Whangarei District Council

ENVIRONMENTAL ENGINEERING STANDARDS

Issue 1 – Operative from 1 June 2007

TABLE OF CONTENTS

TABLE OF CONTENTS

1. GENERAL REQUIREMENTS AND PROCEDURES

1.1 GENERAL REQUIREMENTS

1.1.1 General

These Engineering Standards:

- Provide a means of compliance with the Rules and Performance Criteria of the Whangarei District Council District Plan for subdivision and development, and
- Specify minimum acceptable requirements for the design and construction of Council infrastructure.

The main purposes of the Standard are to ensure that:

- Assets to be vested in Council achieve acceptable levels of service (capacity, maintainability and useful working life),
- Subdivisions and developments comply with the requirements of the District Plan,
- Assets that remain in private ownership achieve acceptable levels of service,
- Council has accurate records of the assets installed.

The goal is to achieve public assets that are current best-practice, cost-effect, and durable.

This Standard should be read in conjunction with relevant New Zealand Standards (in particular, NZS 4404:2004) and other referenced documents in this standard. Where requirements differ, the Environmental Engineering Standards shall take precedence.

Further mandatory engineering stipulations are required by legislation, Northland Regional Council regional plans and the NZ Building Code. Developers shall comply with the requirements of these documents.

1.1.2 Statutory requirements

The provisions of this standard shall be read subject to the provisions of the District Plan, and all applicable statutes, regulations and bylaws, including:

- Building Act 2004,
- Electricity Act 1992 and Amendments,
- Health and Safety in Employment Act 1992
- Land Transfer Act 1952,
- Local Government Acts 1974 and 2002,
- Plumbers, Gasfitters and Drainlayers Act 1976,
- Public Works Act 1981,
- Resource Management Act 1991,
- Telecommunications Act 2001,
- Transit New Zealand Act 1989,
- Transport Management Act 2003,
- Water Supplies Protection Regulations 1961.

1.1.3 Health and Safety

All work carried out on Council Assets, or on public land shall strictly comply with the Whangarei District Council 'Health and Safety Policy and Procedure'. This document is available from the Council.

Where the Council is not the Principal (e.g. work is carried out by a developer), all Contractors working within public land, and/or on Council assets are required to complete/comply with the following requirements of the Policy:

- Forms H&S003, H&S004,
- Provide a copy of their Occupational Safety Policy or WDC Approved Health and Safety Contractors Certificate.
- Comply with H&S005, including providing a Traffic Management Plan in a format that is consistent with TNZ Code of Practice for Temporary Traffic Management in New Zealand (Current Edition) where work will be carried out within a road.
- Comply with H&S006.

No work on Council Assets, or on any public land shall proceed before the above has been complied with, and approved by the Council. The Council reserves the right to refuse to allow a contractor that in its opinion may not comply with all Health and Safety requirements, to carry out work on Council Assets, or on public land.

1.2 DEFINITIONS

ANNUAL EXCEEDANCE PROBABILITY (AEP)	The probability of exceedance of an event (generally a storm) within a period of one year. (1% AEP is equivalent to 1 in 100 years storm).
ARTERIAL ROAD	Major roads with high traffic volumes or a significant component of through traffic. These include major roads into and through the District and roads serving significant areas of development. Existing arterial roads are shown on District Plan maps.
COLLECTOR ROAD	Roads that collect traffic from specific areas, or link important roads or major traffic generators. Existing collector roads are shown on District Plan maps.
COMMERCIAL AND INDUSTRIAL AREA	Land within Business 1, Business 2, Business 3, Business 4 (including Oil Refinery and Kauri Dairy Factory), Marsden Point Port and Airport Environments.
COMMUNITY SEWERAGE SYSTEM	A wastewater reticulation, treatment and disposal system that serves two or more properties. This applies irrespective of whether or not it is maintained by Council.
COUNCIL	The Whangarei District Council
CYCLEWAY	The part of a road that is laid-out or constructed primarily for cyclists. It may include the associated edging, kerb and channel.

