expects to act on the pipeline in service. In a gravity supply system, this is usually the elevation difference between the reservoir top water level and the lowest elevation of the pipeline in metres head.

DI: Ductile iron pipes - generally socket jointed with Tyton elastomeric seal rings.

DN: Nominal pipe bore diameter in millimetres. For PE pipes, this relates to the pipes outside diameter.

GRP: Glass reinforced plastics pipes, e.g. Hobas. This type of pipe is generally only used for major transfer or transmission mains since pipe diameters of less than DN 300 mm are rare.

Maximum Design Pressure (MDP): The DP plus a pressure surge allowance (preferably calculated), or a fixed allowance of 200-500 kPa or such other allowance as the pipeline designer may decide is appropriate.

Operating Pressure: The internal pressure which occurs at a particular time and at a particular point in the water reticulation system. For a gravity system, the operating pressure will depend on the water level of the reservoir, the ground level at the point on the pipeline under consideration, and the head loss due to demand in the system.

PE: Polyethylene pipes, generally PE 80B or PE 100 for water supply networks. PE 80C is not recommend for long term water reticulation networks.

Nominal Pressure Rating (PN): The pressure marked on the pipe or component and the maximum pressure that it can operate at throughout its design life.

System Test Pressure (STP): The hydrostatic pressure to be applied to a newly laid pipeline (measured at the lowest point) to ensure its integrity and water tightness.

3.0 Acceptance Pressure Tests for all Pipeline Materials

3.1 General

Every pressure pipeline is required to pass a water pressure test to verify the integrity of the pipes, joints, fittings and other components such as thrust blocks.

For drinking-water pipelines, the test medium shall be potable water that may contain sufficient additional disinfectant to minimise the risk of the commissioned pipeline containing potentially harmful organisms. For safety reasons, compressed air shall not be used for pressure testing

3.2 Health and Safety Issues

Appropriate safety equipment shall be available on site prior to commencement of any pressure testing operations. Only suitably qualified personnel shall carry out and oversee the testing and shall have appropriate protective clothing.

All excavations shall be adequately barricaded. Work in pipe trenches that is not related to the pressure test shall not be permitted during the pressure test.

All test equipment shall be correctly calibrated, in good working order, suitable for the test procedure and be correctly fitted to the pipeline.

The section to be tested shall be completed in accordance with the specification and the pipes and fittings etc adequately restrained. Any permanent or temporary concrete thrust blocks shall be designed for and have attained sufficient compressive strength to resist the test thrusts. No temporary thrust blocks or supports shall be removed until the pipeline is depressurised.

Where water for testing purposes is derived from a potable water supply, appropriate backflow prevention equipment shall be incorporated in the connection to the potable water supply to minimise the risk of accidental backflow and possible contamination of the potable water supply occurring.

The contractor shall have contingency plans and sufficient equipment on site to deal with any bursts or other foreseeable emergency that may arise during testing.

3.3 Personnel Qualifications

The testing of all pipelines shall only be carried out and supervised by acceptably qualified or accredited personnel.

Qualified or accredited personnel shall:

- hold appropriate qualifications issued by a registered training organisation;
or
- have attended a relevant training course, and received accreditation relating to the work being undertaken, and
- show competence and knowledge of the relevant testing methods and procedures.

3.4 Filling the Pipeline

New pipelines should preferably be filled from the low end of the line. The rate of flow and time of day for filling may be controlled by the availability of water. Where the pipeline is to be charged with water from the existing reticulation network, the filling rate of flow should not cause a pressure drop that will be noticeable or cause inconvenience to consumers. Water from an alternative source shall not be used to fill pipelines for testing purposes unless the quality of the water complies in all respects with grade B (or better) for water Source and Treatment of the Public Health Grading of Drinking-Water Supplies.

It may be necessary to carry out the filling, flushing or swabbing operations at times that do not coincide with peak demands on the reticulation network. The pipeline designer should specify the filling times and rates of flow, especially where large diameter pipelines are involved.

Suitable means of introducing flushing water, including temporary facilities for launching and release of swabs (as appropriate) shall be installed as part of the testing procedure and a means provided for the safe disposal of any water that is flushed from the pipeline.

A suitable backflow preventer shall be used on any connection made to fill, flush out or to drive a swab or swabs through a new pipeline. A dual check valve (without test facilities) will be suitable provided its effectiveness is confirmed prior to use.

3.5 Pressure and Volume Measurement

The accuracy and readability of pressure monitoring and make-up volume measurement equipment used for pressure testing can have a significant bearing on the interpretation of pressure tests. This is particularly so when a pipeline contains a significant amount of air.

Appendix B gives detailed requirements for volume and pressure measurement equipment.

3.6 Test Section Length

The pipeline length tested may be either the whole or a section of the pipeline, depending on the length and diameter, the availability of water and the spacing between sectioning valves or blank ends. When installing long pipelines, it is advisable to begin testing early in the installation to confirm the adequacy of the laying procedures, and to increase the length tested progressively as experience is gained. The Contract documents may contain specific requirements that effectively control the length/s to be tested.

Note: Long sections may incorporate large numbers of mechanical joints that may need to be checked for leakage if there is a test failure. Leaks become harder and more costly to pinpoint in longer test sections.

Pipeline test sections longer than 1,000 m may need to be tested in shorter sections. If long lengths are to be tested, the use of radios or cell phones may be necessary to facilitate the testing procedure.

Pipelines should be tested in suitable lengths so that:

- The overall pressure at the lowest point of the line does not exceed the STP.
- The pressure at the highest point in the section is at least equal to the MDP.

- Sufficient suitable water is available for the test and there are appropriate plans in place for the disposal of the test water (including disinfection residual if applicable).
- Site considerations such as; mixed pipe materials, locations of blank ends to ensure safe and convenient accessibility, etc are taken into account.

3.7 Test Duration

The test duration will vary depending on the testing method used. The main test phase for any method will be at least an hour and may take more than one working day. The test duration given in the specification or in the approved methodology shall be used.

3.8 Pipe Temperature

The temperature of the pipe may need to be taken into account when testing plastics pipes. If the average temperature of the pipe wall is greater than 23°C the test pressure may have to be reduced to allow for pipe material de-rating requirements. This situation can occur where pipelines are not buried, but are exposed to the sun.

Refer also to Appendix B for additional comments on temperature effects.

3.9 Test Methodology

The Contractor shall provide a test methodology for the Engineers approval prior to commencing testing. The methodology shall include at least the following:

- names and experience/qualifications of the personnel to be used
- details of the test length (including any changes in diameter or pipe material) marked on a longitudinal profile of the pipeline
- details of temporary anchors or thrust blocks and sectioning valves
- timing of, method proposed for and rate of filling the pipeline (including details of backflow prevention equipment proposed)
- details of method for removal of air from the line
- details of the pressurising pump, its capacity and the method proposed for controlling pulsation's and ensuring that the STP is not exceeded
- pressure rating of the lowest rated pipeline component
- system test pressure
- test duration
- details of the test rig (pressure gauges and/or transducer and data logger to be used)
- details of the method (and equipment) proposed for determining make-up water volume or volume discharged in confirming the remaining air for the rebound test
- method for ensuring that line valves seal satisfactorily
- acceptance criteria for the method proposed

- maximum allowable concentration of total available chlorine that can be discharged to a stormwater system or natural channel (if applicable)
- proposals for disposal of water drained on completion of the test, including the method of de-chlorination and the means of measuring the chlorine residual to ensure it does not exceed the allowable value (if applicable)
- test record sheet proposed

3.10 Acceptance Test Requirements

3.10.1 General Requirements

The length to be tested shall be as scheduled in the contract documents or as planned by the Contractor in the approved methodology. If any test proves to be unsatisfactory, detect and rectify the fault/s, and re-test. Even if testing procedures produce a satisfactory result, any visible leaks that are discovered shall be rectified and the pipeline re-tested.

Acceptance testing may be done progressively, but shall not be commenced before:

- at least 2 working days notice of the intention to start testing has been given to the Engineer
- the Contractors written testing methodology and all equipment (including backflow prevention device/s, pressure test rig, makeup volume measurement, etc) have been approved
- suitable means for filling and flushing, including temporary facilities for launching and release of swabs (as appropriate) are in place
- the Engineer has approved the source of water and the rate of flow for filling the line
- the section to be tested has been completed and backfilled (joints, fittings and connections visible) and is in conformity with the specification
- any permanent or temporary concrete thrust blocks have been poured and have attained sufficient compressive strength to resist test thrusts
- end caps (that allow for filling and bleeding of air) and any temporary anchors are in place and are adequately braced to resist test thrusts
- air valves (if applicable) are installed and their isolating valves are open
- arrangements have been made for the safe disposal of water flushed from the pipeline
- contingency plans are in place for dealing with a possible pipeline burst
- suitably qualified personnel are on site to carry out, oversee and approve the acceptance test
- appropriate and approved record sheets are available for recording all aspects of the test

3.10.2 Filling the Pipeline

Nelson City Council will make water available from its reticulation for the first filling and flushing operations at no cost to the Contractor. Water used for any subsequent fill/s and flushing will be charged at Council's current supply rate. The quantity of water to be charged shall be as measured by meter or as assessed by the Engineer if suitable metering equipment is not used.

The pipeline shall be filled at the approved rate, in accordance with the following conditions:

- fill from the low end and ensure that air valves and venting points are open and operating
- run a polyurethane foam swab along with the filling water to assist with air removal if specified or approved
- where swabbing is not carried out, flush (if possible and approved) the pipeline at a rate that will transport construction debris to scour point/s and air to vented connections and air valves
- make sure that the filling or flushing operations do not cause an unacceptable pressure drop in the reticulation
- make adequate provision for the safe disposal of any flushed water
- raise the pressure in the pipeline to the pipeline DP as specified or to $75 \pm 5\%$ of the STP if the DP is not specified
- repair any leaks or make good any defects that are revealed
- allow the pipeline to "soak" for a period of 2 to 24 hours (or more) to allow the temperature to stabilise and any time dependent movement to take place (the longer period may be necessary for saturation of cement mortar linings on pipes or fittings)
- a disinfection solution may be introduced with the fill water or final flushing water if approved by the Engineer

3.10.3 System Test Pressure (STP)

The STP shall be as set by the system designer. If the STP has not been specified, the pipeline shall be subjected to a pressure that is the lower of:

- $1.25 \times \text{PN}$ of the lowest rated pipe or component installed in the section to be tested, or

Where surge pressures have been included:

- $\text{DP} + 100\text{kPa}$, or

Where surge pressures have not been included:

- $\text{DP} + 500 \text{ kPa}$, or $1.5 \times \text{DP}$ (whichever is the greater),

Where short lengths of pipeline are tested separately, e.g. for service pipes of $\text{DN} \leq 63$ and of ≤ 100 metres the STP may be taken as the DP unless otherwise specified.

3.10.4 Pressure Monitoring Point

The pressure shall be monitored at the lowest part of the pipeline or if that is not possible, at some other convenient point and the STP adjusted to take account of the elevation difference between the pipelines lowest point and the test rig. The adjustment shall be made by subtracting 10 kPa for every metre elevation that the rig is above the lowest part of the line.

3.11 Pressurising the Pipeline

3.11.1 Test Pump Capacity

The pump capacity is an important consideration. If its capacity is too small, it may take too long to reach the test pressure, conversely, if its capacity is too great, it may not be controllable and could cause over-pressurisation.

If a motorised test pump is used, it shall be fitted with an adjustable pressure relief valve that is set to discharge the full flow of the pump at a pressure equal to the PN of the pipe. To pressurise the pipeline, the relief valve setting should be gradually adjusted to raise the pressure in a controlled manner until the STP is reached. Continual discharge from the relief valve is preferable to the possibility of overloading the pipeline. The test pump should not create excessive pulsation's that may affect the ability to achieve the STP accurately. A surge-damping device may be needed to control pressure pulsations.

3.11.2 General Comments

Pressurising the pipeline above the DP (or 75% of the STP) shall not begin until the Engineer and Designer (if appropriate) is on site to witness the test, unless the Engineer has given prior approval.

The pressure shall be raised steadily and smoothly to the STP and must not be raised to more than 1.5 x the PN of the lowest rated component in the line.

If over pressurisation is considered by the Engineer to have compromised the pipeline materials integrity, the Contractor may be liable for all costs involved in replacing and relaying the over-stressed section of pipeline. The degree and duration of the over pressurisation will have a bearing on the outcome and the Engineer may wish to consult with a recognised expert in pipeline materials before making a ruling. The Contractor shall be responsible for any costs incurred and for any delays that may be associated.

3.12 Testing Against a Closed Valve

Pressure testing against a closed valve is not acceptable. The test line shall be blanked off and suitably anchored.

3.13 Final Pressure Test

When a pipeline has been divided into two or more test sections for pressure testing and all sections have tested satisfactorily, the total pipeline shall be pressurised to the DP. After one hour at the DP, all joints on closer pipes between sections or any additional components that have been installed after the pressure test of the adjacent sections shall be inspected visually for leaks and changes of line or level. This inspection shall only be carried out in dry weather or if a suitable shelter is erected over the joints and the area dried sufficiently to show dripping or weeping.

If, for any reason, it is not possible to observe leakage at joints on closer sections, the final test shall be carried out using a full test procedure as per

the appropriate test method for the pipeline material. The STP for this final test shall be selected so that:

- the pressure at the lowest part of the pipeline does not exceed $1.5 \times PN$ of the lowest rated component in the system
- the pressure at the highest part of the line is at least equal to the MDP

The Engineer shall be advised so that the final test can be witnessed before backfilling. Any leakage or other fault shall be rectified and the test repeated until there is no fault.

3.14 Connections to Existing Pipelines

No connection to an existing pipeline shall be made until the new pipeline and any connecting pipes and fittings have been disinfected. The joints between the new pipeline and existing pipelines shall be subjected to the operating pressure for at least one hour and then inspected for leakage. This inspection shall only be carried out in dry weather or if a suitable shelter is erected over the joints and the area dried sufficiently to show dripping or weeping.

The Engineer shall be advised so that the final connecting joints can be witnessed before backfilling. Any leakage or other fault shall be rectified and the test repeated until there is no fault.

3.15 Additional or Failed Pressure Tests

The cost for the Engineer to attend pressure tests that fail shall be a cost to the contractor for Council contracts and a cost to the Developer when the work is for a subdivision.

3.16 Reporting

A complete record of all details of the test shall be made. This record shall include the following:

- full details of the pipeline tested (including details of pipe material, diameter and pressure class, pressure rating, manufacturers identification, jointing system, pipeline profile showing changes in pipe material as well as the location of valves and fittings, and the location of test sections)
- failure of any thrust block, pipe, fitting or other component
- any visible leakage detected and repaired
- a detailed record of the pressure in the pipeline at appropriate time intervals. This may be from a pressure data logger or by manually recording times and pressure readings at appropriate intervals
- details of the addition of make-up water (either by volume drawn off or volume pumped in)
- the allowable quantity of make up water for the test conditions
- confirmation that valves sealed when subjected to DP on one side
- whether the pipeline passed or failed the test
- the signatures of the representatives of the Contractor, Engineer and/or Designer who witnessed the test

A suitable record form is attached as Appendix A.

3.17 Completion of the Test

After testing, release the test pressure slowly and if necessary, open air valves and drain points to drain the line. If the pipeline has been disinfected, do not drain it until just prior to final commissioning so that the risk of contamination is minimised.

If it is necessary to drain a line that contains a disinfection residual of chlorine, this residual shall be reduced to an acceptable level before being discharged to a storm water system. Alternatively, (and with the Engineers approval) the chlorinated water may be discharged to the sewage system provided a positive air gap separation is maintained at all times and the rate of discharge does not overload the sewer.

4.0 Method for Pressure Testing DI, CLS, PVC-U, PVC-O, PVC-M & GRP Pipelines

4.1 Pressurising the Pipeline

Pressurising of the pipeline above the DP (or 75% of the STP) shall not begin until the Engineer and Designer (if appropriate) are on site to witness the test, unless the Engineer has given prior approval.

The pressure shall be raised steadily and smoothly to the STP and shall not be raised to more than 1.5 x PN of the lowest rated component in the line.

Maintain the STP, by pumping at 15-30 minute intervals (if necessary) for the specified test duration (usually at least one hour). Measure and record the quantity of make-up water added at each occasion, either by the volume pumped in or the volume drawn off method as detailed in the Contractors approved test methodology or Appendix B. Restore the STP whenever the pressure drops by more than 5%.

4.2 Acceptance Criteria

The pressure test shall be satisfactory if:

- There is no failure of any thrust block, pipe, fitting or other pipeline component
- There is no visible leakage – if a leak is suspected but not visible, use aural or ultrasonic assistance to locate
- The total make-up water volume does not exceed the maximum allowable quantity as calculated from the equation:

$$Q(\text{litres/hr}) \leq (0.14 \times L \times D \times H)$$

Where:

L = Length of pipeline under test (km)

D = Internal diameter of pipe (m)

H = Average value of head in the pipeline over the full test length (m)

4.3 Failure of Test

Should the test fail, the cause shall be located and rectified and the section re-tested until satisfactory results are obtained.

Failure to allow adequate "soak" time for a cement mortar lined pipe or if there is a significant amount of entrapped air in the pipeline may result in an inconclusive test or a marginal failure. In such a case, the test period may be extended for a further one to two hours, as may be agreed between the Contractor and the Engineer.

Provided the quantity of make-up water meets the acceptance criteria during the last hour of this extended period, the pipeline will pass the test.

When PE service connections or sub-mains are tested along with a main pipeline, the visco elastic creep of these pipes may cause a test failure. It may be necessary to isolate the PE sections and test these separately or to apply the methods given in sections 5 or 6.

4.4 Reporting

On satisfactory completion of the test, the test report shall be prepared by the Contractor and signed off by the Contractor, Engineer and Designer witnessing the test.

5.0 Method for Pressure Testing Visco-Elastic Pipes (PE) – Rebound Method

5.1 General

Pressurising of the pipeline above the DP (or 75% of the STP) shall not begin until the Engineer and Designer are on site to witness the test, unless the Engineer has given prior approval.

A Pressure transducer and data logger is required for monitoring the pressure during this test method. However, results are to be supplied in an Excel spreadsheet or 'CSV' file.

5.2 Preliminary Phase

This preliminary phase is necessary before proceeding to the subsequent phases. It is intended to set up the prerequisites for volume alterations that are dependent on pressure, time and temperature.

- After flushing/swabbing and thoroughly venting the pipeline, depressurise to just above atmospheric at the highest point of the line and allow a relaxation period of at least 60 minutes to release pressure related stress. Ensure that no air enters the line.
- After the relaxation period, raise the pressure steadily and smoothly to the STP (it must not be raised to more than 1.5 x PN of the pipe or fittings). Maintain the STP for a period of 30 minutes by pumping continuously or at short intervals. Take care not to exceed the STP. During this time, carry out an inspection to identify any obvious leaks.
- Stop pumping and allow the pressure to decay by visco-elastic creep for 1 hour.
- Measure the remaining pressure at the end of the hour.

- If the pressure has dropped to 70% (or less) of the STP, the pipeline will not pass the test and the cause should be located and rectified. This could be due to leakage or temperature change. If the pressure at the end of the hour >70% of the STP, continue with phase two, the pressure drop test to prove the volume of air in the pipeline is sufficiently low to allow the main test phase to be carried out.

5.3 Pressure Drop Test

The main test phase requires that the pipeline has been adequately vented and the volume of remaining air is less than the calculated maximum allowable. The procedure to confirm the air volume is described below. This test (pressure drop test) is carried out immediately after the completion of a successful preliminary phase.

- Reduce the pressure remaining in the pipeline rapidly at the end of the preliminary phase by opening a metered "bleed" connection to produce a pressure drop (Δp) of 10 – 15% of the STP. The bleed time should be kept as short as possible, (preferably less than 2 minutes). A large diameter/volume test section will require a large connection and meter in order to achieve the bleed time requirement – this should be confirmed by calculation.
- Measure accurately and record the volume of water "bled" from the line (ΔV).
- Measure and record the temperature of the water within the pipe at the end of the pressure drop phase and at the finish of the test.
- Calculate the maximum allowable water loss (ΔV_{max}) using the following formula. The volume of water removed should not exceed ΔV_{max} .
- If ΔV is more than ΔV_{max} , stop the test and remove excess air.

$$\Delta V_{max} = 1.2V\Delta p [1/E_w + D/eE_R]$$

Where:

ΔV_{max} = allowable water loss in litres

V = total volume of the tested pipeline in litres

Δp = measured pressure drop in kPa

E_w = bulk modulus of water (kPa) @ test temperature (see Table 1)

D = internal pipe diameter in metres

e = wall thickness of the pipe in metres

E_R = modulus of elasticity of the pipe wall in kPa (see Table2)

1.2 = an allowance for remaining air

Table 1 – Bulk Modulus of Water at Various Temperatures

TEMPERATURE °C	BULK MODULUS (kPa)
5	2080000
10	2110000
15	2140000
20	2170000
25	2210000
30	2230000

Table 2 – E Modulus of PE 80B and PE100 at Various Temperatures

TEMP . °C	PE 80B - E Modulus (kPa) @ hrs			PE 100 – E Modulus (kPa) @ hrs		
	1 hour	2 hours	3 hours	1 hour	2 hours	3 hours
5	740000	700000	680000	990000	930000	900000
10	670000	630000	610000	900000	850000	820000
15	600000	570000	550000	820000	780000	750000
20	550000	520000	510000	750000	710000	680000
25	510000	490000	470000	690000	650000	630000
30	470000	450000	430000	640000	610000	600000

Notes:

The value of ER should be representative of the temperature and duration of the test (see Table 2 above).

Δp and ΔV should be measured as accurately as possible, especially where the test section volume is small. =

5.4 Main Test Phase

The visco-elastic creep due to the STP is interrupted by the rapid pressure drop described above. The rapid drop in pressure leads to the contraction of the pipeline. Observe and record the increase in pressure that results from the contraction of the pipeline for a period of 30 or 90 minutes.

5.5 Acceptance Criteria

The pressure test shall be satisfactory if:

- There is no failure of any thrust block, pipe, fitting or other pipeline component.
- There is no visible leakage.
- The pressure shows a rising tendency throughout 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 20kPa over the full 90-minute period.
- If the pressure drops by more than 20kPa during the 90 minute extended period, the test fails.
- Repetition of the main test phase may only be done by carrying out the whole test procedure including the relaxation period of 60 minutes described in the preliminary phase.

5.6 Failure of Test

Should the test fail, the cause shall be located, rectified and the section re-tested until satisfactory results are obtained.

5.7 Reporting

On satisfactory completion of the test, the test report shall be prepared by the Contractor and signed off by the Contractor, Engineer and Designer witnessing the test.

6.0 Method for Pressure Testing Visco-Elastic Pipes (PE,) – Volumetric Method

6.1 Purpose

This method is included as a reference method that can quantify the amount of leakage in a visco-elastic pipeline. It will generally require a greater length of time to achieve a result.

6.2 Pressurising the Pipeline

The pressure shall be raised steadily and smoothly to STP. (It must not be raised to more than 1.5 x PN of the pipe or fittings).

When the STP has been reached, isolate the pipeline and allow the pressure to decay naturally for 12 hours. (The pressure will drop significantly during this pre-stressing period).

After 12 hours, re-apply and maintain the STP for 5 hours as detailed below:

- Restore the STP at the end of the 12 hour pre-stressing period

- Restore the STP at the end of hour 1
- Restore the STP at the end of hour 2
- Measure and record the water volume (V1 Litres) needed to restore the STP at the end of hour 3
- Restore the STP at the end of hour 4
- Measure and record the water volume (V2 Litres) required to restore the STP at the end of hour 5

Calculate

$$V2 \leq 0.55 \times V1 + Q$$

Where:

Q is the allowable make-up volume obtained from the equation:

$$Q \text{ (litres/hr)} \leq (0.14 \times L \times D \times H)$$

Where:

L = Length of pipeline under test (km)

D = Internal diameter of pipe (m)

H = Average value of head in the pipeline (m)

6.3 Acceptance Criteria

The pressure test shall be satisfactory if:

- There is no failure of any thrust block, pipe, fitting or other pipeline component.
- There is no visible leakage – if a leak is suspected but not visible, use aural or ultrasonic assistance.
- The make-up water volume (Q) does not exceed the maximum allowable volume as calculated.

6.4 Failure of Test

Should the test fail, the cause shall be located, rectified and the section re-tested until satisfactory results are obtained. Note that the STP and the quantity of water required to restore the STP must be measured as accurately as possible.

6.5 Reporting

On satisfactory completion of the test, a test report prepared by the Contractor shall be signed off by the Contractor, Engineer and Consultant witnessing the test.

7.0 Pressure Test Record

Nelson City Council

PRESSURE PIPELINE - TEST RECORD

PIPE PURPOSE: DATE:
 LOCATION: DESIGNER:
 CONTRACTOR: FOREMAN:
 CONSULTANT OBSERVER: COUNCIL OBSERVER:

OPERATING & TEST DETAILS

MAX. OPERATING PRES:
SYSTEM TEST PRESSURE:
PASS CRITERIA:
PASSED THE TEST?
 SIGNATURES:

MAIN PIPELINE DETAILS

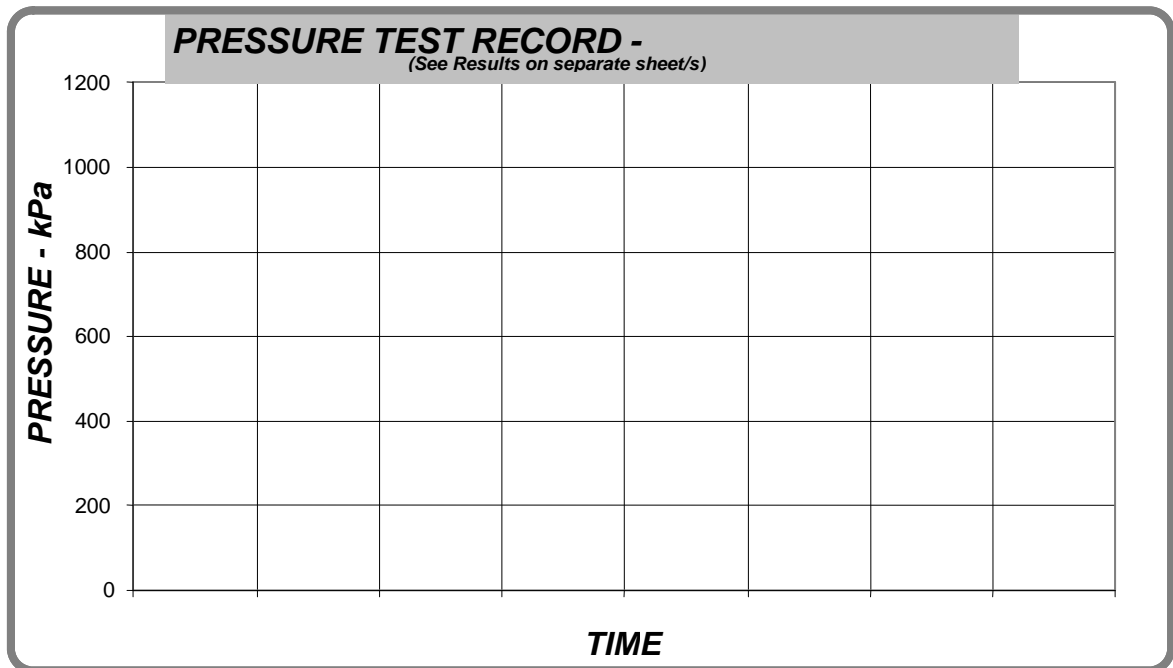
PIPE MAKE/DESCRIPTION: PIPE OD (mm):
 NOMINAL DIAMETER: PRESSURE CLASS:
 PIPE MATERIAL: LENGTH OF PIPE:
 JOINTING SYSTEM:
 PIPE SERIAL NUMBER/S:

RIDER MAIN DETAILS

PIPE MAKE/DESCRIPTION: PIPE OD (mm):
 NOMINAL DIAMETER: PRESSURE CLASS:
 PIPE MATERIAL: LENGTH OF PIPE:
 JOINTING SYSTEM:
 PIPE SERIAL NUMBER/S:

HOUSE CONNECTION DETAILS

PIPE MAKE/DESCRIPTION: PIPE OD (mm):
 NOMINAL DIAMETER: PRESSURE CLASS:
 PIPE MATERIAL: LENGTH OF PIPE:
 JOINTING SYSTEM:
 PIPE SERIAL NUMBER/S:



8.0 Measurement of Make-up Water Volume

There are two equivalent methods for measuring the volume of make-up water; i.e. measurement of the volume drawn off or the volume pumped in.

8.1 Measurement of the Volume Pumped in

At the end of the test period (or at intervals during the test) measure and record the reduced pressure in the main. Then restore the STP by pumping and measure the volume that is pumped in.

The quantities of water pumped in should be summed if it's necessary to raise the pressure in the line more than once during the test.

The volume of water pumped into the pipeline may be measured by any suitable device. A 15 or 20-mm class C or D water meter may be appropriate, provided the inflow rate is within the meters' Q_{min} and Q_{max} .

The quantity of water may be quite small (especially for a small diameter and short length of main). If a motorised test pump is used, it may be difficult to control the rate of pressure rise and pump pulsations may affect the water meter's accuracy. If this is the case, the use of a hand pump should be considered or the "volume drawn off" method used.

8.2 Measurement of the Volume Drawn off

At the end of the test period (or at intervals during the test) measure and record the reduced pressure in the main. Restore the STP by pumping and measure the volume that has to be drawn off to reach the reduced pressure previously recorded, then restore the STP. This whole operation should be carried out as quickly as possible, consistent with ensuring the accuracy of the pressure and volume measurement.

The quantities of water drawn off should be summed if it's necessary to restore the pressure in the line more than once during the test.

The volume of water drawn off may be measured by any suitable device. A 15 or 20-mm class C or D water meter may be appropriate, provided the outflow rate is within the meters' Q_{min} and Q_{max} .

8.3 Accuracy of Pressure and Volume Measurement

The equipment used to determine the make-up volume shall be capable of measuring the quantity of water to an accuracy of $\pm 2\%$ or better.

The precision of the pressure measurement will have an effect on the accuracy of the volume measurements, especially if a significant amount of air remains in the pipeline. The precision with which the STP is set and restored will also have an effect on the test results. Measurement of the volume drawn off may be more precise and controllable than the volume pumped in. The equipment (pressure gauges and volume measuring devices) shall be to the accuracy specified and every care shall be taken to ensure that the results are as accurate as the equipment will allow.

8.4 Acceptable Pressure Measurement Devices

The accuracy and readability of pressure monitoring equipment used for pressure testing can have a significant bearing on the interpretation of pressure tests. This is particularly so when a pipeline contains a significant amount of air.

The pressure range of the gauges used shall be such that the STP falls within the range 50 - 90% of the full-scale range of the gauge. The main gauge shall have been calibrated within 6 months of use and have a minimum dial diameter of 100-mm

(preferably 150 mm). A check gauge of a similar pressure range shall also be used to confirm the calibration of the main gauge. (A "test" pressure gauge with an accuracy of $\pm 0.5\%$ of full scale is preferred for the main gauge).

Alternatively, a data logger may be used to log the pressure signal from an accurately calibrated pressure transducer. A suitable "check" pressure gauge shall be used in conjunction with the pressure transducer to confirm the calibration of the transducer. The test gauge shall be read at frequent intervals and the readings recorded for later comparison with the data logger results. The data logger shall be set to log the pressure at suitable intervals that are not more than 2 minutes apart for PE pipeline tests and 5 minutes for testing pipelines of other materials.

Note that pressure pulsations from a motorised test pump may destroy a pressure gauge unless some form of pressure damping is incorporated to protect the gauge.

8.5 Preferred Pressure Test Rig

The preferred rig shall have a recently calibrated pressure transducer and check pressure gauge.

The transducer shall have:

- non-linearity and hysteresis within $\pm 0.2\%$
- a resolution of 0.02 bar or better
- a pressure range so that the output at STP is 50 - 90% of full scale
- been checked for calibration within the last 6 months
- a data logger capable of storing the pressures at 2-minute intervals over a period of up to 24 hours

The check pressure gauge shall have:

- a dial of ≥ 100 -mm
- readability to within 10 kPa
- a pressure range so that the STP falls within 50 - 90% of the range
- been checked for calibration within the last 6 months

The transducer and the check gauge shall read within 3% of each other. If they do not agree within this limitation, the cause shall be determined and the faulty unit/s replaced or recalibrated at the Contractor's cost.

8.6 Alternative Pressure Test Rig

The pressure test may be conducted using two pressure gauges.

The main "test" gauge shall have:

- an accuracy of $\pm 0.5\%$ of full scale
- ≥ 100 -mm dial
- readability of 5 kPa
- a pressure range so that the STP falls within 50 - 90% of the range

The check gauge shall have:

- an accuracy of $\pm 1\%$ of full scale
- ≥ 100 -mm dial
- readability of 10 kPa
- a pressure range so that STP falls within 50 - 90% of the range
- been checked for calibration within the last 6 months

The gauges shall read within 3% of each other. If they do not agree within this limitation, the cause shall be determined and the faulty unit/s replaced or recalibrated at the Contractor's cost.

The test rig shall incorporate provision for manually bleeding air as well as an isolated 15-mm BSP socket to allow for the installation of an independent check gauge.

In the case of a dispute over a pressure test result, a pressure transducer and data logger and check gauge shall be used for any re-testing that may be necessary.

8.7 Effects of Entrapped Air

Air trapped in a pipeline during the test will affect the test results. As much air as possible should be expelled from the pipeline during filling and before the pressure test is commenced. Air removal may necessitate swabbing.

8.8 Pipe Temperature and Temperature Changes During the Test

The temperature of the pipe may need to be taken into account when testing plastics pipes. If the average temperature of the pipe wall is greater than 23°C the test pressure may have to be reduced to allow for pipe material de-rating requirements. This situation can occur where pipelines are not buried, but are exposed to the sun.

Changes in temperature during the test can have a significant effect on the internal pressure as a temperature change can cause the pipe to expand or contract. Under normal circumstances, the temperature of a buried pipeline will remain relatively constant after initial filling and stabilising.

Note that the temperature of any water added to a pipeline (e.g. to restore the STP) should be within $\pm 3^\circ\text{C}$ of the temperature of the water already in the pipeline.

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8. TRENCHING AND REINSTATEMENT

8.1 INTRODUCTION

The purpose of this section is to clearly outline Council's requirements for excavation, backfilling and reinstatement works within the road reserve and public property.

It is important to ensure that all excavation works are completed to a high standard with minimal disruption to the surrounding environment.

8.1.1 Objectives

Council must ensure that all trenching and excavation works meet the following objectives:

- a) The health and safety of the public, particularly the local community, has been ensured;
 - 1) The level of the service is as good as or better than the existing standard of service following the new excavation works;
 - 2) All practicable steps have been taken to minimise the level of disruption;
 - 3) Council has been informed of excavation works and all steps have been taken to follow standards and conditions of notification;
 - 4) Any affected or potentially affected persons have been notified in advance of the proposed disruption;
- b) Remediation and reinstatement works have been completed to the same or higher standard than prior to the initiation of works.

8.1.2 Key References

- a) Table 8-1 sets out the New Zealand Standards and other publications that apply to the design and construction of trenching and reinstatement within the road reserve and public land. Where a Standard or publication is referenced this shall be the current version including any associated amendments

Table 8-1 Minimum Standards for Trenching and Reinstatement with Road Reserve or Public Land

Document	Reference
NCC Land Development Manual	Liability for maintenance in the road reserve lies with the Road Controlling Authority.
National Code of Practice for Utilities, Access to the Transport Corridors	Working on the Road - for Temporary Traffic Control and Safety at Roadwork Sites
NZS 6803	The Measurement and Assessment of Noise From Construction, Maintenance and Demolition Works'
NZS 3116	Concrete segmental and flagstone paving
New Zealand Standards	Compaction standards
NZ Health and Safety in Employment Act 1992	

8.2 GENERAL

- a) Unless resolved otherwise by the Council, all new telecommunications, broadcasting and electricity cables, fittings and equipment in the road reserve shall be laid underground.

8.2.1 Public Liability

- a) Any operator undertaking excavation and reinstatement works within the road reserve shall have current Public Liability Insurance cover. The policy shall also include a local authority Extension Clause indemnifying the Council against liability for any damage, loss or injury for an amount not less than \$2,000,000 for any claim or series of claims arising out of the existence of a trench or excavation or other obstacle associated with the work.
- b) Compliance with any instruction of the Council, or any person acting on its behalf, in performing what is considered to be necessary actions in terms of this "Specification" shall not absolve the operator from any legal liability that he would otherwise have had in regard to claims for damage or failure of work for his client.

8.2.2 Approved Operators

- a) Only Operators approved by the Council shall be permitted to undertake trenching and reinstatement works within road reserves within the Nelson City area.
- b) The Council may require the Operator to pay to the Council a Cash Deposit or enter into a Bond for the performance of their works in the District prior to work commencing. The amount of this deposit or bond shall be for the full cost of the said works to a maximum of \$10,000.

8.3 NOTIFICATION

8.3.1 Corridor Access Request

- a) A Corridor Access Request (CAR) as set out in the 'National Code of Practice for Utilities, Access to the Transport Corridors' is required to be lodged by the Operator at the Council for each separate job or section of a continuing job, which involves excavation, or the lifting of the surface within a road reserve in the City of Nelson. A copy of these CAR application forms is available on the NCC website (www.nelsoncitycouncil.co.nz)
- b) For minor work the CAR must be lodged at least five working days before work starts, unless otherwise agreed. For major and project work, the CAR must be lodged at least fifteen working days before work starts, unless otherwise agreed.
- c) Where emergency maintenance is necessary, the notice shall be lodged on the next working day. For routine service connection where the area of surface disturbance is less than 1 square metre, a schedule of work completed shall be required to be submitted on a monthly basis. If the road involved is a State Highway, the notice shall require confirmation that New Zealand Transport Agency has been notified and if any special conditions imposed by that body have been received.

8.3.2 Plans

- a) Plans of the proposed work shall be submitted to the Council with the CAR. The plans shall be to a scale of 1:500 or 1:200 where needed for clarity and shall show the location and size of all existing and proposed cables, conduits, pipes, underground structures, property boundaries and kerb lines. Dimensions to boundaries and kerbs shall be shown and proposed depths below existing surface levels shall be shown at regular intervals.

8.3.3 Notification to other Service Authorities

- a) The operator shall advise other affected Service Authorities of proposed construction works. Confirmation that other affected Service Authorities have been advised of planned works shall be indicated on the CAR.

8.3.4 Issue of Work Approval Notice

- a) Providing that all required information has been supplied with the CAR, the Council shall issue a Work Approval Notice (WAN) and advise of existing Council services in the locality and any specific conditions related to the proposal. No works may commence in advance of the WAN being issued. WAN are valid for six (6) months from the date of issue unless agreed otherwise by the Engineering Manager.

8.3.5 Fees

- a) A charge for each WAN issued will be made in accordance with the rates that may be set by the Council from time to time.

8.4 CONSTRUCTION REQUIREMENTS

8.4.1 Disruption to Public

- a) Normal work hours shall be between 0700-1800 hours, Monday to Saturday. Works on arterial streets may be limited to 0900-1600 hours or other hours as may be appropriate. Work hours within the CBD (Central Business District) shall be as approved by the Council.
- b) During any construction in the street, the disruption to the public and adjacent residents shall be kept to a minimum.
- c) Noise created by construction shall be kept to a minimum and shall not exceed the levels described in part 5 of NZS 6803P.
- d) Arterial streets comprise of: all State Highway 6, Main Road Stoke, Waimea Road, Rutherford Street, Haven Road and Trafalgar Street between Halifax Street and Queen Elizabeth 2 Drive.
- e) Arrangements shall be made to damp down work areas and excavated material as may be required from time to time to eliminate any dust nuisance.

8.4.2 Public Relations and notification

- a) Prior to planned excavation commencing, the operator shall give written notice (48 hours) to all affected residents and business owners of the nature of the work and who to contact for further information or to convey complaints. Twenty four (24) hours notice shall be given to the occupiers of any property which will have its access blocked for more than one hour and shall be notified in writing and in sufficient time to enable them to remove any vehicles etc from their property. The Operator shall also ensure parked cars etc are moved off the site.

8.4.3 Temporary Traffic Control, Public Safety

- a) The Operator's attention is drawn to the employees' and sub-contractors' obligations under the Health and Safety in Employment Act 1992.
- b) All Operator's who carry out work which may impact on the normal use of the roads and/or footpaths must submit a Traffic Management Plan to NCC for approval before commencing works. The Operator shall as a minimum comply with the requirements of the NCC Traffic Management Guidelines, June 2003 and submit a Traffic Management Plan prior to the commencement of work.
- c) The Operator shall be responsible for the supply, erection and maintenance of all necessary barricades, lights, warning notices, traffic control signs etc.
- d) Should the Operator wish to use any alternative methods of traffic control, the prior consultation with and approval of the Council shall be required.

- e) Should the Police (Traffic Safety Branch), Occupational Safety and Health Service or the Council consider at any time there is a risk to traffic, the general public or the Operator's employees, the Operator shall immediately provide such other traffic control etc, necessary to achieve the required standards. This may include the erection of additional barricades, lights, warning notices or traffic control signs including, where necessary, the provision of staff to control traffic.
- f) Failure by the Operator to provide adequate safety measures may result in a work suspension notice being issued by the Council, until such time as adequate control is provided.
- g) The carriageway shall be fully open to traffic during hours of darkness and not more than half the carriageway shall be closed at any one time, except with the express permission in writing of the Council.

8.4.4 Closure of Streets

- a) No street may be closed to any traffic without the specific written approval of the Council.
- b) The closure of any streets requires public notification. This notification will be carried out by the Council at the Operator's expense.
- c) Where any closure is required for less than twelve (12) hours within any twenty four (24) hour period the Council requires a minimum of forty eight (48) hours notice to approve and advertise any closure.
- d) Where any closure is required for more than twelve (12) hours within any twenty four (24) hour period the Council requires a minimum of 45 days to approve and advertise any closure.
- e) Approval for street closure will only be given where all other options are unsatisfactory.

8.4.5 Position of Service

- a) The positioning of services or mains, wherever possible, shall be in accordance with SD 414 and 415.
- b) Variations from these alignments shall be by written agreement from the Council, following discussions with other affected Service Authorities.

8.4.6 Existing Services

- a) The position of existing Water mains, sewers and other services or structures above or below ground, insofar as they are known, are available for the information of the operator at the offices of the Council and respective Service Authorities, but their positions are not guaranteed. The Operator is strongly advised to make itself fully aware of the position of all underground services in the locality, before commencing work.

- b) Where existing services are damaged as a result of the construction work, the Operator shall immediately advise the owner of the damaged services, (public or private).
- c) The cost of repair or reinstatement of any disturbances or damage to any water pipe, sewer or stormwater drain, other underground services or structure, shall be borne by the Operator.

8.4.7 Road Markings/Survey Marks

- a) All works that are likely to cause damage to any road markings must be brought to the attention of the Council in order that they may be replaced at the earliest possible opportunity for the safety of the general public. The Operator shall be responsible for the cost of any remarking that is necessary. All road marking shall be undertaken by a registered Road Marking Contractor to the current New Zealand Transport Agency standards. Road marking shall be completed within 5 days of resurfacing. Limit lines must be replaced when trafficked. This can be a temporary marking for the first five days. All edgelines, centrelines, continuity lines and limit lines shall be reflectorised Road Markings
- b) The Operator shall avoid disturbance to any survey marks within the vicinity of their work. Where any survey marks are disturbed, the cost of replacing and re-surveying the mark shall be met by the Operator.

8.4.8 Trenchless Technology

- a) Unless impractical or unsafe, installation by trenchless technology shall be required under concrete carriageways and vehicle crossings; at intersections; where there is a large number of existing services; and in areas with any high quality paving surface.
- b) Water jetting shall not be permitted.
- c) Drilling with an auger shall not be permitted under carriageways.

8.4.9 Length of Open Trench

- a) The maximum permitted length of trench to be open shall be 100m unless specifically authorised by the Council.
- b) Notwithstanding this the Operator shall not exceed any length that is not capable of being backfilled and opened to traffic in the same day, nor shall it interfere with two-way traffic flow.
- c) Open trenches shall not be permitted overnight without the prior authority of the Council.

8.4.10 Trees, Shrubs etc

- a) All works that are likely to cause damage to any trees, shrubs, or ornamental gardens within the road reserve, shall be brought to the attention of the Council prior to work commencing. It shall be the Operator's responsibility to make good or replace any damaged trees, shrubs or ornamental gardens.

8.4.11 Water in Trenches/Sediment Control

- a) All open trenches shall be maintained in a dewatered condition and water logged material removed to the satisfaction of the Council. Water from any excavation shall be disposed of to the stormwater main so as not to cause any damage or nuisance.
- b) The Operator shall take all due care to prevent excavated material from being washed into the stormwater system in the event of rain occurring during a trenching operation (See Section 9)

8.4.12 Damage to Kerb and Channel

- a) Where damage occurs to existing kerb and channel the damage shall be made good to the satisfaction of the Council. Where any kerb and channel requires replacing this shall be done by the Council's approved kerbing contractor at the Operator's expense.

8.4.13 Traffic Signals

- a) Where work is to take place within 50m of traffic signals the Operator shall consult with the Council.
- b) Special conditions when working near traffic signals may be imposed by the Council to protect the detector loops and the operation of the signals.
- c) A traffic signals communication network is located in Halifax Street, Collingwood Street, Rutherford Street and Selwyn Place, Putaitai Street and Songer Street. The Operator shall liaise with the Council to locate this network.

8.4.14 Clean Up and Make Good

- a) As work proceeds the Operator shall progressively carry out all restoration and tidying up work. If regular tidying up and restoration is not being done, the Council shall require and instruct the Operator concerned to carry out this work immediately. On completion of the work, the Operator shall remove all plant, materials and other things that may have been brought upon the site in aid of the works, and generally clear away all rubbish and leave the site in a similar or better condition to that which existed before the work was commenced.
- b) Any trees or branches cut down or tree stumps uprooted during the work shall be removed. Branches that require removal should be cut by saw and not broken by machinery. The Operator shall at its own expense, clean out all sumps and repair or reinstate all road surfaces, fencing, walls, floors, lawns, gardens, paths, inclusive of transplanting trees, shrubs etc and make good all damage which may have been caused through his operations to at least as good as the "as found condition" in connection with the work.