DEVELOPER	In relation to resource consent applications, is the person, organisation or legal entity who/that has the financial responsibility for the development project. It includes the owner.
DEVELOPERS PROFESSIONAL ADVISOR	The person or persons appointed by the developer who shall be responsible for: • Investigation, design and obtaining approvals for the work, • Contract administration and supervision of the works, • Certification on completion of the works.
DISTRICT PLAN	The operative and proposed plans for the Whangarei District and any combination of them applicable to a resource consent application.
DRAIN	A pipe or channel that conveys sewage or stormwater flow. Drainage has a corresponding meaning.
EARTHWORKS	Any alteration to the contours of the ground by excavation, backfilling or recompaction of existing natural ground and the stripping of vegetation and topsoil. It includes: • quarrying • prospecting and exploration • the disturbance of land surfaces by moving, removing, placing or replacing soil or earth, or by excavation, cutting or filling operations • contouring • road, driveway and other access construction • clean fill operations, It does not include: • horticulture • gardening for domestic purposes • work carried out to provide for effluent disposal systems or pile foundations for residential buildings, • trenching work for the installation or maintenance of infrastructure
FOOTPATH	The part of a road that is laid out or constructed primarily for pedestrians. It may include the associated edging, kerb and channel.
GEOTECHNICAL ENGINEER	A Chartered Professional Engineer (CPEng) or an engineering geologist, with recognised qualifications and experience in geotechnical engineering, and experience related to the development.
GROUND	The material in the vicinity of the surface of the earth whether soil or rock.
DWELLING UNIT (DU) OR HOUSEHOLD UNIT EQUIVALENT (HUE)	A building or group of buildings or part thereof principally used for residential purposes by a single household. A Household Unit Equivalent is the demand on infrastructure services created by an average household unit. The Whangarei District Council 'Development Contributions Policy' defines the assumptions as to the demand created by one HUE (Appendix C of the Policy), and factors to be applied for non-residential developments (Appendices D and F of the Policy).

INDEPENDENT QUALIFIED PERSON (IQP)	A specialist approved by the Council, having the appropriate skills and qualifications to carry out specific procedures. Refer to Section 1.4 of this Standard.
INDUSTRIAL PREMISES	a) Any premises used for industrial or trade purposes or that is used for the storage, transfer, treatment or disposal of waste materials, for other waste management purposes, or for the composting of organic material; b) Any factory farm (such as battery pig or poultry farms, cattle feed lots).
LAND DRAINAGE SYSTEM	The system of drainage that controls surface and subsurface flow. It is mainly used for peak surface flows in urban areas.
LEGAL WIDTH FOR ROADS	For public roads, this is the width of the strip of land that has been declared road in accordance with section 114 of the Public Works Act, 1981. For private roads, private ways or easements (rights-of-way), it is the width of the strip of land over which the public, shared owners or landowners with dominant tenement are legally entitled to pass without the specific approval of any one landowner. The term "legal road" is interchangeable with the term "road reserve".
LICENSED CONTRACTOR	A specialist contractor who has been Licensed by the Whangarei District Council to perform a particular type of work on Council Assets, that only Licensed Contractors are permitted to perform (e.g. live connections to existing water reticulation). Normally only a limited number of contractors will be licensed at any one time.
LOCAL ROAD	Roads not classified as arterial or collector, whose major function is to provide access to properties rather than provide routes for traffic.
MEANS OF COMPLIANCE	A method by which the requirements of the standard may be complied with.
NETWORK UTILITY OPERATOR	Has the same meaning as given to it by Section (s.) 166 of the Resource Management Act 1991.
OWNER	Includes an owner of land, whether beneficially or as trustee, and their agent or attorney, and a mortgagee acting in exercise of power of sale. It also includes the Crown, the Public Trustee, and any person, local authority, board or other body or authority however designated, constituted or appointed, having power to dispose of the land or interest therein by way of sale.
PAVEMENT	The layer(s) of a road structure above the subgrade, incorporating subbase and/or basecourse crushed granular material whether chemically stabilised or not, or rigid material (such as concrete), but excluding any seal coat.
PRIMARY DESIGN FLOW	The estimated stormwater run-off selected to provide a reasonable degree of protection to surrounding land and buildings. This flow will generally be piped or contained within narrow confines, under public control by reserve or easement.