8.4.15 Inspections/Maintenance

- a) The Operator shall notify the Council immediately upon the completion of final reinstatement so that an inspection may be made of the completed surface reinstatement works.
- b) The Operator will be held responsible for any street maintenance work required as a result of the excavation and reinstatement operations until twenty four (24) months after notification to the Council that the final surfacing material has been applied including Polymer Modified Bitumen (PMB) and Road Marking. Any such maintenance work required by Council shall be undertaken by the Operator at the Operator's cost within five (5) working days of being notified by the Council to undertake repair works. If on the grounds of safety there is a need for more immediate action this remedial work shall be completed within forty eight (48) hours or such other time as may be directed by the Council. Should this not be complied with, Council reserves the right to arrange or undertake such maintenance work and this work shall be at the cost of the Operator. The (24) month maintenance period will start from the time that the council is notified of completion of remedial works.

8.5 EXCAVATIONS

- a) When an excavation is required to be made through any cement concrete, asphaltic concrete or chip seal surface, the proposed edges of the excavation or trench shall be cut with a power saw prior to the excavation of the trench. The cut is to extend through the full thickness of the surface layer in a clean straight vertical line. The cut shall be 150mm beyond and parallel to the edge of the trench or to a line outside any pavement damage, whichever is greater. Within footpaths all saw cuts shall be parallel to or at right angles to the centreline of the footpath.
- b) Only wet cutting shall be permitted in the CBD, in the vicinity of Suburban Shopping Centres or where directed by the Council, to minimise the problems caused by dust.
- c) Unless approved otherwise by the Engineering Manager, all excavated material shall be removed from the site immediately as excavation proceeds.
- d) Areas adjacent to the excavation shall not be undercut. If slumping of material from the sides of the excavation causes depressed areas adjacent to the excavation or if the edges of the pavement are lifted during excavation, additional saw cutting outside of the original line of the excavation and out side the area of damage shall be required before reinstatement is permitted.
- e) Trench widths shall be kept to the minimum necessary to lay the service and correctly compact the backfill.

8.6 BACKFILLING

- a) The backfilling of excavations shall be undertaken in accordance with SD 801 - 803 using imported backfill material that comply with New Zealand Transport Agency specifications.
- b) Basecourse used in the Pavement section of the backfill shall be to New Zealand Transport Agency (TNZ) M /4 Specifications or SD 402.
- c) The material used for bedding underneath and around the service or service duct shall be as required by the Service Authority. In no case shall it exceed 100mm above the top of the service, unless specific coverage is required by a reticulation pipe laying specification.

8.7 SURFACE REINSTATMENT

8.7.1 General

- a) Surface reinstatement (including sealing) shall be completed prior to vehicle and pedestrian traffic being permitted to use the surface. In all other situations, surface reinstatement shall be completed within 5 days of the trench being opened or such other period as directed by the Council. Variation from this condition shall require the written agreement of the Council. For works within the CBD or Arterial Roads, surface reinstatement shall be completed within 24 hours of the trench being opened or such other period as directed by the Council.
- b) Failure to complete reinstatement within the specified period may result in Council arranging reinstatement at the Operator's expense.
- c) All excavations shall be backfilled, as detailed on SD 801 - 803 to the underside of the proposed wearing surface, or to the finished level if permanent reinstatement is not being undertaken immediately. This temporary over filling shall be removed when permanent reinstatement is carried out. If permanent reinstatement cannot be undertaken immediately, in areas to be reopened for vehicle or pedestrian use, the Operator shall arrange for a 10mm thick layer of fine plant mix or a rubberised pre fabricated chip seal with 100mm over lap laid to manufactures instructions to be applied to the trench immediately backfilling is completed. If Plant Mix is not available a temporary seal of sprayed Emulsion and Grade 6 chip may be substituted with the approval of the Council.
- d) This is to be regarded as a temporary seal only and shall be removed before the permanent resurfacing of the trench is carried out. The Operator shall maintain this surface, even and free draining, until the final restoration is complete. The cost of all temporary resurfacing and subsequent removal shall be born by the Operator

- e) Where work is required within an area that has been re-surfaced within the last five years an alternative route must be identified. If this is not possible then a full width reinstatement shall be carried out. The length of the reinstatement shall be not less than the width of the carriageway (or footpath)
- f) All temporary markings to locate services shall be removed on completion of the works.

8.7.2 Within Carriageways

- a) All permanent surface reinstatement on carriageways shall be completed as shown on SD 801 and 803, and 806, with the finished wearing surface depth, matching that of the existing road and finishing flush with or no more than 5mm above the existing surface. All parts of the surface damaged during or as a result of the work shall be reinstated to an "as found" condition or better. Excavations that are closer than 1.0m horizontal to the existing edge of the seal, kerb and channel or previous excavation reinstatement, shall have a reinstated sealed surface that extends to join with the existing edge of seal, kerb and channel or adjacent reinstatement.
- b) Subject to favourable weather conditions, PMB bandaging shall be completed within 5 days of resurfacing.
- c) On unsealed rural roads and metal shoulders backfilling shall be as for chipsealed carriageways with 50mm of top course being placed as the final reinstatement. Finished levels shall be compatible with the existing pavement.
- d) Surface boxes, e.g. water hydrant boxes, manholes etc shall be installed in their final location during trench compaction and their finished level shall be finished flush with or no more than 5mm above the reinstated pavement surface. All surface boxes and lids shall be raised and adjusted to final level prior to placement of surfacing seal coat.

8.7.3 Within Footpaths and Vehicle Crossings

- a) All permanent surface reinstatement on footpaths shall be completed as shown on SD 802 and 804 - 806 with a finished surface matching the existing and finishing flush with or no more than 5mm above the existing surface. The minimum dimension of any reinstated portion of the footpath shall not be less than 600mm wide. The width of remaining undamaged footpath shall not be less than 600mm. (See SD 804). If these criteria cannot be met the reinstatement shall be across the full width of the footpath. Also the full width of the footpath shall be replaced when trenching in footpaths within the Nelson CBD, Stoke and Tahunanui shopping area, or Arterial, and Principal roads or new footpaths less than 5 years old. (Note, patching of small areas, eg around service boxes, may be permitted by Council).

- b) In concrete footpaths the depth shall match the existing with a minimum thickness of 100mm and the concrete shall attain a minimum compressive strength of 25 MPa after 28 days. Construction joints shall be formed at 6.0m centres and the line and level of the finished surface shall match the crossfall and level of the adjacent undamaged surface.
- c) Vehicle crossings which are affected by the work shall be reinstated with a minimum of 150mm thick concrete for residential crossings, 200mm thick concrete for commercial crossings, while industrial crossings are to match existing with a minimum of 300mm thick concrete. Concrete for commercial and industrial entrance slabs shall be reinforced with 665 WWF. (see SD 409)
- d) Note: In asphaltic concrete and chipsealed footpaths the depth of basecourse at vehicle crossings shall match the depth of the existing basecourse, with a minimum depth of 200mm for commercial and industrial crossings and 150mm for residential crossings.
- e) Surface boxes etc shall be finished to the tolerances specified in Sec. 8.7.2.d).

8.7.4 Within Interlocking Pavement Block Surfaces

- a) The blocks removed during excavation or new blocks of identical shape, thickness and colour shall be replaced on a subgrade similar to that in adjoining undisturbed areas and compacted and filled to give a true surface in accordance with NZS 3116. All paving work shall be carried out by staff competent in this work. Gaps between blocks shall be 2-3mm. Jointing sand shall be 'Pavelock' or similar approved sand. A neoprene sheet shall be used to protect blocks when a plate compactor is used. The minimum size of part blocks used shall be a half block.

8.7.5 Within Grassed Berms and Shoulders

- a) Surface reinstatement to grassed berms and shoulders shall be completed as shown on SD 802. The final 100mm shall consist of topsoil, which shall be raked level with surrounding areas and shall be free of all stones. A dressing of Superphosphate shall be applied at the rate of 30 grams per square metre. Alternative fertiliser and application rates may be used subject to prior consultation and agreement with the Council. After two months a dressing of Sulphate of Ammonia applied at a rate of 30g per square metre shall be applied.
- b) The reinstated area shall be sown with the following grass seed mixture at a rate of 1Kg to 40 square metres and raked into the soil:
 - 1.0kg chewing fescue
 - 4.5kg dwarf rye grass
 - 0.5kg browntop

- c) Alternatively, turfs may be cut from the berm 75mm in thickness and 50mm wider than the trench and stacked for re-use. Full reinstatement shall be achieved within 48 hours with screened top soil being raked into all cut joints, with all turfs being adequately watered immediately following completion of reinstatement.
- d) Surface boxes etc shall be finished to the tolerances specified in Sec. 8.7.2.d) unless in a planted/landscaped (non-pedestrian) area then surface lids shall be finished to 40mm higher than surrounding finished surface.

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9. EARTHWORKS

9.1 INTRODUCTION

This section provides standards for the management of earthworks, excavation, soil disturbance and sedimentation.

The purpose of the earthworks standards is to provide guidance to any operator involved in vegetation removal, excavation, recontouring of land and the preparation of sites for development involving any land disturbance works.

The standards are designed to ensure that any disruption associated with earthworks is minimised, that soil loss and sedimentation are controlled to avoid adverse off-site effects, that development sites are safe and stable, and that finished landscapes are rehabilitated.

Poorly managed earthworks and development can result in soil loss, erosion and instability.

9.1.1 Objectives

Council is responsible for ensuring that all earthworks being undertaken during the construction and installation phases of land development meet the following general objectives:

- a) The extent and scale of disruption has been minimised;
- b) Significant re-contouring and large-scale earth movement has been minimised;
- c) All practicable measures have been undertaken to minimise soil loss, erosion and sedimentation from exposed surfaces;
- d) Finished landscapes, sites for future building development, and surfaces that will become part of the road network, meet geotechnical approval;
- e) Finished landscapes have been rehabilitated to a standard that is the same as or better than the standard of finish prior to the earthworks activity;
- f) The earthworks activity is consistent with all permitted activity standards and conditions, or has obtained resource consent, in terms of the NRMP.
- g) All permitted activity standards, subdivision consents standards and/or conditions of any applicable resource consent have been met.

9.1.2 Key References

The standards and external references set out in Table 9-1 must also be taken into account in the design and management of any earthworks activity. Where a Standard or document is referenced this shall be the current version including any associated amendments.

Table 9-1 Standards and External References

Matter	Standard or reference	Comment
Nelson Resource Management Plan	Earthworks Rule in relevant zone	A resource consent will be required where significant earthworks is proposed and/or where permitted activity standards and conditions cannot be met.
Subdivision	RMA Sections 104 and 106	Conditions may be imposed through the subdivisions consent process. Any applicable conditions must be met prior to Section 224 certificate approval. Subdivision may not be granted if land is not suitable for development as a result of instability, subsidence, inundation and/or erosion.
Engineering Plan and Subdivision Consent Approvals	RMA Section 223 and 224	Prior to Section 223 approval, Council needs to be satisfied that potential house sites can exist and can be serviced. Prior to Section 224 approval Council must be satisfied that house sites do exist.
Consent notice requirements	RMA Section 221	Any conditions may be registered against the property and outlined in consent notices to be recorded on the individual titles pursuant to section 221.
New Zealand Standards	NZS4404, 4402, 4431	General earthworks standards and guidance for the preparation of a future building site or road sub-grade.
Other technical publications	TP10, TP90, TP124 TNZ F/1	Stormwater and sedimentation control technical guidance from the Auckland Regional Council.

9.2 EARTHWORKS

9.2.1 General

The following general principles shall apply to all earthworks in the Nelson City Council area:

- a) All earthworks activities comply with permitted activity standards and conditions of the NRMP.
- b) Information to show compliance with permitted activity standards, or that compliance can be achieved, may be required at the request of Council.
- c) Where permitted activity standards and conditions cannot be achieved, a land disturbance resource consent must be obtained in accordance with the NRMP. The applicant may be required to provide information to show compliance with all conditions of consent;

- d) All earthworks and land disturbance shall be consistent with the principles of earthworks in section 9.2.2 below
- e) Management of sedimentation and control of erosion shall be undertaken in accordance with section 9.3 below;
- f) Where a large earth fill is required, the following information shall be submitted:
 - 1) plans showing contours or levels of the existing site, existing water courses, drainage features and any water table information;
 - 2) a plan showing proposed final contour levels, sections boundaries, the extent of cut and fill;
 - 3) a plan showing batter slopes, surface and subsoil drainage and/or culverting; and
 - 4) the naming of a Designer experienced in soil compaction techniques, who will be responsible for supervising and controlling the operations on the site as set out in the specification.
 - 5) specifications on compaction methods and degrees of compaction required, also giving moisture/density test results of the soil to be encountered;
- g) On completion of the earthworks, certification shall be supplied from the Designer stating that the requirements of the specification have been carried out and giving details of the test results in accordance with the requirements of the specification (as per NZS 4431, section 10);
- h) Stormwater and drainage management must be undertaken in accordance with section 5 of the Land Development Manual.

9.2.2 Principles

All earthworks and land disturbance activities in the Nelson City Council area, regardless of the scale and size of the activity, compliance with permitted activity standards and conditions, or resource consent conditions, must be consistent with the following principles:

- a) Minimise disturbance – significant works should be staged, to minimise the total area of exposed soils at any point in time. Every effort should be made to minimise disturbance of existing vegetation;
- b) Maintain natural drainage – where practicable, retain existing natural contours and features, such as gullies, streams and wetland areas. Avoiding disturbance of these areas can help to reduce the potential for excessive soil loss, erosion, sedimentation and inundation.

- c) Topsoil stripping - All topsoil shall be stripped from the earthwork areas with the stripped area being kept to the practical minimum at any one time. Topsoil should be stockpiled and used in the rehabilitation of the site;
- d) Unsuitable material - All unsuitable material uncovered during stripping or earthworks shall be excavated. Unsuitable material is generally described as any material having a California Bearing Ratio (Scala or equivalent) (CBR) inferred value of three or less;
- e) Compaction - all fill areas must be re-worked and compacted in accordance with the appropriate design relevant to soil conditions and geology.
- f) Protect steep slopes – Steep slopes shall be protected in accordance with section 9.3.2.3 to reduce erosion and sedimentation.
- g) Stabilise exposed areas rapidly – Exposed areas must be stabilised as soon as practicable. Vegetated ground cover is the most effective form of erosion control. Keep machinery off areas that have been stabilised;
- h) Protect watercourses - Vegetation clearance and soil disturbance is not permitted within 10m of the banks of any river or within 200m of the coastal marine area without resource consent as per the NRMP. The realignment of a natural watercourse is not permitted without resource consent;
- i) Install perimeter controls - Install diversion drains, silt fences and earth bunds to divert clean water runoff away from worked areas and keep separate from sediment prone water.

9.2.3 Subsoil Drainage

- a) Subsoil drainage will generally be required for significant areas of fill. More extensive sub-soil drains may be necessary on flatter ground in wet areas.
- b) Sub-soil drains are discouraged under proposed building envelopes as they may be damaged in piling/excavations for the future dwelling.
- c) Subsoil drainage will not be a general requirement for a permeable retaining wall except in the following circumstances:
 - 1) Where semi-watertight materials (such as tongue and groove boards) are used;
 - 2) Where walls have a back-sloping, below-ground footing where water may be trapped;
 - 3) Where seepage from a retaining wall may cause a nuisance to an adjoining property owner;

- 4) Where seepage from a retaining wall in close proximity to a building site may be a nuisance or unsightly; or
- 5) Where a retaining wall is being built in an area of suspect stability and the removal of surface or groundwater would be an advantage.

d) Sub-soil drains shall be shown on all as-built drawings, with depths to finished ground levels.

9.3 EROSION AND SEDIMENTATION CONTROL

9.3.1 General

a) An Erosion and Sedimentation Control Plan (E&SCP) is required for any activity where the cumulative disturbed land is greater than 0.3ha, or where the disturbed land is in a sensitive area, to ensure that the adverse environmental effects of the activity are minimised.

b) Sensitive areas are classed as those within 5m of the banks of any river, within proposed esplanade strip (identified in Appendix 6 of the Nelson Resource Management Plan(RMP)) or within 20m of the coastal marine area, or where the slope of the land is greater than 1 in 2.0 (50%).

c) A land disturbing activity less than 0.3ha that requires a resource or building consent, and is outside a sensitive area does not require an E&SCP but is required to provide the minimum level of erosion and sedimentation control identified in Section 9.3.5. This minimum level shall be indicated on the resource or building consent application for approval by Council.

d) An E&SCP will not be applicable for general farming and forestry activities. Resource Consent requirements for these activities are covered under rules RUr.25 Vegetation Clearance, RUr.26 Soil Disturbance, RUr.27 Earthworks, RUr.53 Coastal; Environment Overlay (Earthworks), RUr.78 Subdivision.

e) E&SCP's are required to be submitted to Council, and approval given, prior to commencement of the activity on site. Notification of the start of the land disturbing activity is required a minimum of 1 week prior to commencement.

f) The E&SCP should be appropriate to the scale of the operation, and shall include: -

- 1) Consideration of the principles identified in section 9.3.2.
- 2) Details required in Appendix A
- 3) Site drawing(s), to the standards required in section 2, clearly identifying:

- Site boundaries and relevant features, i.e. streams, access points etc.

- Site description, i.e. topography, vegetation, soil types, including highlighting steep areas where slope of disturbed land or exposed soil is greater than 1 in 20 (5%), 1 in 5 (20%), 1 in 2.0 (50%) and 1 in 1.43 (70%).
- Proposed stages of construction with boundaries and limits of land disturbance identified on the plan.
- Plans showing proposed erosion and sedimentation controls, i.e. diversion channels, perimeter cut offs, benched drains, stabilisation/revegetation types and locations, stabilised construction entrances, sedimentation ponds, silt fences etc.
- Details of any stream crossings.

4) Specifications and supporting calculations for erosion and sedimentation controls proposed.

5) Measures to be taken to ensure the E&SCP is implemented and adequately maintained on site. An example of the proposed erosion and sedimentation control inspection checklist will be required. It is recognised that the Plan will be a working document and may be subject to change as the activity progresses. Provision should be made for identifying and recording necessary changes on the inspection checklist.

6) Details of any other measures designed to reduce the impact of the activity on the environment.

7) Copies of the inspection checklists should be submitted to Council at regular specified intervals for the duration of the activity.

8) Where a major variation to the planned site works is proposed a revision to the E&SCP shall be submitted to Council, and works shall not commence until approval is given.

9) Erosion and sedimentation controls should only be removed from each stage of the development when the land from that stage has been fully stabilised.

10) Disturbance is defined in section 2 of the Nelson RMP.

9.3.2 Principles of Erosion and Sedimentation Control

- a) Erosion is the process whereby the land surface is worn away by the action of water, wind, or any other geological process. The resultant displaced material is sediment. Sedimentation is the deposition of this eroded material.
- b) The principles that should be considered when preparing an Erosion and Sedimentation Control plan are:

9.3.2.1 Minimise disturbance

- a) Design the project with a view to limiting the disturbed land area. Programme the works to keep forward clearing of vegetation to a minimum. Identify in the E&SCP staged vegetation clearance areas and ensure the boundaries of these areas are clearly identified on site using fences, signs and flags.
- b) Erosion from temporary earth stockpiles formed on site should also be addressed in the E&SCP.

9.3.2.2 Stage construction

- a) As much as practicable stage construction to minimise the time and area that soil is exposed and prone to erosion.
- b) Ensure that control measures are installed before commencement of the land disturbing activity for each stage.

9.3.2.3 Protect steep slopes

- a) Slope length and slope angle are critical factors in erosion potential because they play a large part in determining the speed of run off. Long continuous slopes allow run off to build up speed and to concentrate flows, which produces rill and gully erosion.

- b) Where the slope of disturbed land or exposed soil is between 1 in 20 (5%) and 1 in 5 (20%) and the land is to:

- 1) Have measures taken for the land to be stabilised within 14 days, then temporary contour drains (SD 903) will be required, draining to temporary earth bunds (SD 915), until the land is stabilised; or
- 2) Have no measures taken for the land to be stabilised within 14 days, then temporary contour drains are required, draining to a sedimentation pond (SD 907), until the land is stabilised.

- c) Where the slope of disturbed land or exposed soil is greater than 1 in 5 (20%) and the land is to:-

- 1) Have measures taken for the land to be stabilised within 14 days, then temporary benched slopes (NCC Standard Drawing No. 904) will be required, draining to temporary earth bunds, until the land is stabilised; or
- 2) Have no measures taken for the land to be stabilised within 14 days, then temporary benched slopes are required, draining to a sedimentation pond, until the land is stabilised.

- d) For slopes steeper than 1 in 1.43 (70%) or less, depending on earth conditions and circumstances, permanent benched slopes may be required.

- e) Divert clean water run off from above steep slopes, away from worked areas and keep separate from sediment prone water.
- f) Compact all fills to reduce erosion and sedimentation.

9.3.2.4 Stabilise exposed areas rapidly

- a) Vegetated ground cover is the most effective form of erosion control. Vegetation shields the soil structure from rain drop impact, slows the velocity of run off, holds soil particles in place and maintains the soil capacity to absorb water.
- b) Save topsoil and re-spread on disturbed areas as soon as possible.
- c) For disturbed land sloping less than 1 in 20 (5%), revegetate or otherwise protect from erosion as soon as practicable, and not later than 12 months from the date of disturbance.
- d) If permanent rehabilitation / stabilisation is delayed then temporary measures such as mulching will be required.
- e) Keep machinery off areas that have been stabilised.

9.3.2.5 Protect Watercourses

- a) Vegetation clearance and soil disturbance is not permitted within 5m of the banks of any river or within 20m of the coastal marine area without resource consent. The realignment of a natural watercourse is not permitted without resource consent.
- b) Identify all watercourses in the E&SCP and address: -
 - 1) how these watercourses will be protected;
 - 2) how sediment laden water will be prevented from flowing into the watercourse;
 - 3) how watercourse crossings will be constructed to prevent erosion;
 - 4) watercourse includes every river, stream and channel whether natural or not, through which water flows, whether continuously or intermittently, during the duration of construction.

9.3.2.6 Install perimeter controls

- a) Install diversion drains, silt fences and earth bunds to divert clean water run off away from worked areas and keep separate from sediment prone water.

9.3.3 Erosion Control

When developing the E&SCP, emphasis should be placed on erosion control to prevent sediment generation rather than attempting to catch unnecessarily generated sediments downstream. Below is a list of the main techniques that should be considered. There are many more techniques not listed here, which may be used subject to approval.

9.3.3.1 Diversion channel or bund

- a) Diversion channels and bunds are to be used to divert clean or sediment laden run off.
- b) Designs are to be submitted with the E&SCP to include:
- c) Calculations showing that the channel will contain a Q15 return period peak flood flow from the catchment, plus 300mm freeboard.
- d) Calculations showing the maximum design velocity. Where channel velocity is greater than 1m/s stabilisation measures such as geotextile, rock check dams or pipe drop structure will be required to prevent channel erosion.
- e) Channels are to be of a trapezoidal cross sectional shape.
- f) Avoid abrupt changes in grade / direction, or design structure to allow for sediment deposition or super-elevation.
- g) Incorporate erosion proof outfall, such as a level spreader to prevent scour and reduce outfall velocities.
- h) Where there are critical downstream structures, secondary flow path measures may need to be considered.
- i) Refer to SD 901 and 902

9.3.3.2 Contour drain or benched slopes

- a) Contour drains and benched slopes are to be used to prevent overland flow velocity build up on long continuous, and steep slopes and convey sediment loaded water across sloping land on a minimal grade to sediment retention structure(s), probably via runoff diversion channels / bunds.
- b) Contour drains should be used where the slope of disturbed land or exposed soil is between 1 in 20 (5%) and 1 in 5 (20%). The spacing of the drains should be in accordance with the table below. The drains gradient should not exceed 1 in 50 (2%).

Slope of land (%)	Spacing of contour drains along the slope (m)
5 to 10	50
10 to 15	40
15 to 20	30

- c) Benched slopes should be used where the slope of disturbed land or exposed soil is greater than 1 in 5 (20%). The spacing of the benched slopes should be in accordance with the table below and located to divide the slope evenly. Careful consideration of the diversion channel design draining the benched slopes is required.

Slope of land (%)	Vertical height between benches (m)
20 to 33	20
33 to 50	15
Greater than 50	10

- d) Designs are to be submitted with the E&SCP to include: -

- 1) The benched slope with a maximum reverse angle of 1 in 6.6 (15%), a minimum depth of 300mm and a width suitable to allow access for maintenance.
- 2) The benched slope gradient should not exceed 1 in 50 (2%).
- 3) Benched slopes are to be a maximum 250m long.
- 4) Install additional drainage where natural seepage is present which may affect slope stability or create excessive run off
- 5) Consider risk of erosion, sedimentation, slippage, settlement, subsidence and rotation of the slope on downstream land.
- 6) Consider design of diversion channel draining the benched slopes.
- 7) Refer to SD 903 and 904

9.3.3.3 Stabilisation techniques

- a) Stabilisation of disturbed and exposed earth will protect the earth from erosion by the action of water, wind, or any other geological process and reduce sediment and run off. Stabilisation measures include seeding, mulching, hydroseeding, turfing and the installation of geosynthetic erosion control systems. Mulching "with sheep foot roller compaction" is the most effective instant protection.
- b) Seeding may be used to stabilise disturbed ground or exposed soils where the gradient is less than 1 in 4 (25%) and where the seed is applied between 1st February and 15th May and between 15th August and 31st November.
- c) For slopes greater than 1 in 4 (25%) mulching must be used in conjunction with seeding. Consideration of using sheep foot roller compaction should be considered on slopes steeper than 1 in 2.14 (47%).

- d) Install the seed bed free of large clods, rocks and other unsuitable material and apply a minimum of 100mm topsoil. Fertiliser may be applied where necessary.
- e) Seeded disturbed land is considered stabilised 2 months after sowing.
- f) Mulching can be used at any time of the year, where the instant stabilisation of exposed soils is required. Mulching may be used in conjunction with seeding and sheep foot roller compaction on steeper slopes.
- g) Mulch should contain un-rotted small grain straw, an adhesive and fertilizer applied at a minimum rate of 4,000kg per ha spread uniformly to a minimum depth of 60mm.
- h) In some circumstances, consideration of ground conditions and the season should be taken into consideration when considering the method that the mulch will be anchored to the ground.
- i) Alternative mulch materials such as wood fibre, wood chip, hay, hydromulch may be acceptable, where appropriate, subject to approval.
- j) Hydroseeding should be used to establish vegetation quickly for critical areas such as steep slopes and sediment retention pond batters. The limits of application and specification proposed should be specified by the supplier for approval. Hydroseeded disturbed land is considered stabilised when 2 months after application.
- k) Turf may be used where immediate cover is required (i.e. run off diversion channels and beside watercourses). Turf reinforced with geosynthetic matting should be considered for areas of high erosion potential.
- l) Turf is to be installed in accordance with the supplier's recommendations.
- m) Geosynthetic Erosion Control Systems provide artificial protection of channels and slopes and include matting, geotextiles and erosion matting. There are several types of systems suitable for different circumstances. Systems should be designed, specified and installed in accordance with the manufactures recommendations and submitted with the E & SCP for approval.
- n) For all techniques the following design factors shall be considered:
 - 1) Site preparation – Install all necessary erosion and sedimentation control structures prior to stabilisation
 - 2) Irrigation – Address water supply measures for seed germination and plant growth. Control irrigation to prevent erosion.

- 3) Protection – Protect re-vegetated areas from traffic and other ground disturbing activities.
- 4) Maintenance – Reseed where erosion or germination is unsuccessful prior to 31st May, otherwise consider mulching.

9.3.3.4 Stabilised construction entrance

- a) A stabilised construction entrance is required to prevent site access points becoming sediment sources. A stabilised construction entrance is required on all site entrances onto a public road or right of way.
- b) The stabilised construction entrance should be installed in accordance with the standard drawing and drainage should be provided to carry sediment laden runoff from the entrance to an appropriate sediment control measure such as an earth bund or sedimentation pond.
- c) Where it is found or anticipated that a stabilised construction entrance will not prevent sediment being transported onto the road additional measures will be required such as the installation of a wheel wash facility.
- d) Refer to SD 905

9.3.3.5 Pipe drop structures

- a) A pipe drop structure is required to convey run off down an un-stabilised slope to prevent erosion of that slope. Pipe drop structures can be used as diversion channels where run off velocities are high.
- b) Designs are to be submitted with the E & SCP to include: -
- c) Calculations showing that the structure will contain a Q15 return period peak flood flow from the catchment.
- d) Materials, inlets and joints should be watertight.
- e) Secure the pipe drop structure to the slope at least every 4m.
- f) Careful consideration of the inlet and outlet is required to ensure no erosion occurs.
- g) The structure is placed on suitably compacted or undisturbed material.
- h) The structure is constructed in accordance with the standard drawing.
- i) Refer to SD 906

9.3.4 Sedimentation Control

Below is a list of the sedimentation control techniques that should be considered. There are more techniques not listed here, which may be used subject to Council approval.

9.3.4.1 Sediment retention pond

- a) A sediment retention pond is a temporary structure designed to treat sediment laden run off by dewatering the pond at a rate that allows suspended sediments to settle out. The pond should be designed so that larger run off events will receive partial treatment, while smaller events will receive a high level of treatment. To achieve this, the energy of the inlet water needs to be low to minimise re-suspension of sediment, and the decant rate at the outlet also needs to be low to minimise water currents and to allow time for the suspended sediments to settle.
- b) Design calculations and drawings shall be submitted with the E&SCP.
- c) A sediment retention pond shall be designed in accordance with the following requirements and figures:-
- d) for any activity where the disturbed land slopes less than 1 in 10 (10%) and less than 200m in length the pond shall be designed with a minimum volume of 1% of the contributing catchment, i.e. 100m³ for each ha of contributing catchment.
- e) for any activity where the disturbed land slopes greater than 1 in 10 (10%) and/or greater than 200m in length the pond shall be designed with a minimum volume of 2% of the contributing catchment, i.e. 200m³ for each ha of contributing catchment.
- f) For any activity where the disturbed land slopes greater than 1 in 2.14 (47%) and greater than 200m in length the pond shall be designed with a minimum volume of 3% of the contributing catchment, i.e. 300m³ for each ha of contributing catchment.
- g) The slope angle is determined by that slope immediately above the pond, or by the average slope angle over the contributing catchment, whichever is greater.
- h) Ensure base of pond is level, between 1m and 2m deep and between 3 to 5 times longer than wide. The distance between the pond inlet and decant structure should be as great as possible.
- i) The decant system should be carefully designed to ensure approximately 30% dead storage at the bottom of the pond to dissipate energy flows.

- j) Decants work only through the remaining 70% live storage volume. For catchments up to 1.5ha, 1 decant should work through the whole live storage height. For catchments 1.5ha to 3ha, 2 decants required, one through the whole live storage, the second through the top half only. For catchments 3ha to 4.5ha, 3 decants required, one through the whole live storage, the second through upper 2/3's and the third through upper 1/3rd of live storage.
- k) A decant should be provided for each 1.5ha catchment with 6 rows of 10mm diameter holes at 60mm spacing (200 holes) along the 2m long decant arm. For catchments less than a multiple of 1.5ha, the appropriate number of holes should be sealed off (i.e. for 1ha catchment drill 133 holes in decant), one 10mm diameter hole per 75m² of contributing catchment.
- l) Each decant should be weighted to keep it submerged just below the pond surface through all stages of the decant cycle to prevent blockage from debris.
- m) The discharge pipe should be installed with anti-seep collars.
- n) The pond inlet should utilise a level spreader to maximise the pond capacity. The level spreader should be the same width as the pond floor. The inlet slope, below the level spreader should be protected from erosion with geotextile and at a slope no greater than 1 in 3(33%).
- o) The level spreader weir should be set 100-200mm above the invert of the emergency spillway.
- p) Incorporate a 1m deep by 2m wide fore bay in front of the level spreader weir.
- q) Silt fences should be installed below the pond prior to construction to prevent downstream sedimentation until the pond batters are stabilised.
- r) Stabilise the pond batters, and any other disturbed areas, immediately after construction
- s) For catchments between 1.5ha and 3ha, a 150mm diameter primary spillway pipe is required. For catchments greater than 3ha, a concrete manhole riser and pipe outlet is required, sized for a Q15 return period peak flood flow from the catchment.
- t) An emergency spillway must be installed on all sediment retention ponds, designed for a Q50 return period peak flood flow from the catchment. The spillway requires adequate stabilisation to accommodate a Q50 flow and should be a minimum 6m wide or the width of the pond floor, whichever is the greater. The spillway should have 300mm freeboard above the height of the primary spillway and 300mm below the pond banks.
- u) Fence sediment ponds as necessary in accordance with site safety management plan.

- v) Sediment ponds are to be cleaned out when the volume of sediment accumulated reaches 20%. The 20% level should be clearly marked on the decant riser.
- w) Identify sediment disposal locations where there is no risk of erosion.
- x) Chemical treatment of the pond, promoting flocculation to increase the rate of sediment settlement may be considered, subject to council approval, in circumstances where the pond volume cannot be achieved, where there are high levels of downstream sensitivity, or high proportion of clays in the disturbed land.
- y) Refer to SD 907 to 912

9.3.4.2 Silt fence

- a) Silt fences should be used to detain sheet flow run off so that sedimentation can occur through settlement. They should be used on low gradient sites, or for confined areas where the contributing catchment is small (less than 0.5ha.). Silt fences should not be used as velocity checks in channels or watercourses or to intercept concentrated flows.

- b) Silt fences shall be designed in accordance with the following requirements and figures, but alternative designs may be acceptable, subject to approval:

- 1) The maximum slope length, spacing of returns and gradients for silt fences is shown in Table 9-2 below.
- 2) The silt fences should be constructed in accordance with the standard drawing and should be positioned along the contour, where possible. Where this is not possible, or for long lengths of fence, install short silt fence returns (minimum 2m long) to minimise concentration of flows.
- 3) Excavate a trench a minimum 100mm wide and 200mm deep along the line of the proposed fence. Install the support post and fence fabric and backfill the trench with compacted soil.
- 4) Where water may pond behind the fence provide extra support.
- 5) The fence fabric shall have minimum tension strength of 0.345pa, minimum tensile modulus of 0.140pa and apparent opening size of 100µm.
- 6) Fence supporting posts shall be a minimum 50mm square of tanalised timber or steel waratahs, a minimum 2m apart.
- 7) The top of the fence fabric shall be reinforced with 2.5mm galvanised wire, tensioned and tied.

- 8) Repair fences where bulges occur or when sediment accumulation reached 50% of the fabric height.
- 9) Silt fences shall remain in place until the catchment has been stabilised.

c) Refer to SD 913

Table 9-2 Silt Fence Design Criteria

Slope Steepness %	Slope Length (m) (maximum)	Spacing of Returns (m)
Flatter than 2%	Unlimited	N/A
2 – 10%	40	60
10 – 20%	30	50
20 – 33%	20	40
33 – 50%	15	30
> 50%	6	20

9.3.4.3 Stormwater sump protection

- a) Stormwater sump protection may be used only as a secondary control device to filter sediment laden runoff before it enters the stormwater reticulation system from small catchments less than 0.5ha. Additional measures are required such as diversion bunds, contour drains, benched slopes and silt fences to minimise the volume of sediment laden water reaching the stormwater inlet.
- b) Stormwater sump protection offers limited treatment because the flows arriving at them are concentrated. Their use may indicate poor erosion and sedimentation control and/or inadequate stabilisation following the activity.
- c) A silt fence can be erected around the inlet or course geotextile fabric wrapped around the cesspit grate with a layer of aggregate material over to act as a primary filter and hold the fabric in place. Back entry sumps require additional fabric protection secured in place. Sandbag check dams should be placed up the gutter to act as sediment traps, ensuring these are lower than the kerb to prevent berm runoff.
- d) Stormwater sump protection and sandbag check dams require high maintenance as the capacity for sediment storage is small. Address maintenance measures in the E&SCP.
- e) Refer to SD 914

9.3.4.4 Earth bund

- a) Earth bunds are used to intercept and detain sediment laden run off for disturbed land or exposed soils that are to be stabilised within 14 days, where the catchment area is less than 0.3ha. They are to be kept in place until stabilisation is complete.
- b) Earth bund outlets need to be designed as for a sediment retention pond decant system or by using a perforated pipe. The perforated pipe outlet should be 150mm lower than the stabilised spillway which in turn should be 250mm below the top of the earth bund. The outlet should be watertight along the bed of, and through, the bund. The impoundment area of the bund is to be level, and have a minimum volume (measured to the top of the novacoil pipe) of 1m³ for every 100m² of contributing catchment.
- c) Refer to SD 915.

9.3.5 Controls on Small Sites

- a) For sites with less than 0.3 ha of disturbed land, outside sensitive areas, an E&SCP is not required although the following measures are still necessary to ensure that the activity complies with the soil disturbance and earthworks rules in the Nelson Resource Management Plan. These rules state that some soil disturbance and earthworks activities are permitted without resource consent provided:
 - *soil is contained on the site during the construction period and after, such that there are no adverse effects on adjoining properties or any water bodies;*
 - *all bare soil areas are revegetated or otherwise protected from soil erosion as soon as practicable and not later than 12 months from the date of disturbance;*
 - *no vegetative debris is positioned where it may dam or divert any river or stream or adversely affect instream habitats.*
- b) A stabilised construction entrance shall be installed in accordance with 9.3.3.4 above.
- c) Silt fences shall be used to trap sediment laden overland flows before they leave the site. Silt fences should be installed in accordance with 9.3.4.2 above.
- d) Earth bunds shall be used to treat sediment laden run off and should be constructed in accordance with 9.3.4.4 above.

Appendix A Erosion and Sedimentation Control Plan Preface

1) Project Details

Project title
Eng Plan No.
Site Address

2) Client Details

Name / Company Name
Address
Telephone No.
E-mail
Name of Contact person

3) Consultant Details (Architect / Surveyor)

Name / Company Name
Address
Telephone No.
E-mail
Name of Contact person

4) Contractor Details

Name / Company Name
Address
Telephone No.
E-mail
Name of Contact person
After hours contact telephone No.

5) Type of Development

6) Programme

- i) Activity commencement date
- ii) Activity completion date

7) Site Details

- i) Total property area (ha)
- ii) Maximum area of disturbed land or exposed soil that will be unvegetated for any one period during the activity.
- iii) Maximum slope of disturbed land or exposed soil for any period during the activity
- iv) Water body into which runoff will be discharged
- v) Is the activity in a sensitive area

8) Measures to be taken to ensure E & S controls are adequately maintained

- i) Person responsible for E & S site controls
- ii) Person responsible for E & S site inspections and the submitting of the checklists to Council
- iii) Frequency of inspections,
 - regular
 - before and after rain

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10. ELECTRICAL AND STREETLIGHTING

10.1 INTRODUCTION

- a) The purpose of the Electrical Utilities section of the Land Development Manual is to ensure that all electrical cabling is designed and installed to meet Council and network line operator expectations.
- b) The standards ensure that community expectations for electricity and streetlighting are met in a safe and efficient way, and that access to all underground services is achieved with a minimum of disruption.

10.1.1 Objectives

- a) The objectives of the electrical utilities standards are as follows:
 - 1) All new electrical infrastructure meets the needs of people and communities for electricity and streetlighting;
 - 2) All new electrical infrastructure is located within public land, and/or is legally and physically protected where it is located on private property;
 - 3) Access to underground cabling is ensured for ease of repairs and maintenance, with a minimum of disturbance;
 - 4) The location of all electrical services is clearly marked;
 - 5) Streetlighting has been provided to ensure personal and traffic safety; and
 - 6) Streetlighting shall be in keeping with the amenity and character of the environment.

10.1.2 Key References

- a) All electricity and streetlighting infrastructure shall be consistent with the standards set out in Table 10-1. Where a Standard or document is referenced this shall be the current version including any associated amendments.

Table 10-1 External Standards and References for Electrical Utilities

Standard / Reference	Description
	Nelson City Council Resource Management Plan
AS/NZS 1158.0:2005	Road lighting – Introduction
AS/NZS 1158.1.1:2005	Road lighting – Vehicular traffic (Category V) lighting – Performance and design requirements
AS/NZS 1158.1.3:1997	Road lighting – Vehicular traffic (Category V)

Standard / Reference	Description
	lighting – Guide to design, installation, operation and maintenance
AS/NZS 1158.2:2005	Road lighting – computer procedures for the calculation of light technical parameters for Category V and Category P lighting
AS/NZS 1158.3.1:2005	Road lighting – Pedestrian area (Category P) lighting – Performance and design requirements
AS/NZS 1158.4:2009	Road lighting – Lighting of pedestrian crossings
AS/NZS 1158.5:2007	Road lighting – Tunnels and underpasses
AS/NZS 1158.6:2004	Road lighting – Lighting for roads and public spaces - Luminaires
Electrical Act 1992	Electrical safety regulations 2009 Design of reticulation
NZ Electricity Code of Practice	Current and voltage ratings
AS/NZS3000	Electrical installations (Australian/New Zealand wiring rules)
Line Owner	Design and Construct and Distribution Codes

10.1.3 Interpretation

- a) "Electricity (Network) Operator" means any person (company) declared (by the minister) under section 4 or section 4a of the Electricity Act 1992 to be an Electricity Operator. A list of current Electricity Operators is held by the Ministry of Economic Development and is available on their website.
- b) "Line Owner" means any person or Company that owns Works that are used or intended to be used for the conveyance of electricity.
- c) "Works" means all "Works" that are owned by the "Electricity Operator" and form part of the Electricity Operator's Electrical Reticulation System or "Network". It has the meaning as per the Electricity Act 1992 sec 2.
- d) "Network Connection Point" means the point where a service main connects to a Line Owner's Works. This point is the demarcation point (typically defined by a fuse) between the Line Owner's Works and customer owned cables.
- e) "Service Main" or "Mains" is the term for the cable (fitting), owned by the owner of a premises and connecting a premises to the Line Owner's Works at a network connection point.
- f) "Point of supply" means the point at which the Line Owner responsibility ends. It has the meaning as per the Electricity Act 1992 sec 2.

10.2 ELECTRICAL RETICULATION

10.2.1 General

The following general standards and conditions apply to the provision of electrical utilities:

- a) All new Works and service main will be by underground cabling in urban areas.
- b) All new service mains will be by underground cabling in "rural areas" or as amended by Clause 10.2.56 d).
- c) Reinforcement or replacement of existing overhead Works will be by underground cabling apart from specific exemption from Council. This will not exclude the Line Owner carrying out any maintenance (replacement or upgrade) of existing works as long as the land will not be injuriously affected as a result of the maintenance (replacement or upgrade).
- d) Any dispensations (exceptional circumstances) given by either the line owner (for dispensation from its own electrical design and construction standards) or Council (for dispensation from its Land Development Manual) shall be in writing and shall indicate which section and subsection of the relevant standards the dispensation applies to.
- e) Existing allotments with no "power to the boundary" and requiring an electrical supply will be by underground cabling.
- f) All Works assets to be vested with the line owner or Electricity Operator will meet their respective design and construction standards and distribution code.
- g) Any underground or overhead Works cable being vested with the Electricity Operator and installed on any titled land will be secured by way of an easement in favour of the Line Owner. See section 10.2.7
- h) Service main exclusive fittings owned by a third party will also have private easements registered outside the point of supply if the route crosses titled land not owned by the third party. See section 10.2.87.
- i) Where a boundary is adjusted enabling a lot to contain an installation Council will require confirmation from the Line Owner that the existing Works is sufficient to supply another installation.
- j) Designers are to liaise with other service authorities to achieve economical use of road reserve area with due consideration given to ease of maintenance to the Works system and other services in the road reserve area.

10.2.2 Design

The following standards apply to the design of all electrical infrastructure:

- a) The design of the Works shall, as a minimum requirement, comply with the current Electricity Regulations and the requirements and standards of the line owner.
- b) The design of the Works shall give consideration to the likely electrical demand requirements per lot and allow for this in the initial design.
- c) Residential subdivisions should allow a minimum of 15kVA with diversity per lot and industrial subdivisions should allow a minimum of 40kVA without diversity per lot.
- d) The minimum electrical demand design criteria per lot and allowable after diversity maximum demand factor, shall be to the requirements of the line owner.
- e) All new residential, commercial and industrial subdivisions shall be reticulated with underground cabling running along each side of the road reserve. Council may allow dispensation for a single sided reticulation in exceptional circumstances (e.g. where allotment frontages are greater than 30.0m in length).
- f) Provision shall be made by land developers for the continuation of appropriate cabling along road frontages to facilitate the Works of adjoining future development. This may be achieved by the installation of cable ducting systems. Council may waive this requirement where it is demonstrated with approval from the line owner that adjacent sub-dividable land may be reticulated from another suitable route.
- g) Consideration shall be given to the future extension or reinforcement of the Works system without necessitating major road reserve disturbance to achieve such expansion or reinforcement. Where appropriate spare, ducting shall be installed along routes likely to be used for an extension, or reinforcement of the Works.
- h) Road crossings for power cables shall be kept to a minimum and where necessary, shall be at right angles to the carriage way and have minimum cover of 900mm.
- i) The typical design position for electrical cabling in road reserve is parallel with and 600mm from the boundary.