PRINCIPAL WATER MAINS	All water reticulation 100mm in diameter or greater. Includes associated valves.
PRIVATE ROAD	Any roadway, place, or arcade laid out within a district on private land intended for the use of the public generally.
PRIVATE WAY / PRIVATE ACCESSWAY	A road or passage over private land which is not open or intended to be open to general public use. (See also District Plan definitions).
REGISTERED CONTRACTOR	A contractor who has obtained approval from the Whangarei District Council to construct or modify assets that are owned or will be taken over by the Council, and has been added to Council's official list of Registered Contractors. Registration is restricted to the type of work for which approval has been given. Reference should be made to the Whangarei District Council Procedures and Specifications for Registered Contractors.
RIDER MAIN	Water reticulation less than 100mm in diameter that serves more than one property. Includes associated valves.
RISING MAIN	Wastewater pressure reticulation between a pump station and non-pressurised junction or termination including another pump station, manhole, reservoir or treatment system.
ROAD OR STREET	Has the same meaning as "road" as defined by Section 315 of the Local Government Act 1974.
RURAL AREA	Land within Countryside, Coastal Countryside or Living 3 Environments. Where a Resource Consent allows small lot sizes within these Environments, the Council may require 'Urban' standards to be applied.
SECONDARY OR OVERLAND FLOW PATH	Refers to the path taken by runoff in excess of the primary design flow, which has the purpose of preventing inundation of surrounding building sites. A freeboard above the secondary flow level is required to cater for inaccuracies in flow estimation and possible failure of the primary system.
SERVICE LANE	Has the meaning given in section 315 of the Local Government Act.
SERVICE PIPES (WATER)	Pipes located between a water meter and a building with the purpose of supplying water to a single property. Service pipes are installed and maintained by the owner.
SEWER	An enclosed pipe used for conveying sewage by gravity.
SPECIFIC DESIGN	A design that requires calculation and design, either using a method referenced in this standard, or outside of the scope of methods used in this standard. Specific designs shall be prepared by a person suitably qualified with adequate expertise and experience in accordance with sound and accepted engineering practice and principles and that meets the objectives set out in

	these standards and/or the District Plan. The design shall comply with New Zealand Standard specifications and/or other nationally recognised procedure and systems.
STABLE GROUND	Ground that, in the opinion of a suitably qualified and experienced geotechnical engineer, is in a state which is unlikely to settle, slip, erode or otherwise move to the detriment of superimposed buildings, services, roads or property generally.
STORMWATER	Rain water that flows via overland flow, channels or pipes.
SURVEY PLAN	A survey plan in terms of s.2 of the Resource Management Act 1991.
URBAN AREA	Land within Living 1 and Living 2 Environments and all Business/Commercial/Industrial Environments.

1.3 APPLICABILITY

Sections 1.4 to 1.12 inclusive are applicable to all infrastructure design and construction. Section 1.13 gives requirements particular to Resource Consent applications. For infrastructure design and construction commissioned by the Whangarei District Council, specific conditions of engagement/contract will apply.

1.4 GENERAL DESIGN REQUIREMENTS

1.4.1 Investigation and Design

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

- Are experienced in the respective fields,
- Hold appropriate membership in the relevant professional bodies,
- Have appropriate professional indemnity insurance.

Surveyors with MNZIS qualifications may carry out the design of developments except for specialist aspects requiring an IQP.

Specialist aspects of the design will require investigation, calculations, design, supervision and certification by an IQP. Table 1.1 lists aspects which will generally require design by an IQP. This list is not exhaustive, and the Council may require design by an IQP of further parts of the project where it considers that the scale or complexity of the project warrants it.

The requirement for an IQP is deemed to be satisfied by:

- A Professional Member of the Institution of Professional Engineers New Zealand working within his/her area of competence,
- Other appropriately qualified technical specialist approved by the Council, working within his/her area of competence.

Table 1.1 Specialist Aspects that Require an Independent Qualified Person (IQP) for Investigation, Calculations, Design, Supervision and Certification

Aspect	Investigation/Design by IQP
Site Suitability	• Geotechnical Assessment Report for land with Moderate or High Risk of instability, • Report on other hazards, e.g. Coastal Erosion and Instability, Mine Zones, Flood Zones etc, • Earthworks/Compaction design.
Roads and Access	• Complete design of Collector Roads and Arterial Roads, including pavement structural design, geometric design and surfacing design. • Pavement structural design for roads where the subgrade CBR is less than 7, • Geometric design for all roads with a design speed of greater than 50 km/hr, • Intersections with collector or arterial roads, and roundabouts, • Lighting design, • Bridges and major culverts, including waterway design, • Retaining walls, • Peer Reviews and Safety Audits.
Stormwater	• Catchment Analysis, • Overland flow paths, • Stormwater treatment devices, attenuation structures/devices etc.
Wastewater	• Gravity reticulation requiring pipework larger than 150mm ID, • Sewer pump stations and rising mains serving more than 5 lots, • Suitability Report for on-site disposal on small lots or lots with particular constraints, • Community Wastewater Treatment systems. • Pipe Bridges and other structures.
Water	• Water booster pump stations, • Reservoirs, • Pipe Bridges and other structures, • Hydraulic Design of Reticulation, • All Design outside the scope of Simplified Methods in this Standard.

1.4.2 Design Basis

Designs may either conform to this standard, or be an alternative design appropriate to a specific situation.