10.2.3 Cabling, Ducting and Service Boxes

These standards relate to the installation and design of cabling, ducting and services:

- a) Access to a three phase power supply shall be provided at the boundary of the road frontage of each lot of an industrial, commercial or residential subdivision.
- b) Rights-of-way not longer than 60.0m may have individual service duct systems (orange 50mm minimum diameter PVC to AS/NZS 2503 and wide swept bends) or appropriately sized service mains cable installed from a service box on the road frontage down the right-of-way to each rear allotment.
- c) Rights-of-way exceeding 60.0m to any allotment shall have an appropriate power cable installed to the main body of the rear allotments.
- d) Fusing and "network connection points" shall be to the satisfaction of the line owner. No service duct system extending from a service box, within a right-of-way shall be longer than 60.0m. No service duct system in road reserve shall be longer than 10.0m.
- e) Where either the service mains or the line owner's Works is installed within the sealed area of a right of way the cable is to be installed within a duct or a spare duct is to be laid beside the cable.
- f) Appropriate registration of Easements In Gross to the line owner's requirements shall be provided by the landowners prior to livening for all Works titled land. Where service cables cross others properties or right-of-ways private easements between lots will be required prior to livening.
- g) Where multiple driveways make it impractical to position a service box at a common boundary between lots or where a narrow road frontage width of a lot makes the location of a service box vulnerable to damage, it is permissible to install a service duct (orange 50mm minimum diameter PVC) in the road reserve from a service box offset no more than 10.0m from the affected lot.
- h) Any ducting systems installed in the road reserve area shall be considered as part of the Works system for the purpose of as-built records.
- i) Any excavation within the existing road reserve is subject to Council's approval including the National Code of Practice for Utilities Access to the Road and Rail Corridors and a Corridor Access approval issued by Council.

10.2.4 Location and Capacity

The following standards and conditions relate to the location of cabling and capacity of the Works:

- a) Voltage drop shall be no greater than permitted under the current Electricity (Safety) Regulations and the requirements and standards of the line owner.
- b) Current ratings shall be in accordance with Line Owner's design and construction standards, and relevant legislation.
- c) The design shall take into account the requirements of section 10.2.2 with specific attention given to the following details relating to likely electrical loads:
 - 1) Lot size in relation to permissible coverage and anticipated usage of the lot (e.g. multiple dwellings, cross-lease and potential subdivision permitted within the zoning).
 - 2) An appropriate after diversity maximum demand factor.
 - 3) The design of the Works shall give consideration to the likely electrical demand requirements per lot and allow for this in the initial design. Residential subdivisions should allow a minimum of 15kVA with diversity per lot and industrial subdivisions should allow a minimum of 40kVA without diversity per lot.
 - 4) Future load growth and Works expansion or reinforcement.
- d) Existing overhead electrical cabling shall be dealt with in accordance with section 10.2.6.

10.2.5 Subdivision Requirements

The following standards apply to the reticulation of electricity within the subdivisions process:

- a) Any variations (change to resource consent conditions) issued by Council from resource consent conditions shall be in writing and shall specifically state which condition the dispensation applies to, including how the condition is to be met.
- b) New allotments shall be serviced with live 400/230v Works to the boundary of each lot.
- c) Rear lots down right-of-ways or through front lots may have ducts provided from the road reserve frontage to the rear lots ready for future service mains installation at the owner's cost. Exceptions are catered for where it is impractical to position a supply at a boundary.
- d) Where practical, existing overhead 400/230v Works or "service mains" crossing new subdivisions shall be placed underground.

- e) High voltage power lines (greater than 1000 volts) across new subdivisions shall be relocated clear of the subdivisions or placed underground with the agreement of the line owner. Dispensation may be granted by Council where it is demonstrated to be impractical to achieve this requirement.
- f) In remote rural subdivisions where the allotments have a large land area and it is demonstrated that the lots are not intended for habitable dwellings or buildings ancillary, Council may waive the requirement for the supply of Works to the boundary. A consent notice will be required noting that the site will not have an electrical supply.
- g) Where Works referred to in the above paragraphs is not practically accessible or economically viable, local generation e.g. Hydro, solar, wind, may be considered as an alternative. It should be demonstrated that local electrical generation of 3kWhr minimum sustainable storage capacity over a 24-hour period per household is feasible for supplying lighting and small electrical appliances with alternative fuel for heating and cooking.
- h) All new subdivisions reticulated with service boxes or poles shall have service ducting (50mm orange PVC electrical duct) from the pole or box to 1.0m within the property it is intended to supply. Wide sweeping bends shall be used. Service ducting shall be 1.0m deep, 900mm cover. Duct ends shall be clearly marked within properties, and fixed by measurement to survey points or other permanent fixtures on as built records.

10.2.6 Rural

- a) Recognising the extent of 11kV Works in the rural sector, together with the difficulty and high cost of providing underground 11kV cabling, Council may in accordance with Section 35 of the Electricity Act and at its discretion and in agreement with the line owner, allow overhead 11kV Works and associated substations in the rural sector.
- b) Easements In Gross are to be provided by the land owner, in favour of the line owner, for all new or altered Works over private property. All proposed electricity easements over private property, whether the land is owned by the developer or not, must be listed under a memorandum of Easements In Gross on the subdivision plans.
- c) Substations may be located on lot boundaries or within the subdivided lots to enable an adequate electrical supply to specified or potential building sites on the allotments.
- d) 400/230v Works and service mains to individual premises shall be by underground cable unless precluded by ground profiles or other impediments in which case Council may grant dispensation for overhead cables to traverse the area concerned.

- e) Network connection points to individual lot boundaries shall be located to provide practical and legal access for service mains to specified or potential building sites.
- f) Where the length of a service mains cable exceeds 200.0m from a network connection point to a specified or potential building site, the Works designer shall state on the application drawing, the proposed service mains cable size and design criteria applicable to the lot.
- g) Subject to existing load and future development the line owner may approve the use of an existing two phase 11kV overhead line for residential and general farming purposes where it is demonstrated that three phase power is not likely to be required for the management of the land (e.g. irrigation). The design of any two-phase 11kV line extension should be to a standard whereby a third phase can be run or livened without changes to poles, cross-arms or guys.

10.2.7 Easements

- a) It is the responsibility of the Developer to ensure that all easements are obtainable. The Developer shall, where necessary and at their expense, provide any easements and obtain any formal consents required for overhead lines, underground cabling and equipment to be installed or altered in, on, under or over property other than road reserve.
- b) Easements In Gross with the line owner as the grantee/transferee shall be obtained and registered on all private land.
- c) Easements are required in the following cases but shall not be limited to:
 - 1) Where new works (lines or cables) are located on private properties.
 - 2) Where a padmount substation, switching station or transformer is to be located on other than road reserve.
 - 3) Where an overhead line located in a legal road intrudes into a privately owned property. This applies especially to crossarms and conductors where air space is encroached.
 - 4) Where an existing service main is physically altered, shifted or its status is changed, for example, to supply a new separately subdivided property.
 - 5) Where a network cable is used to supply lot(s) in right-of-ways or access lots.
- d) Conditions imposed in the consents granted by Council under section 220 of the RMA generally do not fully describe conditions required by the line owner particularly in relation to easements where neighbouring properties are affected by new or altered network systems. The line owner will have separate conditions that should be met to ensure, for instance, that perpetual right is gained

for new or altered works and the status of those works cannot be compromised by aggrieved property owners wishing to contest the line owners interests. A risk of stranding customers is not an option.

- e) Easements required on land being developed under subdivision consent must be described under a memorandum of easements. Land outside the subdivision and affected by new or altered network system changes must also be described in a memorandum of easements. Where lot servicing is able to be satisfied using service mains in right-of-ways or access lots, easements shall be prescribed on the deposited plan.
- f) Where service mains are used to service lots on a shared right-of-way, access lot, or across private land then an easement in favour of the line owner is not required. However, an easement between the respective parcels of land is necessary with the wording "right to convey electricity, telecommunications and computer data" entered as the purpose description.
- g) The line owner will not connect new works or allow alterations to its network system which constitutes new work by definition in the Electricity Act 1997 and subsequent amendments, until an Easement In Gross has been acknowledged and receipted by the district land registrar on the properties affected. This requirement may be waived for subdivisions approved by Council under section 220 of the RMA where property outside the subdivided property is unaffected and subdivision deposited plans with relevant transfers are lodged to the satisfaction of the line owner.
- h) Works are to be vested with the line owner prior to connection and livening, and registration of the easement. A separate agreement will be required to confirm vestment conditions and will be signed by approved signatories.
- i) Overhead lines require 6.0m wide easement corridors symmetrical to the actual line route.
- j) Underground cables require 3.0m wide easement corridors symmetrical to the actual cable route.

10.2.8 Physical Location

- a) Service boxes shall be set back 250mm from section boundaries and are to be clear of designated vehicular access and pedestrian ways by a minimum of 1.2m along the boundary and 700mm diagonally to the nearest point where the driveway tapers out to the kerb.
- b) The minimum spacing of any service box from any boundary line or survey peg shall be 250mm so as to enable future fencing construction.
- c) Cable and duct locations in the road reserve area shall be in general accordance with SD 1001, being 600mm from section boundaries at

a nominal laying depth of 1.0m (900mm cover) with provision for shared trenching with communication services.

- d) Cable and duct locations down right-of-ways shall, where possible be located 600mm from a boundary in a berm area where provided. Otherwise, the centre of the right-of-way is the preferred location. The standard cable depth shall be 1.0m (900mm cover) and may be in a common trench with water and communication services as shown in SD 1002. Individual consumer service mains cabling or ducting, within a right-of-way, shall be 600mm minimum depth as shown in SD 1002. Any cable installed under seal within a right-of-way must be installed within a duct or with a spare duct beside it.
- e) Appropriate mechanical protection shall be provided for any underground Works in accordance with the Line Owner's design and construction standards and appropriate legislation. Cable marker warning strip shall be placed along all cable routes at half the cable trench depth.
- f) In addition, where Works cables are on private property (excluding right-of-ways), visible above ground warning markers shall be placed where cables change direction and in between not more than 10.0m spacing in all but rural areas where the minimum spacing shall not be more than 20.0m. The warning markers shall be as stated in the line owner's design and construction standards.
- g) Road crossings for Works cables shall be in 100mm minimum orange electrical PVC ducts to the line owner's requirement at a depth of 1.0m (900mm cover).
- h) At all sites where cable is installed cable marker warning strip shall be placed along the cable route at half the cable trench depth unless the cable is mole-tunnelled or drilled and ducted.

10.2.9 Specific Installation Requirements

- a) Substations shall be of adequate design capability to supply the anticipated after diversity maximum demand with due consideration to section 10.2.4.
- b) Ground mounted substations will be permitted within new residential, commercial and industrial subdivisions.
- c) Pole mounted substations may be permitted in rural subdivisions.
- d) Pole mounted substations may be allowed in existing overhead Works.
- e) Substations shall be located in the berm, clear of designated vehicular access ways by a minimum of 1.0m and close to section frontages (but no closer than 300mm) or, in a recess into a lot or a public reserve, secured either by easement or preferably designated as road reserve. The line owner is to determine the size of the recess.
- f) Adequate public protection shall be provided at all substation sites, giving consideration to:

- 1) Earthing (NZECP 35);
- 2) Physical location to minimise the risk of damage by vehicles; and
- 3) Security to protect against public access to electrical contents.

10.2.10 Design Approvals

Prior to any works commencing on site, the following requirements shall be submitted and approved:

- a) A Line Owner's approved electrical Works design plan and the designated street light connection point.
- b) The plan shall bear a design statement covering the following:
 - 1) Before diversity load per lot (i.e. 15 kVA per residential lot).
 - 2) Compliance with the line owner's design and construction standards.
 - 3) Compliance with the Land Development Manual.
 - 4) A list of easement requirements for any Works on titled land to be vested with the line owner and a list of reciprocal rights for service mains cables or ducts over shared right-of-ways or easements for service mains cables crossing titled land.
- c) Council signed approval of the design plan (for subdivision or large area Works).
- d) Prior to the 224 certification stage (for subdivision), the following details shall be forwarded via the Designer to Council:
 - 1) A letter of acceptance by the line owner confirming that:
 - As built documentation has been filed for network extensions and/or service mains; and
 - The Works has been livened and fulfils the line owner's design and construction standards and any other line owner requirements.

10.2.11 Cable Locations

- a) The location and layout of the Works shall be shown on the design plan, with all variations authorised by the network line operator's representative.

- b) A shared services trench is likely to be the most economic option. Separation between the services in subdivisions is required. These will be detailed in the laying specification. However, safe working distances are required for all services within minimum separations for power cables. Table 10-2 shows the minimum clearances between power and telecommunications cables. SD 1001 - 1003 show the general layout of services.

Table 10-2 Minimum Separations Between Power and Telecommunications Cables

Voltage and cable type	At Crossings		On Parallel Runs	
	With protection	Without protection	With protection	Without protection
LV, neutral screened, or armoured	50mm	150mm	50mm No limit to length	300mm No limit to length
LV, neutral unscreened, or unarmoured	50mm	450mm	450mm No limit to length	450mm No limit to length
HV, single and multicore	150mm	450mm	450mm 2.4km limit to length	450mm 2.4km limit to length
<p>LV power cable is defined in the current electricity regulations as "any voltage exceeding 50 volts a.c. or 120 volts ripple free d.c. but not exceeding 1000 volts a.c. or 1500volts d.c.</p> <p>HV power cable is defined in the current electricity regulations as "any voltage exceeding 1000 volts a.c. or 1500 volts d.c.</p>				

- c) Protection shall take the form of either:

- 2) 50mm thick non metallic reinforced concrete slabs (usually 150mm wide and 500mm long); or
- 3) 100mm x 50mm ground retention treated timber with a minimum specification of the New Zealand Timber Preservation Authority classification h4 group b; or
- 4) 5mm polymeric cable cover.

- d) The depth and offset of trenches will be specified on the laying plan. It is essential that these be maintained. Minimum cover shall generally be 450mm in footways and 600mm in roadways.

- e) All services crossing the proposed duct pipe route shall be exposed and the necessary clearances maintained to enable other network line operator's ducts to be installed either above or below these other services. Telecommunication ducts shall be laid above power cables, but not directly above.
- f) All joints in duct pipe shall be water tight and may be glue jointed with solvent cement or rubber ring seal, depending on the ducting supplied. The rubber "o" ring sealed pipe is the preferred type of duct and will replace solvent cement glued ducting in the long term.
- g) The base of the trench shall be level with large objects removed. The duct pipe shall be bedded in suitable fine soil or pea metal if required. The suitability of the bedding material will be assessed by the Network Owner representative.

10.2.12 Records

- a) The network utility operator shall keep and maintain as-built records of their Works within the road reserve and on private property where the reticulation will be owned by the Line Owner in accordance with the Electrical (Safety) Regulations 2009.
- b) The Line Owner shall ensure that they receive and maintain as-built records of the Works and ensure that such records are made available upon request and as required, mark out cable routes on site for council or contractors carrying out works.
- c) Provision of as-built drawings for planned works shall be made available with 5 working days notice during normal working hours and for emergency call outs with no prior notice at any time.

10.3 ROAD LIGHTING

10.3.1 General

- a) The lighting design must maximise safety and efficiency while minimising the life cycle cost and impact on the environment.
- b) Lighting shall be designed to match the style, height and spacing of adjoining sections of road that have the same hierarchical classification.
- c) Lighting should complement the neighbourhood character and, as far as is reasonably practicable, minimise the impact on the neighbouring properties and environment with regard to aesthetics, glare and spill light. A tilt angle of 2.5% is set to achieve consistency across the network and reduce unwanted light spill. A tilt angle variation may be accepted only on approval by Council.
- d) The design must comply with all the appropriate New Zealand Standards, in particular the requirements of AS/NZS 1158. Anything not specified within the Land Development Manual is specified in those standards.

10.3.2 Lighting Hierarchy

- a) Roads and accessways will fall into the following roading hierarchy classifications (refer Section 4 Transport) and the lighting level associated with that classification is given below:
 - 1) Local Roads and Residential Lanes Category P4
 - 2) Cul-de-sacs Category P4
 - 3) Collector or Industrial Category V4 or P3
 - 4) Arterial and Principal Category V3 or V2
 - 5) Pedestrian Accessway See Table 10-3
- b) Category V lighting should provide a lighted environment conducive to the safe and comfortable movement of vehicular and pedestrian traffic at night.
- c) Design the lighting to accord with AS/NZS 1158.1:2005 Road lighting – Vehicular traffic (Category V) lighting.
- d) Category P lighting should assist pedestrians to orientate themselves and detect potential hazards, and discourage fear of crime and crime against the person.
- e) Design the lighting to accord with AS/NZS 1158.3.1:2005 Road lighting – Pedestrian area (Category P) lighting. The luminaires must meet the requirements for type 4 luminaires detailed in AS 1158.3.1, Table 2.5.
- f) The streetlight design must be certified by a suitably qualified and experienced lighting professional. This shall be endorsed on the plan.

10.3.3 Use of White Light

- a) White light has a number of benefits over conventional 'yellow' light. White light produces better colour rendition allowing objects to appear their natural colour at night, improving perceptions of security and wellbeing. White light also benefits city centres, commercial areas and historical and tourist attractions by making them appear more natural and inviting, increasing visitor numbers. Additionally, there is growing evidence that white light may reduce reaction times.
- b) Metal halide (MH), compact fluorescent (CFL), or new generation metal halide (NGMH or Cosmopolis) lamps produce a white light, in comparison to high pressure sodium (HPS) lamps which produce a more yellow light.
 - 1) White light is to be provided in the following areas:
 - Nelson city centre
 - Commercial areas with heavy pedestrian usage in the night
 - Areas of significant tourist, historical, amusement and entertainment interest

- Public transport terminals and interchanges
- Areas with security cameras
- Pedestrian or cycle areas (actively used at night).

c) The column height and minimum wattage in Table 10-3 applies to installations of high pressure sodium lamps only. Where another lamp type is to be used, the proposed design must be approved by the Engineering Manager.

Table 10-3 Road Lighting Standards by Roothing Hierarchy

Road Hierarchy	Lighting Category (AS/NZS 1158)	Column Height (Minimum)	Luminaire (Min Wattage)	Lamp type	Post Top Luminaires
Arterial	V2	By design	150W	HPS	NO
Principal	V3	By design	150W	HPS	NO
Collector or Industrial	V4 or P3	By design	100W	HPS	NO
Sub-collector	P3	8.5m	100W	HPS	NO
Local	P4	7.5m	70W	HPS, MH or CFL	NO
Cul-de-sac (includes Residential Lanes)	P4	5.5m for post top, 6m with outreaches	70W	HPS, MH or CFL or NGMH	YES
Rural	Flag lights only	8.5m	70W	HPS	NO
Pedestrian accessways (actively used at night)	Evaluated on case by case basis (P2, P3 or P4) see AS/NZS 1158	By design	By design	MH or CFL or NGMH	NO

Note 1: Light spacing shall be designed to meet the requirements in AS/NZ 1158.

Note 2: All luminaires must have a light distribution style with a UWLR (upward waste light ratio) of less than 1%.

Note 3: All luminaires shall have a tilt angle of 2.5%, which has been set to achieve consistency across the network and reduce unwanted light spill. This will reduce the likelihood of luminaires being installed at a negative angle. A tilt angle variation may be accepted only on approval by Nelson City Council.

Note 4: Where existing luminaires are already installed on part of a Local Road (including Cul-de-sacs or Residential lanes) then any extension of that road shall match the style, height, spacing and lamp type/light colour of the existing lights.

Note 5: Intersections will require specific design, except intersections which carry or may carry a combined through ADT traffic volume less than 1000 vehicles/day. All intersections shall comply with the standard intersection layout diagrams in Appendix F as a minimum.

Note 6: The Council prefers to light only those accessways and cycleways that receive high night-time use. Lighting shall be provided where necessary in a manner that is consistent with the Nelson City Council *Safer by Design - Crime Prevention Through Environmental Design (CPTED) Guidelines*. Consideration shall be given to the brightness, placement and coverage of any lights to ensure adequate illumination where necessary and to prevent adverse effects on adjacent landowners from light spill

Note 7: All lighting designs must be submitted to Nelson City Council for approval.

10.3.4 Pedestrian Crossings

- a) Lighting levels shall meet the requirements of AS/NZS 1158.4
- b) The approved luminaire type installation requirements are as shown in Appendix D.

10.3.5 Flag Lighting

- a) Rural Road Flag Lights shall be installed as per clause 3.5 of AS/NZS 1158.1.1.2005.

10.3.6 Luminaire, Column and Lamp Types

10.3.6.1 Luminaire types

- a) All luminaires shall meet the requirements of AS/NZS 1158.6:2004. Verification shall be by the independent test reports. Any such luminaires will also need to meet the Engineering Manager's approval in terms of expected whole of life cost. Whole of life costs are to be measured over a 20-30 year lifetime. Appropriate luminaires will be listed on the Council "Approved Luminaire List". See Appendix A.

- b) Luminaires may be deleted from that list if the engineer deems them to be causing lifetime costs greater than 20% above the average of similar luminaires.

Note: Maintenance lifetime costs of "conventional" luminaires are likely to be significantly less than those of "decorative" luminaires.

- c) Luminaire components and fastenings shall be stainless steel or aluminium. No plated or painted steel components are permitted. Plastic components are permitted as long as they are UV and heat resistant.

- d) Luminaire control gear shall be mounted on easily removable "modular" trays to minimise replacement expense.

- e) Appendix A also gives details of luminaire "style" (classification). This classification is generally to distinguish between the various common references of named types as "conventional", "heritage", "post top" etc.

- f) A minimum Ingress Protection Rating of IP 65 is required for conventional luminaires, and IP 54 for heritage and post top style luminaires. (The first number is for dust, the second for water.)

- g) Luminaires will be added to the Approved List at the discretion of the Engineering Manager, provided they meet the criteria in section 10.3.10 Additions to Approved Lists. Performance curves for lamp mortality and lumen depreciation should be supplied.

10.3.6.2 Columns

- a) See Appendix C for approved types.
- b) Column types will be added to the approved list by being approved by the Engineering Manager.
- c) Columns and outreaches shall meet the requirements of the relevant AS/NZS standards:
 - 1) AS/NZS 4065:2000
 - Concrete utility services poles
 - 2) AS/NZS 4677:2000
 - Steel utility services poles
 - 3) AS/NZS 4676:2000
 - Structural design requirements for utility services poles
 - 4) AS/NZS 4680:2006
 - Hot-dip galvanised (zinc) coatings on fabricated ferrous articles
- d) If column set back complies with the requirements of AS/NZS 1158.1.1 and AS/NZS 1158.1.3 recommendations – then “solid” ground embedded columns may be used.
- e) Frangible (impact absorbing) type shall only be used in high-risk crash locations.
- f) Octagonal steel columns are preferred for “conventional” style luminaires.
- g) Colours permitted (either gloss or matt):
 - 1) Black
 - 2) Wineberry international colour code IPT0016, new code Orica 57074
 - 3) Rangoon green international colour code 12B29
 - 4) Galvanised gray
- h) The painting system to be used shall be the Resene paint system Altex Devoe or a similar approved equivalent. The following methods shall apply:
 - 1) Devthan 379 (previously named E-line 939) used in all exposed marine environments
 - 2) E-line 929 used in all other locations

- i) Any new paint system will require a 5-year workmanship warranty from supplier.
- j) Paint covering around the ground line of modular galvanised columns shall be 100mm above and 300mm below the ground line.
- k) The painting system shall be applied over galvanised poles which meet hot dip galvanised standard AS/NZS 4680:2006. (Note this requires galvanising both inside and outside the pole.)

10.3.6.3 Column Locations and Spacing

- a) Ideally, lighting poles should be positioned in line with the common boundary between properties; however, these locations do not always coincide with the spacing requirements of the lighting design. If an adjacent property has not been developed (e.g. a new subdivision) and the pole cannot be positioned in line with the common boundary, locate the pole at least 5m from the boundary to allow for a future vehicle entrance.
- b) Position poles at least 1m away from a vehicle entrance or kerb cutdown. Keep poles clear of any tree canopies in the street or in adjacent properties. Trees in a legal road or on Council land must be at least 6m away from lighting poles and more clearance may be necessary for some tree species or if the tree is protected.
- c) Where possible, poles should be located close to reserves and other open spaces to provide light in these areas and improve safety.
- d) Consider traffic safety when placing lighting poles, especially when they are on or near bends, intersections, threshold treatments, road humps and roundabouts.
- e) For traffic safety reasons, position rigid poles to comply with 4.3.18 Clear Zones. Wherever the required setback cannot be achieved, it may be necessary to use frangible poles and locate the poles closer to the kerb.
- f) Where installing a pole against the building line, ensure that it is installed on the legal road or on Council land, and not on private property.
- g) The indicative spacing of lighting columns for 'Non-classified Roads' (based on the Legal Road widths specified in Table 4-4) are:
 - 1) Sub-Collector Roads – 45m
 - 2) Local Roads (Cul de sacs and Residential Lanes) – 50m
- h) The last street light in a cul-de-sac head must be no more than 0.4 of the designed light spacing from the end of the cul-de-sac, when measured from the road boundary at the end of the cul-de-sac.

- i) Wherever an existing 'Classified Road' intersects with a new 'Classified Road' or an existing 'Classified Road' being upgraded, apply whichever of the following options provides the higher lighting standard:
 - 1) The requirements of AS/NZS 1158 for such intersections.
 - 2) The provision of a new light position in the side road near the intersection.
- j) The first light from an intersection on a 'Non-Classified Road' road must be less than 10m away from the through road, measured from the kerb line. Where the lighting is attached to reticulation poles, this distance can be increased to 40% of the designed light spacing. The design light spacing requirements for the through road continue through the intersection.

10.3.6.4 Lamp types

- a) The approved types, wattage and suppliers are listed in Appendix B.
- b) High pressure sodium HID Lamps shall meet the requirements of IEC 60662. They shall not have internal (integral) igniters.
- c) Metal halide lamps shall meet the requirements of IEC 60192.

10.3.6.5 Other public lighting

- a) Lighting designs will be required to meet the appropriate level of AS/NZS1158.3.1.2005. Luminaires, lamps and column types are as listed in Appendix A, Appendix B and Appendix C respectively.

10.3.7 Cable Ownership

- a) There are two ownership regimes of underground cables within Nelson City Council area. These are as follows:
 - 1) Nelson Electrical Ltd (NEL) area – All underground cables up to the fuse located in the base of the streetlight pole and all overhead cables shall be scheduled as the property of NEL. The cable from the fuse in the base of the streetlight pole up to the streetlight shall be scheduled as the property of Council.
 - 2) Network Tasman (NWT) area – All lanterns, control circuits, underground cables (except streetlight pilot cores in underground cables), relays and associated equipment up to but not inside of NWT service boxes or padmount transformers shall be scheduled as the property of Council.
- b) All unmetered lighting load connected to the Line Owners "Works" must have prior approval from the Line Owner. Any maintenance changes or new design details must include individual site details, lamp wattages and losses and proposed livening dates. Once connected, the livening date must be confirmed to the Line Owner within 48 hours, allowing the Line Owner 24 hours to enter details on the Electricity Commission Registry pursuant to the Electricity Governance Rules. All work involving streetlights directly

connected to the Line Owners "Works" may only be performed by AHC holders approved by the respective Line Owner.

10.3.8 Data Collection

- a) Prior to the issuing of the Section 224 Resource Management Act certification for new subdivisions the developer must submit street lighting as-built data, including GPS location of all columns. This information shall be supplied on the street light as-built data information sheet Appendix E.

10.3.9 Private Road Lighting

10.3.9.1 Private road lighting (excluding amenity lighting)

- a) Private road lighting on private roads or ROW will only be permitted if the luminaires are on a separate metered circuit and a charging agreement is set up with owners and a power supply company.
- b) These need to be identified by an orange disc, 100mm in diameter, painted at the rear of the pole. The maintenance of these lights will be the owner's responsibility.
- c) The installation of privately owned road lights (owned by power company, or other private company) are not permitted on public roads.

10.3.9.2 Amenity lighting

- a) Amenity lighting that is lighting for decorative purposes that does not serve to provide lighting for pedestrians, vehicles or direction signage is not permitted on legal road.

10.3.10 Additions to Approved Lists

- a) The approved lists of luminaries, lamps and columns offer a wide range of choice to developers when undertaking new subdivisions. The styles identified in the approved lists are those used currently in Nelson. An approved list of products introduces some control on the different styles and product types the Council must maintain and ensures consistency across the city.
- b) Council will consider adding new styles or product types to the approved list if the following criteria are met:
 - 1) The new product is different in style and design to the existing selection, and meets a specific design need or landscape concept for the development.
 - 2) The product meets the design criteria of this standard.
 - 3) The supplier can demonstrate a strong company profile, history of service and assurance of maintenance parts supply.
 - 4) New products demonstrate economic efficiency and economic use of power.

- 5) Whole of life cost is comparable to current approved products or better.
- c) Addition to the list is at the discretion of the Engineering Manager.

Appendix A Approved Luminaire Types

Conventional Style (Side Entry Mounting Spigot)

Luminaire Type	Manufacturer/ Supplier	Lamp size and type
AMBAR 2	Betacom	70w HPS
AMBAR 2	Betacom	100w HPS
AMBAR 2	Betacom	150w HPS
AMBAR 2	Betacom	70w Metal halide
AMBAR 2	Betacom	100w Metal halide
AMBAR 2	Betacom	150w Metal halide
AMBAR 3	Betacom	150w HPS
AMBAR 3	Betacom	250w HPS
AMBAR 3	Betacom	400w HPS
AMBAR 3	Betacom	150w Metal halide
AMBAR 3	Betacom	250w Metal halide
AMBAR 3	Betacom	400w Metal halide
2 Tone	Kendelier	35w Metal halide
2 Tone	Kendelier	70w Metal halide
2 Tone	Kendelier	150w Metal halide
2 Tone	Kendelier	45w NGMH
2 Tone	Kendelier	60w NGMH
2 Tone	Kendelier	90w NGMH
2 Tone	Kendelier	140w NGMH

Notes:

Refer to manufacturers brochures for details of the luminaires listed.

Suppliers will only be approved if they have ISO/AS/NZS 9002 Quality management systems in place and are registered as a quality supplier.

Heritage Style (Top Entry Mounting Spigot)

Luminaire Type	Cat No	Manufacturer /Supplier	Lamp size and type	Location Restriction
Ely	A,B,C	Windsor Heritage	400w to 70w HPS	CBD only
Windsor	Street	Windsor Heritage	100w to 70w HPS	Only Collector, Local, Cul-de-sacs, Lanes
Promenade	PA, PB, PC	Kendelier Kendelier	100w to 70w	Only Collector, Local, Cul-de-sacs, Lanes
Strand	A,B,C	Windsor Heritage	400w to 70w HPS	Only Collector, Local, Cul-de-sacs, Lanes

Post-Top Style (Bottom Entry Mounting Spigot)

Luminaire Type	Cat No	Manufacturer / Supplier	Lamp size and type	Location Restriction
GOUGHLITE PT 1000	GOUGHLITE PT1000	Betacom	70w HPS	Only Local Roads, Cul-de-sacs, Lanes
	B2001 70 HPS	Slyvania	70w HPS	Only Local Roads, Cul-de-sacs, Lanes
GOUGHLITE PT 1000	GOUGHLITE PT1000	Betacom	100w HPS (SONE)	Only Local Roads, Cul-de-sacs
Windsor	Street	Windsor Heritage	100w to 70w HPS	Only in Heritage Areas, Local Roads, Cul-de-sacs, Lanes
Renaissance	RN 25	Kendelier	150w to 70w HPS	Only Local Roads, Cul-de-sacs, Lanes
York	Salisbury	Windsor Heritage	70w HPS	Parks and Reserves, accessways

Appendix B Approved Lamp Types

Notes:

1. Refer to manufacturers' brochures for details of the luminaires listed.
2. Suppliers will only be approved if they have ISO/AS/NZS 9002 Quality management systems in place and are registered as a quality supplier.
3. All High Pressure Sodium lamps shall require external igniters (there may be some specific noted exceptions), they will generally have tubular clear outer envelopes unless the luminaire optical requirements dictate otherwise.

Lamp Type	Cat No
70w High pressure sodium	Philips 70w SON/T
70w High pressure sodium	Osram 70w NAV/T
100w High pressure sodium	Philips 100w SON/T
100w High pressure sodium	Philips 100w SON/T
150w High pressure sodium	Philips 150w SON/T
250w High pressure sodium	Philips 250w SON/T
400w High pressure sodium	Philips 400w SON/T
125w Mercury vapour	Philips HPL/N 125
70w Metal halide	Philips CDM-TT Osram HCI-TT
100w Metal halide	Philips CDM-TT Osram HCI-TT
150w Metal halide	Philips CDM-TT Osram HCI-TT
250w Metal halide	Philips CDM-TT Osram HCI-TT
400w Metal halide	Philips CDM-TT Osram HCI-TT
45w New generation metal halide	Philips MASTER CosmoWhite 45W/628
60w New generation metal halide	Philips MASTER CosmoWhite 60W/728
90w New generation metal halide	Philips MASTER CosmoWhite 90W/728
140w New generation metal halide	Philips MASTER CosmoWhite 140W/728

- a) The maintenance contractor will ensure that the supplier attributes are adequate to give a reliable supply at reasonable cost.
- b) Other Mercury vapour MV are used but only to replace existing lamps.
- c) SON-T-Plus lamps are acceptable.

Appendix C Approved Column Types

Notes:

1. Refer to manufacturers' brochures for details of the luminaires listed.
2. Suppliers will only be approved if they have ISO/AS/NZS 9002 Quality management systems in place and are registered as a quality supplier.
3. Outreaches will vary in length depending upon design and location. Curved or straight outreaches are acceptable.

Mounting Height	Cat No	Manufacturer / Supplier	Location Restriction
Varies	Varies	Spunlite Poles	All roads except CBD
Varies	Varies	CSP Pacific	All roads except CBD
Varies	New Castle	Windsor Heritage	Only on Collector, local, Cul de Sacs, Lanes
Varies	Cardiff	Windsor Heritage	CBD only
Varies	Oxford	Windsor Heritage	Only in Heritage Areas, local Roads, Cul de Sacs, Lanes
7.5m max	Manchester	Kendelier	Only on Collector, local, Cul de Sacs,
7.0m	Manarc	Kendelier	Only on Cul de Sacs,
5.0m	Putney	Kendelier	Heritage Areas and Cul de Sacs, Lanes

Appendix D Pedestrian Crossing Lighting Requirements

Approved Luminaires

- a) Luminaires must be compatible with lamps that produce white light and must be installed so the lighting performance is compliant with AS/NZS 1158.4 2009.

Approved Columns

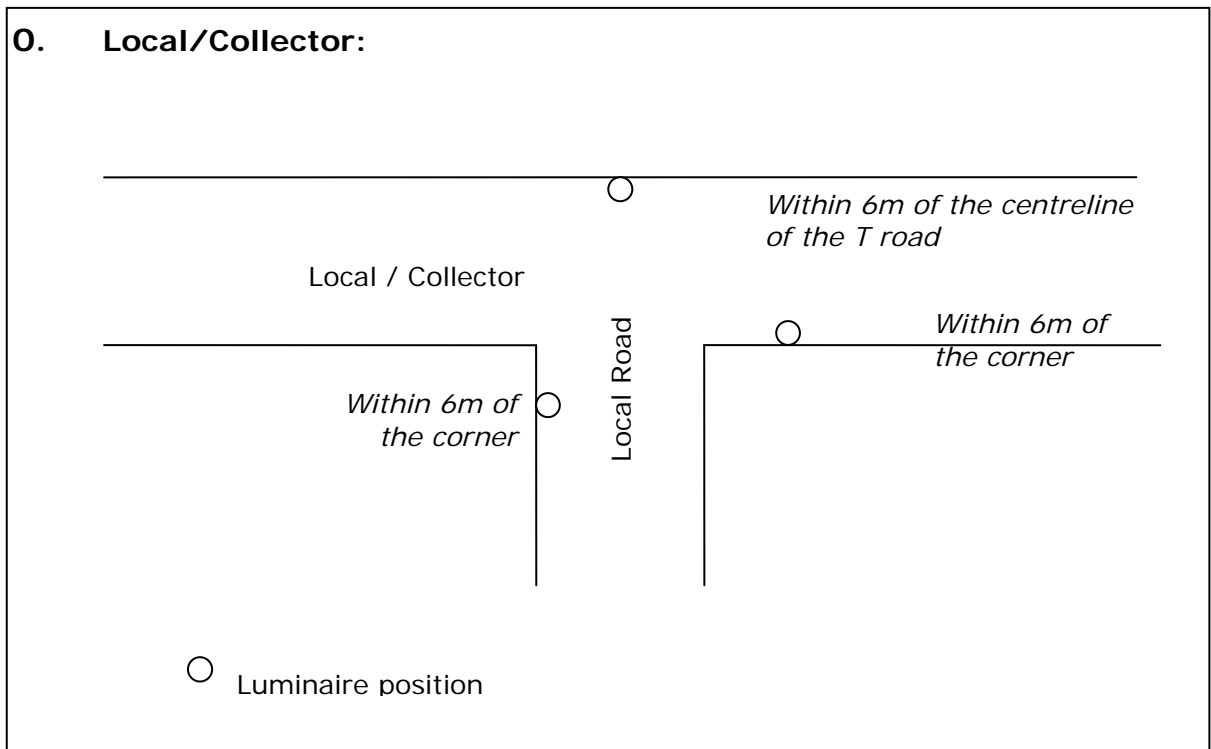
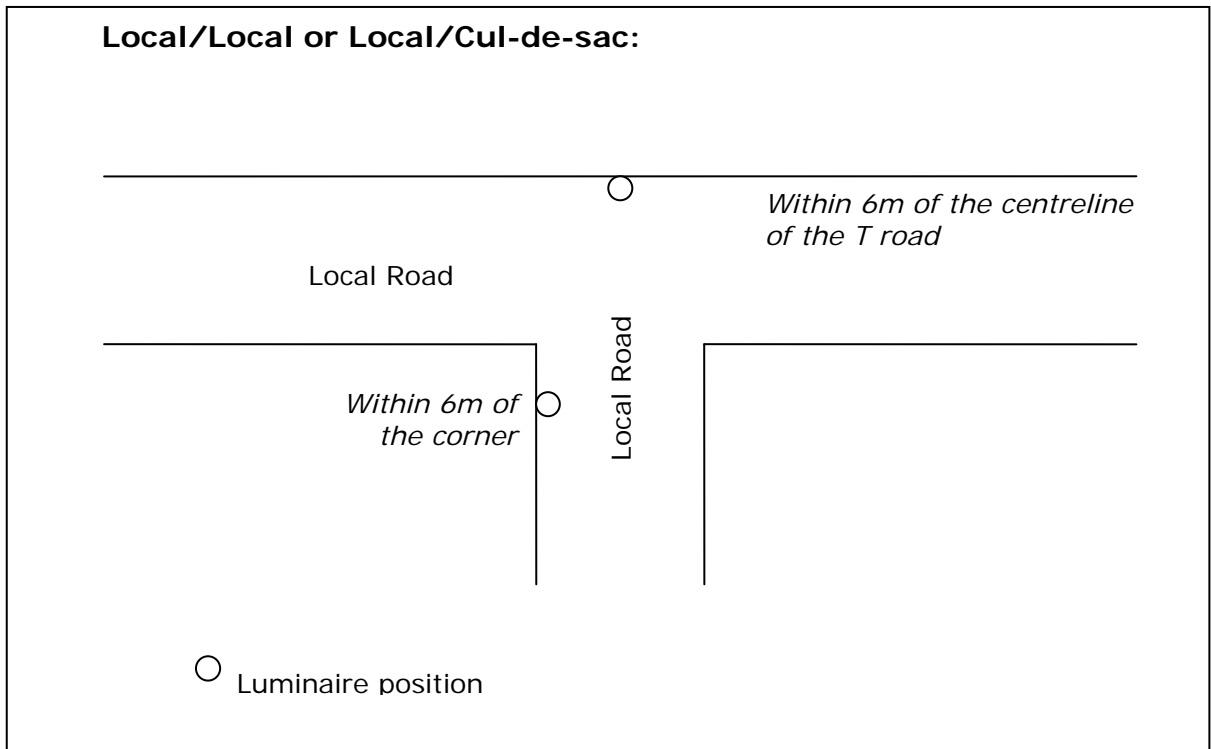
Mounting Height	Cat No	Manufacturer/Supplier
As per AS/NZS 1158	varies	Spunlite Poles
As per AS/NZS 1158	Oclyte pedestrian crossing pole	CSP

Appendix E Streetlight Data Collection Form

ROADLIGHT DATA COLLECTION FORM

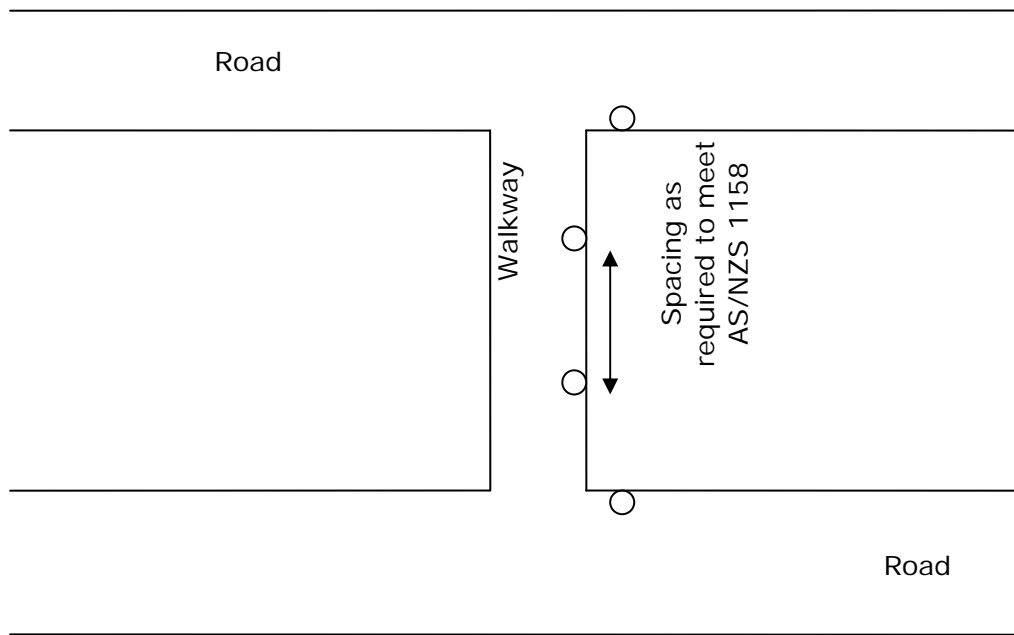
LUMINAIRE NO:		INSPECTION DATE:	
LOCATION			
Roadname:		Side of Road:	Left/Right/Centre/ Unknown
House No.:		Same Side / Opposite	
Intersecting Road:		Side of Inters. Road:	Left/Right/Centre/ Unknown
Comments:			
POLE /COLUMN GENERAL			
Pole Owner:	NCC / Telecom / Nelson Electricity / Network Tasman / Private / Other		
Pole Purpose:	Street lighting / Telephone / Electricity / Other		
Control:	Photocell / Relay / Time Switch / Other		
Material:	Concrete / Fibreglass / Steel / Spun Fibreglass / Wood		
Shape:		Mounting Height:	
Make:		Condition:	
POLE IDENTIFIER			
Pole No.:		Power Board No.:	
Map Pole ID:		'X' Co-ordinate:	
GPS No.:		'Y' Co-ordinate:	
BRACKET			
Type:			
Mounting Height (m):		Outreach (m):	
Notes:			
LANTERN			
Luminaire Owner:	Streets/Carparks/SH6/ROW(private)/Walkways/Ped. Crossings/Parks/Other		
Make:		Model:	
Supply Point:	Overhead / Underground / Other	Transformer/ Service Box No.:	
Description:			
Network Owner:		Energy Supplier:	
CONTROL GEAR			
Make:		Model:	
Comments:			
LAMP			
Make:		Model:	
Lamp Type:		Lamp Wattage:	
Comments:			
	Signature		Date
Checked by Contractor			
Entered by SLMC			
Reviewed by NCC			

Appendix F Required minimum intersection layout for street light column locations



Note: If there are existing luminaires along one side of a road it is not necessary to move them to the opposite side of the road to comply with these diagrams.

Walkway from Road:



○ Luminaire position

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11. TELECOMMUNICATIONS UTILITIES

11.1 INTRODUCTION

- a) The purpose of the telecommunications section of the Engineering Standards and Policies is to ensure that all telecommunications cabling is designed and installed to meet Council and network utility operator expectations.
- b) The standards ensure that community expectations for telephone, broadband or other communications are met in a safe and efficient way, and that access to all underground services is achieved with a minimum of disruption.

11.1.1 Objectives

- a) The objectives of the telecommunications utilities standards are as follows:
 - 1) All new telecommunications cabling meets the needs of people and communities for telecommunications;
 - 2) All new telecommunications cabling is located within public land, and/or is legally and physically protected where it is located on private property;
 - 3) Access to underground cabling is ensured for ease of repairs and maintenance, with a minimum of disturbance;
 - 4) The location of all telecommunication services is clearly marked;

11.1.2 Key References

All telecommunications infrastructure shall be consistent with the standards set out in Table 11-1. Where an Act or document is referenced this shall be the current version including any associated amendments.

Table 11-1 External Standards and References for Electrical Utilities

Standard/Reference	Description
NCC Land Development Manual (LDM)	Liability for maintenance in the road reserve lies with the Road Controlling Authority.
National Code of Practice for Utilities, Access to the Transport Corridors	Working on the Road - for Temporary Traffic Control and Safety at Roadwork Sites
New Zealand Telecommunications Act 2001	Allows Councils to impose "reasonable conditions" on the works of Network Utility Operators in order to protect Council's assets
Electrical Act 1992	Electrical safety regulations 2009

11.1.3 Interpretation

- a) "Network Operator" means any person (company) declared (by the minister) under section 102-105 of the Telecommunications Act 2001 to be a Network Operator. A list of current Network Operators is held by the Ministry of Economic Development and is available on their website.
- b) "Network Owner" means any person or Company that owns Works (telecommunication reticulation) that are used or intended to be used for the conveyance of telecommunication.
- c) "Reticulation" means all Cables/Lines that are owned by the Network Operator and form part of Network Operators Reticulation System or "Network".
- d) "Network" means information communications technology infrastructure associated with the delivery of telecommunications technology comprising one or a combination of the following:
 - Connections over fibre optic lines;
 - Connections over copper wire;
 - Structures providing wireless or satellite or antenna connections;
 - Conduits, masts and pre-cast pits to accommodate all of the above.
- e) "Connection Point" means the point where customer's equipment or cabling connects to a Network Operators reticulation. This point is the demarcation point between the Network Operators reticulation and customer owned cables (usually referred to as ETP, External Termination Point).
- f) Road reserve has the same meaning given to it by section 315 of the Local Government Act 1974

11.2 GENERAL CONDITIONS

- a) Council will only give approval for communication Cables to be installed in road reserve where they will be owned, maintained, and remain the responsibility of an organisation which has attained "network operator" status.
- b) Approval must be obtained from Council to install services in the road reserve prior to any work commencing on site. A fully detailed design plan must be submitted to Council for checking and approval purposes.
- c) Developer or customer instigated reinforcement or replacement of existing overhead telecommunication reticulation shall be by underground cabling apart from specific exemption from the Council. This shall not exclude the Network Operator carrying out any maintenance (replacement or upgrade) of existing works as long as the land will not be injuriously affected as a result of the maintenance (replacement or upgrade).

- d) Any dispensations given by either the network operator (for dispensation from its own design and construction standards) or council (for dispensation from its engineering standards and policies) should be in writing and should indicate which section and subsection of the relevant standards the dispensation applies to. Dispensations will only be given in very exceptional circumstances.
- e) All telecommunication reticulation assets to be vested with the Network Operator shall meet the Network Operators Design and Construction Standards
- f) Any telecommunication reticulation cable being vested with the Network Operator and installed on private property including Rights of Way shall be secured by way of a telecommunication easement in favour of the Network Operator
- g) All electrical service mains supplying communication sites shall be by underground cable and shall be no longer than 10 meters in length whilst in road reserve

11.3 DESIGN

- a) All new residential, commercial and industrial subdivisions shall be reticulated with underground cabling running along each side of the road reserve. The Council may allow dispensation for a single sided reticulation in exceptional circumstances (eg where allotment frontages are greater than 30m in length).
- b) All allotments capable of accommodating residential dwellings or other human occupation shall be provided with a connection to a reticulated telecommunications network.
- c) All new residential, commercial and industrial subdivisions shall be reticulated to deliver a minimum uncontested performance level of 100Mbps downlink and 50Mbps uplink where the existing reticulation, at the point of connection, has this capacity. Otherwise the new reticulation must have the capacity to deliver a minimum performance level of 100Mbps downlink and 50Mbps uplink without necessitating major road reserve disturbance or further trenching works at the subdivision site in the future.
- d) The design of the telecommunication reticulation shall give consideration to the likely and future demand requirements per lot and allow for this in the initial design.
- e) Consideration shall be given to the future extension or reinforcement of the telecommunications reticulation system without necessitating major road reserve disturbance to achieve such expansion or reinforcement. Where appropriate, spare ducting shall be installed along routes likely to be used for an extension or reinforcement of the telecommunication system.

- f) Provision shall be made by land developers for the continuation of appropriate cabling along road frontages to facilitate the telecommunications reticulation of adjoining future development. This may be achieved by the installation of cable ducting systems.
- g) The Council may waive the requirement of section 11.3 f) where it is demonstrated with approval from the Network Operator that adjacent subdivisible land may be reticulated from another suitable route.
- h) A tentative layout of any future stages in the subdivision shall be provided to the Network Operator. This will allow the Network Operator to provide for additional stages and minimise the possibility of having to re-excavate the subdivision at a later stage to install additional services.
- i) Road crossings for telecommunications cables shall be kept to a minimum and where necessary, shall be at right angles to the carriageway.
- j) Designers are to liaise with other Service Authorities to achieve economical use of road reserve area with due consideration given to ease of maintenance to the telecommunications reticulation system and other services in the road reserve area.
- k) A shared services trench is likely to be the most economic option. Separation between the services in subdivisions is required. These will be detailed in the laying specification. However, safe working distances are required for all services within minimum separations for power cables. See Table 11-2
- l) Cabinets shall be located in the berm, clear of designated vehicular access ways by a minimum of 1 meter and close to section frontages (but no closer than 300mm) or, in a recess into a lot or a public reserve, secured either by easement or preferably designated as 'Road Reserve'.

11.4 DESIGN PLAN AND AS BUILT APPROVAL

- a) Prior to any works commencing on site, a design plan detailing the proposed telecommunications reticulation shall be submitted to council and approved. The plan shall bear a design statement covering the following:
 - 1) Compliance with the Network Operators design and construction standards.
 - 2) Compliance with the NCC LDM.
 - 3) A list of easement requirements for any telecommunications reticulation on private property to be vested with the Network Operator and a list of reciprocal rights for service lead cables or ducts over shared rights of way, or easements for service main lead crossing private property.
 - 4) Network Operator signed approval of the design plan.

b) Prior to the 224 Certification stage, certification details shall be forwarded to the Council including a letter of acceptance by the Network Operator confirming that:

- 1) As Built documentation has been received and filed
- 2) The telecommunication reticulation has been lived and fulfils the Network Operators design and construction standards and any other Network Operators requirements

11.5 CABLE INSTALLATION/LOCATION

a) Table 11-2 shows the minimum clearances from power cables. SD 1001 - 1003 and 1101 show the general layout of services.

Table 11-2 Minimum Separations for Power and Telecommunication Cables

Voltage and cable type	At Crossings		On Parallel Runs	
	With protection	Without protection	With protection	Without protection
LV, neutral screened, or armoured	50mm	150mm	50mm No limit to length	300mm No limit to length
LV, neutral unscreened, or unarmoured	50mm	450mm	450mm No limit to length	450mm No limit to length
HV, single and multicore	150mm	450mm	450mm 2.4km limit to length	450mm 2.4km limit to length
<p>LV power cable is defined in the current electricity regulations as "any voltage exceeding 50 volts a.c. or 120 volts ripple free d.c. but not exceeding 1000 volts a.c. or 1500volts d.c.</p> <p>HV power cable is defined in the current electricity regulations as "any voltage exceeding 1000 volts a.c. or 1500 volts d.c.</p>				

b) Protection shall take the form of either:

- 1) 50mm thick non metallic reinforced concrete slabs (usually 150mm wide and 500mm long); or
- 2) 100mm x 50mm ground retention treated timber with a minimum specification of the New Zealand Timber Preservation Authority classification h4 group b; or
- 3) 5mm polymeric cable cover.

c) The depth and offset of trenches will be specified on the laying plan provided by the network line operator. It is essential that these be maintained. Minimum cover shall generally be 450mm in footways and 600mm in roadways.

- d) All services crossing the proposed duct pipe route shall be exposed and the necessary clearances maintained to enable the network line operator's ducts to be installed either above or below these other services. The network line operator's ducts shall be laid above power cables.
- e) All joints in duct pipe shall be water tight and may be glue jointed with solvent cement or rubber ring seal, depending on the ducting supplied.
- f) The base of the trench shall be level with large objects removed. The duct pipe shall be bedded in accordance with section 7.9.2 of the LDM
- g) Adequate provision shall be made for draining cable/ducting trenches as per section 7.9.2.5 of the water section of the LDM.
- h) Cable and duct locations in the road reserve area shall be in general accordance with SD 1001 - 1003 and 414 and 415.
- i) Cable and duct locations down rights of way shall, where possible be located 750mm from a boundary in a berm area where provided. Otherwise, the centre of the right of way is the preferred location. The standard cable depth shall be 450-600mm and may be in a common trench with water and power services as shown in SD 1002.
- j) Appropriate mechanical protection shall be provided for any underground telecommunication reticulation in accordance with the Network Operators requirements.
- k) In addition, where telecommunication reticulation cables are on private property (excluding rights of way), visible 'above ground' warning markers shall be placed where cables change direction and in between not more than 10m spacing in all but rural areas where the minimum spacing shall be not more than 20m. The warning markers shall be as stated in the network owners design and construction standards.
- l) Road crossings for telecommunication reticulation cables shall be in PVC ducts to the Network Operators requirement at a minimum depth of 450-600mm
- m) Any excavation within the existing road reserve is subject to Council approval and a Work Approval Notice issued by Council.

11.6 INSTALLATION OF DISTRIBUTION PITS/PILLARS

- a) The pits and lids are designed to withstand light vehicular loading only. Therefore installation shall take place only in the footpath or in grassed areas within the defined kerb network. On mountable kerbs they shall be located in grass areas and behind the footpath.
- b) The grass berm or footpath shall be excavated to a sufficient depth to ensure that the pit lid will be level with the finished level of the surface.

- c) Service pillars shall be set back close to section boundaries and are to be clear of designated vehicular access and pedestrian ways by a minimum of 1 meter.
- d) The minimum spacing of any service pillars from any boundary line or survey peg shall be 200mm so as to enable future fencing construction.
- e) Where multiple driveways on lot boundaries make it impractical to position a service pillar at a common boundary between lots or, where a narrow road frontage width of a lot makes the location of a service pillar vulnerable to damage, it is permissible to install a duct in the road reserve from a lot boundary to a service pillar with an offset of no more than 10m from the affected lot. This is the only occasion service leads are to be run along road reserve.
- f) Any ducting systems installed in the road reserve area shall be considered as part of the telecommunication reticulation system for the purpose of 'As Built' records.
- g) Any excavation within the existing road reserve is subject to Council approval and a Work Approval Notice issued by Council.

11.7 RECORDS

- a) The Network Operator shall keep and maintain as-built records of their reticulation within the road reserve and on private property where that reticulation will be owned by the network utility operator.
- b) The Network Operator shall ensure that they receive and maintain as-built records of the telecommunications reticulation (works) and ensure that such records are made available upon request.
- c) Provision of as-built drawings for planned works shall be free of charge to NCC and made available with 24-hours prior notice during normal working hours and for emergency call outs with no prior notice at any time.
- d) The Network Operator will ensure a cable location service is available either by providing the service in-house or making available approved contractors for the Council or its contractors or any party carrying out civil works.

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12. RESERVES AND LANDSCAPING

12.1 REFERENCED DOCUMENTS

Copies of these documents are available on the Council website or can be obtained from Nelson City Council.

- Nelson City Council *Parks and Reserves Activity Management Plan*
- Nelson City Council *Safer by Design - Crime Prevention Through Environmental Design (CPTED) Guidelines*
- Nelson City Council *Outdoor Sign Manual*
- Nelson City Council / Department of Conservation *Living Heritage - Growing Native Plants in Nelson*
- Nelson City Council / Department of Conservation Nelson *Streamside Planting Guide*
- Nelson City Council *Nelson Resource Management Plan*
- Nelson City Council *Street Tree Guidelines*

12.2 RESERVE DESIGN

12.2.1 General

- a) A range of parks and reserves are to be provided throughout the city that are accessible and well used by residents and that contribute to quality of life.
- b) Council purchases and develops reserve land for the following management purposes:
 - 1) Neighbourhood Parks
 - 2) Esplanade and Foreshore Reserves
 - 3) Conservation and Landscape Reserves
 - 4) Sportsfield Reserves
 - 5) Horticultural Parks
 - 6) Cemeteries
- c) Where land is used primarily for stormwater management purposes, this may be vested as utility reserve and maintained by Council but will not be purchased by Council.
- d) It is generally expected that land vested as reserve within new developments will be for the purpose of neighbourhood park, esplanade reserve, and/or utility reserve.

- e) Council may consider the purchase of land for other reserve management purposes in consultation with the landowner. See the Nelson City Council *Parks and Reserves Activity Management Plan* for further information on park and reserve types and their management purposes.

12.2.2 Neighbourhood Parks

General outcomes required are to provide attractive well maintained areas of open space close to local communities within Nelson that may be developed with amenity plantings, paths, park furniture and playgrounds and are available for passive and active recreation. These areas are to be linked with the road pattern to provide an integrated open space framework in the development.

12.2.2.1 General Design Principles and Requirements

- a) It is important to ensure that neighbourhood parks are designed at the time of subdivision, and constructed as soon as practicable after the subdivision is completed, so that:
- 1) The arrangement of lots can positively relate to the reserve.
 - 2) Buildings can be sited and orientated with certainty regarding relationships between them and the reserve.
 - 3) The reserve construction (play equipment, landscaping etc) is completed within two years of titles being issued for the adjoining residential lots, thereby ensuring residents gain the benefits of the reserve straight away.
 - 4) The use of reserve land as storage and access to residential building sites by contractors is avoided, as are the subsequent compaction, and surface disturbance associated with it.
- b) If Council's Parks and Reserves Activity Management Plan has identified the need for a neighbourhood park in the area, or a neighbourhood park is identified in a structure plan/outline development plan, the applicant shall consult Council and work with the Manager Community Projects on the suitability, design and location of the reserve (See park design criteria in section 12.2.2.2 below). Council will then provide the applicant with a concept for the reserve (landscaping and facilities) at no cost to the applicant. The concept shall be integrated with the intended subdivision design plan at no cost to the Council. This concept is to be included with the subdivision consent application and the vesting of the reserve land in Council will be made a condition of the consent. A condition of consent will also require that a consent notice be imposed on the title of the reserve to require that the reserve is developed generally in accordance with the concept plan approved as part of the subdivision consent application.

- c) Applicants will be able to gain reserves contribution credits for the land to be vested in Council as part of the subdivision. The landscaping and facilities in the reserve will be paid for and constructed by Council (refer item (e) below).
- d) Applicants are encouraged to use the Major Projects Team and/or the Urban Design Panel to facilitate the integrated design of the reserve with the subdivision, and ensure that all urban design goals are met through the overall design of both private and public spaces, and any areas for utility or transportation purposes.
- e) The reserve is to be formed and presented as reserve to vest in accordance with section 12.5.
- f) Council will undertake construction of the reserve (landscaping and facilities) within two years of section 224(c) certificate issue. Applicants are to provide Council's Manager Community Projects with 2 months notice of their intention to seek section 224(c) certificate so that the works can be programmed into Council's construction schedule.
- g) Each neighbourhood park location has a unique set of conditions which requires site-specific design. However, general principles for the design of neighbourhood parks include:
 - 1) Wide, open road frontage to enhance visibility and safety.
 - 2) Amenity plantings around the perimeter and within the reserve that do not obstruct sightlines and visibility through the park.
 - 3) Plantings of larger tree species for amenity and to provide shade in the summer. Consideration to be given to species and location.
 - 4) Any play equipment and/or seating will generally be located to capture the highest sunlight and daylight hours in winter. Play areas may include landscape elements as well as formal play equipment such as swings and slides. Not all neighbourhood parks will have play equipment.
 - 5) Low and/or natural barriers and fencing with neighbouring properties encouraged to enhance safety through surveillance.

12.2.2.2 Design Criteria

A neighbourhood park shall, at a minimum, meet the following criteria:

- a) **Size and topography**
 - 1) Minimum area to be 2500m² with flat useable land to be no less than 1250m². Where it is not possible to create an area of flat space for recreational purposes within the subdivision, walking/cycling connections to existing recreational open space must be incorporated into the subdivision design.

- 2) Even and regular shape that allows for maximum usable space and ease of maintenance.
- 3) Where neighbourhood park provision is already adequately provided for (i.e. properties can access a neighbourhood park within 400m), an area of land may be considered for vesting as reserve if the land is taken to protect trees, buildings, sightlines, views, landscape character, protect biodiversity, enhance local amenity or provide visually appealing areas for passive recreation.

b) Visibility and accessibility

- 1) Neighbourhood parks shall be highly visible to maximise visual amenity, safety and open space benefits for the surrounding community and to allow them to be easily located, including by visitors to the area. They will be accessible to all neighbourhoods and communities within Nelson. As a guide a neighbourhood park will be located within 400m of properties within residential areas. They are to:

- Have a minimum 30 metre road frontage on at least one side.
- Preferably be located on a corner site.
- Be located on a through road and not on a cul-de sac.
- Have additional access points provided to connect to the road network.
- Have access for maintenance vehicles and equipment.

c) Orientation and Safety

- 1) The use of reserves should be encouraged by locating them to maximise favourable conditions and providing surveillance from neighbouring properties.
- 2) Sites are to be located and orientated towards the sun to maximise daylight and sunlight hours and developed so as to reduce draft, shading and cold.
- 3) Sites are to be orientated to encourage neighbouring properties to have living spaces facing onto the reserve.
- 4) Ensure that potential hazards to public safety, such as site stability or contamination, do not exist or it is possible to remedy or mitigate any hazard.

- d) Connection to surrounding environment
- 1) Connecting existing reserves, accessways and open space provides routes and return loops for recreational use, encourages sustainable transport choices by allowing for continuous off-road journeys and can contribute to creating larger open space areas. Consideration should be given to how the development will link to the surrounding landscape including existing areas of open space, and to other public areas, such as schools, town centres, community facilities or public transport routes.
 - 2) Gaps in neighbourhood park provision as identified in the Nelson City Council *Parks and Reserves Activity Management Plan* can be used to determine appropriate sites.
- e) Natural features
- 1) Natural features or features of local interest or significance such as streams, remnant native forest or specimen trees should be included within neighbourhood parks where appropriate.
- f) Stormwater management
- 1) Where appropriate the provision of recreational open space and stormwater management can be combined within a development. Land will be vested as reserve if it meets the neighbourhood park criteria detailed above and:
 - Will not have flooding or ponded stormwater for storm events up to and including a 5 year design storm (Q5 or 20% AEP).
 - Of soil type/s and a water table such that flooding is no deeper than 200mm and drains away within 24 hours.
 - 2) All stormwater detention or treatment devices including stormwater reticulation shall be designed and constructed to the requirements of Section 5 Stormwater of the Nelson City Council Land Development Manual.

12.2.3 Esplanade and Foreshore Reserves

- a) General outcomes required are that riparian and coastal margins of high value are protected and enhanced and public access is provided to rivers, streams and coastal areas. Esplanade reserves also provide important opportunities for connecting the city via shared use paths for pedestrians and cyclists.
- b) The location and minimum width for esplanade reserves is prescribed within the Nelson Resource Management Plan (Appendix 6). Council may seek to purchase additional areas to add to the amenity and recreational value of the reserve.

- c) Consideration should be given to how any esplanade reserve in the development will link to the surrounding landscape including the road network, existing areas of open space and to other public areas. Paths on esplanade reserves shall be provided where it is an integral part of the walking/cycling connection within the subdivision.
- d) Given the generally long and linear nature of esplanade reserves, visibility and accessibility shall be maximised to enhance the amenity, safety and open space benefits for the surrounding community and to allow them to be easily located. An access point should be provided approximately every 250-300 metres in urban environments and surveillance from neighbouring properties through the subdivision design should be encouraged.
- e) Stream banks shall be presented in a stable and natural state. See section 12.4.3 for planting requirements of riparian areas.

12.2.4 Sportsfield Reserves

- a) General outcomes required are to provide a range of sportsfields that are accessible and meet the changing needs of Nelsons residents.
- b) Sportsfield Reserves are distributed throughout the city on large flat versatile sites. Council may seek further land as required in the future for this purpose. Future provision needs for sportsfields are identified in the Nelson City Council *Parks and Reserves Activity Management Plan*.

12.2.5 Conservation and Landscape Reserves

- a) General outcomes required are to protect and restore indigenous vegetation, habitats and ecosystems, protect archaeological and historic sites and values, maintain and restore natural landscape characteristics, especially those that form the Nelson city backdrop, and allow and encourage public use of reserves.
- b) Further purchase of land for conservation and landscape reserves may occur where there are accessible areas of high or potentially high natural or heritage values that require protection and management or where the land may enhance an existing conservation or landscape reserve by providing a buffer.

12.2.6 Horticultural Parks

- a) General outcomes required are to provide a flagship role for the city's identity and heritage, by providing a number of intensively managed reserves that showcase a wide range of horticulture, plant collections and landscape features and styles.

- b) Further purchase of land for horticultural parks may occur if a property containing significant gardens, landscaping or treescape worthy of protection and access by the public becomes available for sale.
- c) Land may also be purchased to enhance or expand existing horticultural parks.

12.2.7 Cemeteries

- a) General outcomes required are to provide cemeteries in a park like setting that meet community expectations and are consistent with the community's beliefs, feelings and personal choice.
- b) Several active and historic cemeteries are currently located within the city. Council may seek to purchase additional land for this purpose, particularly land adjacent to existing cemeteries.

12.2.8 Utility Reserves

- a) General outcomes required are to provide for natural stormwater management within developments that also confer additional benefits such as providing habitat for native species and/or contributing to amenity and providing a sense of openness within the development.
- b) Where it is not possible to combine recreational open space and stormwater management and where land is used primarily for stormwater management purposes (i.e. for storm events up to and including a 5 year design storm (Q5 or 20% AEP) this may be vested as a utility reserve at no cost to Council.
- c) Land used for utility purposes shall be integrated into the design of the development and provide additional benefits so that it does not limit the provision and use of open space for the community to enjoy. It shall be enhanced to provide amenity e.g. through plantings. See section 12.4.4 for planting requirements associated with stormwater devices.

12.3 RESERVE DEVELOPMENT

12.3.1 Pedestrian/Cycle Access

- a) Generally accessways to reserves and paths within reserves, where they form an integral part of the walking/cycling connection within the subdivision, will be installed by the applicant prior to vesting of the reserve.
- b) Linkages to reserves for pedestrians and cyclists should create an attractive, friendly, connected, safe and accessible environment.
- c) Generally paths in reserves and on accessways to reserves are required to be 2 metres wide to allow for shared use by pedestrians and cyclists.

- d) The minimum legal width of any accessway shall be 6 metres including berms and landscaping. Refer to SD 429 for detailed design information.
- e) Ensure there is a clear space buffer on either side of paths of at least 1 metre between the height of 1.2m and 2.4m, to ensure adequate visibility for cyclists. Furniture should be set back at least 1 metre from paths and any plant species should be selected so that future growth will not encroach into the clear space buffer.
- f) Avoid steps to allow for cycle and mobility vehicle use of paths and accessways. Where steps are required then a half-round open concrete channel should be formed adjacent the steps to assist cycle movement.
- g) Consider the location of the path and plantings on reserve accessways to ensure the path receives maximum sunlight hours in winter and that planting minimises the ability to create frosting.
- h) For the standard of formation for paths and tracks within reserves see Table 12-1.
- i) Path surfacing and construction must comply with Section 4 Transport of the Nelson City Council Development Manual.

12.3.2 Vehicle Access

- a) Generally vehicle access will be installed by the applicant prior to vesting of the reserve.
- b) Vehicle access points are required for vehicles to undertake mowing, rubbish collection, maintenance and for emergency vehicles. Vehicle access points must be wide enough to allow for heavy machinery (minimum 4 metres). Vehicle crossings must comply with Section 4 Transport of the Nelson City Council Development Manual.
- c) Access roadways and off-street parking may be required for reserves such as sportsfields, horticultural parks, the starting point of walking tracks and neighbourhood parks receiving high-use or serving a regional function. Consult the Council to see if parking areas and access roadways are required. The design and construction of roadways, parking areas and vehicle crossings must comply with Section 4 Transport of the Nelson City Council Development Manual.

12.3.3 Boundary Fencing

- a) Generally boundary fencing will be installed by private property owners following vesting of the reserve.
- b) The concept of open frontage onto reserves and reserve accessways is promoted. A sense of openness between residential properties and reserves or accessways is required to maintain streetscape amenity, encourage a sense of community, provide

opportunities for passive surveillance and improve safety in public spaces.

- c) This ranges from no fence so that private gardens merge with the reserve, to living barriers or a low fence up to 1.2m high.
- d) Hedges, climbers on trellis or other green living barriers are preferred up to a maximum height of 1.2m.
- e) The maximum height of a fence within 1.5 metre of, or on the boundary with a reserve, reserve accessway or other publicly owned open space is 1.2 metres.
- f) For subdivisions creating private lots adjoining a reserve or proposed reserve, a condition of the consent shall be that the applicant shall enter into a fencing covenant for all lots adjoining reserves within the subdivision, with the covenant to specify the height (maximum 1.2 metres high) and style of the fence. The applicant shall consult Council and work with the Manager Community Projects on appropriate fencing for the location.
- g) Where board or paling fences are used, structural railings shall be on the residential property side of the fence and the timber shall be left natural (not painted).

12.3.4 Vehicle Barriers

- a) Generally vehicle barriers will be installed by the applicant prior to vesting of the reserve.
- b) Barriers between reserves and the road are generally not encouraged. Where possible planting and landscaping should be used as the means of deterring unauthorised vehicles.
- c) Where vehicle barriers are required to control unauthorised vehicles, this may be in the form of a standard non-mountable kerb, or a physical vehicle barrier or bollards. Vehicle barriers should meet the following objectives:
 - 1) Prevent vehicles from accessing reserve land
 - 2) Continue to allow pedestrian and cycle access
 - 3) Be of a design that ensures consistency with other reserve structures and furniture
 - 4) Does not adversely affect the visual amenity of the area
 - 5) Does not greatly increase maintenance requirements
 - 6) Able to withstand or discourage vandalism pressure
- d) Where bollards are required a standard wooden bollard and chain fence shall be constructed on road frontages to reserves (other than entrances).

- e) Bollards should be placed to allow for easy mowing and maintenance and either be on a mowing square (350 x 350mm) or incorporate a mowing strip and should be spaced either 2 metres apart or 3 metres apart with a connecting chain.
- f) See SD 1205 for standard height and construction. Dimensions 700mm height, timber square 125mmx125mm, 30° point flat.

12.3.5 Lighting

- a) Generally reserve lighting will be installed by Council following vesting of the reserve.
- b) The Council prefers to light only those paths, accessways and cycleways that receive high night-time use. Lighting shall be provided where necessary in a manner that is consistent with the Nelson City Council *Safer by Design - Crime Prevention Through Environmental Design (CPTED) Guidelines*. Consideration shall be given to the brightness, placement and coverage of any lights to ensure adequate illumination where necessary and to prevent adverse effects on adjacent landowners from light spill.
- c) Lighting standards for neighbourhood parks shall be the Salisbury Short with Cardiff Column or similar design as approved by Council.
- d) For other locations such as major access roads and car parks within reserves the standard Type C standard streetlight may be used as approved by Council.

12.3.6 Signs

- a) Generally reserve signs will be installed by Council following vesting of the reserve.
- b) Signs for parks and reserves shall be installed as per the requirements of the Nelson City Council *Outdoor Sign Manual*.

12.3.7 Park Furniture

- a) Generally park furniture will be installed by Council following vesting of the reserve.
- b) Park furniture includes seating and picnic tables, rubbish bins, drinking fountains and other structures such as barbeques and boardwalks. Obtain approval from the Council for any park furniture.
- c) Park Furniture shall be set back a minimum of 1 metre from any path or cycleway, and shall not obstruct any pedestrian thoroughway of public spaces.
- d) See SD 1203 for standard height and construction of a park bench seat.

- e) It is desirable that in areas likely to be used by elderly, infirm and disabled people, the park bench seat is designed so that it has:
- Four legs securely fixed to a concrete or paved slab that exceeds the foot print of the seat by 300mm all round
 - A comfortable back that is angled no more than 10 degrees from the vertical
 - No gap between the seat base and seat back that is wider than 110mm
 - An arm rest preferably at both ends, the top of which is between 240mm and 260mm above the seat base
 - Front edge of seat to be no more than 450mm above slab (ground level) and no less than 420mm
 - A tapping rail between the front legs (less than 150mm above ground).

12.3.8 Play Equipment

- a) Play equipment will be installed by Council following vesting of the reserve.
- b) The Council's objective is to provide interesting playgrounds that meet the needs of the local community. Obtain approval from the Council for any play equipment within a reserve. It is important that any proposal integrates the play equipment into the landscape design for the reserve. The use of natural features in conjunction with formal play equipment is desirable.
- c) Any equipment and surfacing installed shall comply with NZS 5828:2004, Playground Equipment and Surfacing. In addition all the equipment and surfacing shall meet the requirements of required building or resource consents.

12.4 PLANTING

- a) This section applies to the provision of planting to enhance the environment in any part of a subdivision or where required as a condition of subdivision consent. Where native planting is desired or required, it should be read in conjunction with the Nelson City Council / Department of Conservation *Living Heritage – Growing Native Plants in Nelson 2003* and the *Nelson Streamside Planting Guide*.
- b) The first part of this section provides general requirements of planting and the second part contains details for different types of planting.

12.4.1 General Requirements

12.4.1.1 Approval of Design

a) Site-specific planting plans are to be submitted to Nelson City Council for approval. These shall be based on achieving planting requiring a minimum of long-term maintenance as well as objectives for different planting types (sections 12.4.2 - 12.4.6). Plans should include at least the following:

- 1) Plant species and spacing
- 2) Timing of planting
- 3) Weed control methodology
- 4) Maintenance methodology and plant replacement after planting and during establishment
- 5) Protection of plants against pests.
- 6) The Parks and Facilities Manager or his/her representative will review the drawings and return them to the applicant's representative, detailing any alterations that are required. If adjustments to the design are required a new set of amended drawings shall be submitted to the Council prior to approval being granted. Only drawings stamped and signed by the Parks and Facilities Manager or authorised representative shall be deemed approved drawings.

12.4.1.2 Species Selection

a) Where plants are part of an environmental planting (i.e. riparian or restoration planting) they shall be eco-sourced (eco-sourced plants are those which are grown from seeds or cuttings collected from a naturally-occurring vegetation in a locality close to where they are replanted) and selected from the Nelson City Council / Department of Conservation *Living Heritage – Growing Native Plants in Nelson*.

- b) The following matters should be considered for correct species selection:
- 1) Overall composition
 - 2) Suitability to environmental conditions e.g. ground moisture, wind, etc
 - 3) Height and spread when mature
 - 4) Pest and disease resistance
 - 5) Non-suckering habit or seed spreading
 - 6) Not a weed species
 - 7) Longevity

- 8) Shading consistent with location
- 9) Minimum maintenance requirements.

12.4.1.3 Quality Control

- a) All plants shall be sound, healthy, vigorous and free of any defects and pests which may be detrimental to plant growth and development. In addition plants should have vigorous root and branch systems and plants supplied in pots must not be root bound.

12.4.1.4 Weed Control

- a) On-site noxious weeds are to be eliminated and adequate follow-up is required during the establishment period.
- b) Any chemicals used for weed control in riparian areas need to comply with the Freshwater Rules in the *Nelson Resource Management Plan*.
- c) Where soil is imported it should be free of noxious/environmental weeds and from a source that is known not to introduce problem weeds and pests.

12.4.1.5 Maintenance Requirements

- a) Any plantings carried out by the applicant (this will mostly relate to riparian and street planting and planting associated with stormwater devices) shall be maintained for a period of at least two years after the issue of Council 224C.
- b) Riparian and other restoration planting or mass planting of groundcover plants needs to be maintained at least until canopy cover has been achieved to ensure that plants have established and can be taken over for maintenance. This may exceed the two year maintenance period as indicated above.
- c) Plants shall be kept free of pests and diseases in order to achieve their optimum performance and visual amenity.
- d) Any plants that have died in the maintenance period need to be replaced.
- e) Where present, stakes and ties shall be maintained and replaced, as required, in order to fulfil their intended purpose without causing damage to the plants.
- f) Where mulch or bark is used (i.e. street gardens) it must be kept at settled thickness as specified, and shall be kept from hard surfaces.
- g) For the duration of the planting maintenance period the planting shall be maintained at the cost of the developer and to the satisfaction of the Manager of Parks and Facilities.

12.4.2 Amenity Planting

- a) A site-specific planting plan and specifications shall be submitted to Nelson City Council for approval.
- b) Amenity plantings within neighbourhood parks and accessways shall be provided in a manner that creates pleasant spaces for active and passive recreation while maintaining enough open space to maintain a safe environment.
- c) They will be designed to meet the following objectives:
 - 1) Functional
 - Define space and create a vegetation barrier
 - Provide shade and shelter
 - Screen unsightly outlooks
 - Control of erosion
 - Enhancement of recreation and amenity value
 - Provide habitat and encourage bird life
 - Restore native biodiversity where possible
 - 2) Aesthetic
 - Frame views
 - Emphasise landscape features
 - Soften hard surfaces
 - Provide colour, form and texture
 - 3) Safety
 - Meet Crime Prevention Through Environmental Design guidelines
 - Maintain adequate visibility for road and path users
 - Maintain adequate site lines for people within the park
 - Adequate separation from parking areas
 - Avoid obstructions to pedestrians and cyclists

12.4.3 Riparian Planting

- a) A site-specific planting plan and specifications shall be submitted to Nelson City Council for approval.
- b) Riparian plantings shall be provided in a manner that enhances the natural environment while maintaining enough open space to maintain a safe environment.
- c) Species shall be planted according to the appropriate riparian zone to ensure that their function is optimised and plants don't create a barrier to water flows (i.e. where flax is planted too low on stream bank). See the Nelson City Council / Department of Conservation *Living Heritage - Growing Native Plants in Nelson* and *Nelson Streamside Planting Guide*.
- d) In general a minimum planting density of two plants per square metre is required in the margin zone. Spaces in the lower and upper bank zones will depend on the species selection but generally one plant per 1.5 m².
- e) They shall be designed to meet the following objectives:
 - 1) Functional
 - Stabilise banks
 - Slow run-off
 - Provide habitat and encourage bird life
 - Enhancement of recreation and amenity value
 - Restore native biodiversity to stream environments
 - Maintain adequate visibility to ensure safety within the reserve in particular where accessways and shared paths are adjacent
 - 2) Maintenance
 - Plants with strap-type leaves and plants likely to spread should be set back a minimum of 1.5 metres from the edge of paths
 - Ongoing weed control around plants to allow establishment

12.4.4 Planting Associated with Stormwater Devices

- a) A site-specific planting plan and specifications shall be submitted to Nelson City Council for approval.
- b) Planting shall be designed to meet the following objectives:
 - 1) Requiring a minimum of long-term maintenance

- 2) Support the functioning of the stormwater device
 - 3) Amenity
- c) The plans and specifications are to include at least the following:
- 1) Timing of planting
 - 2) Density
 - 3) Planting and maintenance methodology
 - 4) Plant replacement during maintenance period
 - 5) Water level control for maintenance / establishment period
 - 6) Protection of plants against pests
 - 7) Weed control methodology
- d) Plants shall be eco-sourced and shall be appropriate to, and tolerant of, particular site conditions. Plants shall be selected from the Nelson City Council / Department of Conservation *Living Heritage - Growing Native Plants in Nelson* and shall be appropriate to the area.

12.4.5 Street Tree Planting

- a) A site-specific planting plan and specifications shall be submitted to Nelson City Council for approval.
- b) Street trees should enhance and strengthen the existing character and intended future character of neighbourhood areas and integrate those areas. The planting shall provide maximum long term benefit to the public with minimum ongoing maintenance. It must not compromise the safe use of the legal road reserve or affect its structural integrity. Refer to Nelson City Council *Street Tree Guidelines* for guidance on selection of tree species.
- c) Plantings shall be designed to meet the following requirements:
 - 1) The minimum planting size of a landscape tree is 1.8m tall at the time of planting and 50mm stem diameter at chest height to minimise vandalism. Staking may be required.
 - 2) Watering during the first two summers if required as necessary to maintain tree health.
 - 3) Replace any that die or are damaged.
 - 4) The planting hole for the tree shall be excavated at least 1m deep and 1.5m square. Good quality soil/compost should be added and the walls of the hole to be loosened for root development.

- 5) Root barriers shall be used within berms along the road kerb edge and footpath edge to reduce the likelihood of footpath/road damage. These shall extend 4m each side of tree.
- 6) Tree pits "root directors" are required where trees are within asphalted or hard surfaces. The subgrade below the tree pit must allow roots to grow into the ground surface. It is to be free draining and shall not contain any rocks or concrete materials.
- d) Trees are generally to be planted in the front berm area between the kerb and footpath and not within the rear (services) berm or in road verges less than 1 metre in width.
- e) The mature size of any tree or garden planting is to be assessed for each planting location and is to be in scale with the surrounding street environment and the space available. Refer to Nelson City Council *Street Tree Guidelines* for tree species relative to city area and berm width.

12.4.6 Street Gardens

- a) A site-specific planting plan and specifications shall be submitted to Nelson City Council for approval.
- b) Gardens should add value to the overall streetscape and complement street tree planting, environment, and scale of surroundings.
- c) Plantings shall be designed to meet the following requirements:
 - 1) Street gardens shall be located so as not to compromise the integrity and efficient operation of infrastructural services or cause any obstruction to pedestrians.
 - 2) The number of species used should be minimised and ensure a unified result and species choice in street gardens to be considered for correct species selection.
 - 3) Where possible street gardens should support trees of a reasonable scale.
 - 4) Suitability to environmental conditions e.g. ground moisture, wind, etc.
 - 5) Pest and disease resistance.
 - 6) Minimum maintenance requirements.

12.5 PRESENTATION OF RESERVES TO VEST

- a) Land to be vested for reserves purposes shall as a minimum meet the following general requirements:
 - 1) All boundaries are to be surveyed and clearly pegged.

- 2) The land is to be free of noxious weeds, tree stumps (above and below ground) surface rocks and other specified unwanted vegetation.
- 3) The land shall be stable and not subject to a high erosion risk.
- 4) Specimen and riparian vegetation & habitats that will contribute to the reserve as identified by Council are to be left in place.
- 5) Stream banks to be maintained in a stable and natural state as required by Council.
- 6) All land subject to earthworks shall be covered with 150mm topsoil and sown in an approved dwarf rye grass mix with a minimum 80% coverage.
- 7) Grassed areas should be free of noxious or broadleaf weeds and mown to 75mm at least twice before presentation.
- 8) All previous fences, farm utilities, and building remains (unless retained for heritage value purposes) to be removed or disposed of to the satisfaction of the Council.
- 9) All rubbish to be removed or disposed of to the satisfaction of the Council.
- 10) A kerb crossing of 4 metres minimum width shall be provided at an approved access point for service vehicles to the reserve. Crossings shall be reinforced and not located adjacent to boundaries.

Table 12-1 Nelson City Council Path, Track and Road Category Standards within Reserves

Grade	Name	Use Suitability	Typical Examples	Formation, Width, Grade	Surface Material	Steps	Bridges / Culverts	Safety Rails and Barriers	Vegetation Clearance	Lighting	Furniture
1	Wheelchair Path	Wheel Chairs, Mobility Scooters, Pedestrians	Queens Gardens	Well formed even benched, with drainage W/T where needed. Width 1.6 – 2m. (Arterial paths usually 1.6). Grade max. 5 deg. Over 9m distance followed by 1m flat rest area. The transverse gradient of crowned or banked footpaths or ramps shall not exceed 1 in 50.	Paved or unpaved smooth surface.	Steps must have wheelchair by-pass.	Required for all streams to prevent any surface flow across track and ensure safety of user groups.	Where a significant hazard to anyone exists and cannot be avoided or mitigated. On one side of steps. Where there is a drop of >1m within 1m of track (as per SD 424 and 425).	From total track width, and to a height of 2.5m.	Lighting may be provided if the path is actively used at night.	Signs may be used to indicate directions, and times at entrance and junctions. Seats, picnic tables, bins, and platforms may be provided.
2	Path	Pedestrians, Cycles	Fairfield Park Paths	Well formed even, benched with drainage W/T where needed. Minimum width 1.6m. To be 2m where shared path required. Grade max. 10 deg. 15 deg. allowable over short distance (50m). The transverse gradient of crowned or banked footpaths or ramps shall not exceed 1 in 50.	Paved	Consistent run of steps allowable (three or more), max 0.18 height x 0.3m depth, at a maximum gradient of 45 deg. Provide Landing every 20 steps	Required for all streams, to prevent surface flow across track and ensure safety of user groups.	Where a significant hazard to anyone exists and cannot be avoided or mitigated. On one side of steps. Where there is a drop of >1m within 1m of path (as per SD 424 and 425).	From total track width, and to a height of 2.5m. If path is shared use, 1m clear space buffer on both sides of the path between 1.2-2.5m high.	Lighting may be provided if the path is actively used at night.	Signs may be used to indicate directions, and times at entrance and junctions. Seats, picnic tables, bins, and platforms may be provided. To be set back at least 1 metre from path.
2a	Cycleway	Pedestrians, Cycles	Railway Reserve	Same as 2 but width 2m-3m.	Paved or unpaved	No Steps	Required for all streams, to prevent surface flow across track and ensure safety of user groups.	Where a significant hazard to anyone exists and cannot be avoided or mitigated. Where there is a drop of >1m within 1m of path (as per SD 424 and 425).	From total track width, and to a height of 2.5m. 1m clear space buffer on both sides of the path between 1.2-2.5m high.	Lighting may be provided if the path is actively used at night.	Signs may be used to indicate directions, and times at entrance and junctions. Seats, picnic tables, bins, and platforms may be provided. To be set back at least 1 metre from cycleway.
3	Short Walk	Walkers (Short stop travellers)	Maitai River	Formed, or unformed. Width 0.75 – 2m. No obstacles on track. Grade max. 10 deg. 15 deg allowable over short distance (50m).	Paved or unpaved	Allowable, max 0.18 height x 0.3m depth, at a maximum gradient of 45 deg. Provide Landing every 20 steps	Required over all major water courses. Required over minor water courses where they cannot be safely crossed by day walkers when in flood.	Where a significant hazard to walkers exists and cannot be avoided or mitigated.	From total track width, and to a height of 2.5m. If path is shared use, 1m clear space buffer on both sides of the path between 1.2-2.5m high.	Not required	Signs may be used to indicate directions, and times at entrance and junctions. Seats, picnic tables, bins, and platforms may be provided. To be set back at least 1 metre from walk where possible.

Grade	Name	Use Suitability	Typical Examples	Formation, Width, Grade	Surface Material	Steps	Bridges / Culverts	Safety Rails and Barriers	Vegetation Clearance	Lighting	Furniture
4	Walking Track	Mountain Bikes/ Walkers (Day Visitors)	Grampians, Branford Park	Formed or unformed. May have obstacles to avoid. Width 0.75m – 2m. Grade max. 15 deg. 20 deg. allowable over max. 100m distance.	Gravel or natural ground / earth.	Allowable, max 0.18 height x 0.3m depth, at a maximum gradient of 45 deg. Provide Landing every 20 steps	Required over all major water courses. Required over minor water courses where they cannot be safely crossed by day walkers when in flood.	Where a significant hazard to Mountain bikers/walkers exists, and cannot be avoided or mitigated.	Sufficient clearance to ensure the track walking surface, the way ahead and furniture can be seen.	Not required	Signs may be used to indicate directions, and times at entrance and junctions. Seats, picnic tables, bins, and platforms may be provided.
5	Easy Tramping Track	(Back Country Comfort Seekers)	Dun Mountain Walkway	Minimum 0.3. Minimum 0.6 where extra width is required due to steep drop offs etc.	Natural ground / earth.	Allowable max 0.18 height x 0.3m depth, at a maximum gradient of 45 deg.	Required over all major water courses.	Where a significant hazard to walkers exists, and cannot be avoided or mitigated.	Sufficient clearance to ensure the track walking surface, the way ahead and furniture can be seen.	Not required	Signs may be used to indicate directions, and times at entrance and junctions. Seats, picnic tables, bins, not generally provided.
5a	Tramping Track	(Back Country Adventurers)	Water Reserves	Formed or unformed, markers used where track formation is unclear. May have obstacles to avoid. Width 0.3m in open flat country, – 0.6m where steep slopes and passing necessary. Grade max. – none.	Natural ground / earth.	Allowable max 0.18 height x 0.3m depth, at a maximum gradient of 45 deg.	Required over water courses where they cannot be safely crossed by day walkers when in flood.	Where a significant hazard to walkers exists, and cannot be avoided or mitigated.	Sufficient clearance to ensure the track walking surface, the way ahead and furniture can be seen.	Not required	Signs may be used to indicate directions, and times at entrance and junctions. Seats, picnic tables, bins, not generally provided.
6	Paved Roads & Car parks	2WD Vehicles, Mountain bikes, Walkers	Maitai Valley Rd	2 lane access, min. width 3m each lane and 1 footpath 1.4m wide. (Refer Section 4 'Transport' of the NCC Land Development Manual for appropriate widths). Grade max. 1 in 8 (7 deg).	AC , or chip seal To comply with Section 4 'Transport' of the NCC Land Development Manual.	No	Required over all water courses.	To comply with Section 4 'Transport' of the NCC Land Development Manual.	To comply with Section 4 'Transport' of the NCC Land Development Manual.	Required as necessary to comply with Section 4 'Transport' of the NCC Land Development Manual.	Signs indicating directions, speed, to comply with Section 4 'Transport' of the NCC Land Development Manual. Other furniture may be provided in appropriate places.
6a	Unpaved Roads	2WD Vehicles, Mountain bikes, Walkers, Horses	Grampians Road	2 lane access, min. width 3m each lane and 1 footpath 1.4m wide. (Refer Section 4 'Transport' of the NCC Land Development Manual for appropriate widths). Grade max. 1 in 8 (7 deg).	Gravel, AC, or sealed To comply with Section 4 'Transport' of the NCC Land Development Manual.	Not allowable	Required over most streams to prevent surface flow across road.	Not required	From total road width, surface, and to a height of 2.5m.	Required as necessary to comply with Section 4 'Transport' of the NCC Land Development Manual.	Signs indicating directions, speed, required to comply with Section 4 'Transport' of the NCC Land Development Manual. Other furniture may be provided in appropriate places.

Grade	Name	Use Suitability	Typical Examples	Formation, Width, Grade	Surface Material	Steps	Bridges / Culverts	Safety Rails and Barriers	Vegetation Clearance	Lighting	Furniture
7	4WD Tracks	4WD Vehicles, Horses	Sir Stanley Whitehead Park	Formed track, with water table drainage. Width 3 - 4 m. Grade max. 1 in 4 (14 deg).	Gravel, or natural ground / earth.	Not allowable	Not required. Where currently existing, they shall meet appropriate design standards.	Not required	From total track width, and to a height of 2.5m.	Not required	Signs indicating directions, distance, and to warn of other users. Other furniture may be provided in appropriate places.
8	Fire Breaks	Horses	Marsden Valley Reserve	Formed track, with cut off drainage minimum 3m, but variable depending on a range of factors. No Grade restriction.	Natural ground / earth.	Not allowable	Not required	Not required	No vegetation allowable above height of 150mm over full break width.	Not required	Furniture may be provided as appropriate.