The acceptance of alternative designs shall be made on the basis of established principles of good engineering and trade practice and objectives stated in this document. In general, the Environmental Engineering Standards will be used as a guide as to the level of performance required by an alternative design.

In special circumstances some dispensations may be acceptable. Approval of an alternative design will not confer approval in general by the Council to any design criteria, construction technique or material forming part of the alternative design. Any approval is based on an examination of the information provided and shall not relieve the designer or developer of the responsibility for

compliance with Council standards, established principles and carrying out work in accordance with sound engineering practice. Where available and relevant, New Zealand standards shall be used. Otherwise, international standards, or those of other countries, may be accepted.

1.4.3 Supporting Information and Calculations

Supporting information shall be provided for the following:

- Site Suitability
- Earthworks
- Roading and Site Access
- Stormwater Drainage, including attenuation and water quality measures.
- Wastewater Reticulation and Disposal,
- Water Supply,
- Landscaping and Reserves,
- Network Utilities

Supporting information shall include:

- Names and details of Independent Qualified Persons (IQPs) that carried out investigations and design,
- Design reports and calculations,
- Drawings and specifications,
- Other reports required to comply with this standard,
- Design certificates for each part of the works.

Specific requirements are detailed in the relevant sections of this standard.

1.4.4 Peer Review

The Council reserves the right to require a peer review by an independent specialist approved by the Council, of any report, design or calculations submitted in support of a development or project, at the developers cost.

1.5 DRAFTING STANDARDS

1.5.1 General

Design and As-Built drawings shall comply with the following standards. Where the drawings do not comply or are not clear in their presentation, Council may require revised drawings to be presented.

Drafting standards shall comply with NZS / AS 1100.

Coloured lines shall not be used.

Standard symbols and line styles as detailed in SHEET 1 shall be used to ensure uniformity. Existing services shall be shown in faint lines and proposed services in heavy bold lines. The extent of existing and new work, and infrastructure that will be modified or removed shall be clearly identified.

Plans shall clearly define the work on public assets as distinct to assets that will remain in private ownership.

Existing and proposed property boundaries shall be shown on all plans.

Service plans shall clearly show the location of each service. This may require separate sheets for each of the services.

Design drawings shall be provided in hard copy format. As-Built drawings shall be provided in both electronic and hard copy formats, except that hard copy plans only may be accepted for minor infill developments at the discretion of the Council.

1.5.2 Survey Co-ordinates and Levels

All engineering surveys for as-builts, and all subdivision survey parcel boundary elements shall be in terms of NZGD2000. They are to be orientated to NZGD2000 and fully connected, bearings and coordinates, to the NZGD2000 survey control such that the subdivision survey will be submitted to LINZ as a NZGD2000 survey.

Levels or elevations shall be Reduced Levels to the LINZ/DOSLI datum (One Tree Point 1964 Datum).

At the time of issue of this standard, all data will be in NZMG coordinate projection. The WDC will be changing to NZTM coordinate projection in the future, and will require its use from this time. The current requirements should be established with the Council at the time of subdivision, before submitting final As-built plans.

The submission of local circuit or site-specific coordinates and levels will not be accepted.

1.5.3 Drawing Orientation

- Plans should generally be oriented with north to the top of the sheet. All plans shall have a North point.
- Plans and long sections shall have the lowest distance/lowest invert on the left hand side of the sheet.
- Road cross sections shall commence at the bottom left hand corner, and proceed upwards.

1.5.4 Scales

Table 1.2 gives preferred scales for drawings.

TABLE 1.2 – Preferred Scales

Plan Type		Preferred Scales
Location Plan		1:5000 to 1:20,000
Site Contours		1:1000, 1:500, 1:250 or 1:200
Road Layout Plan		1:500, 1:250 or 1:200
Road Cross Sections	Horizontal Vertical	1:50 1:50, 1:20
Services Plans		1:500, 1:250 or 1:200
Services Long Sections (Ratio H:V at 1:5 or 1:4)	Horizontal Vertical	1:500, 1:250 or 1:200 1:100, 1:50
Details		1:20, 1:10 or 1:5

1.5.5 Hard Copy Format

All drawings shall be prepared on standard ISO A1, A2 or A3 drawing sheets, with a clean background. Where A1 or A2 sheets are used, reduced A3 copies to scale shall also be provided.

Drawings must be suitable for photo reduction and microfilming. Lines shall not be finer than 0.25 mm on A2 sheets and 0.35 mm on A1 sheets. Printing should be spaced sufficiently to retain clarity when reduced. Capital letters shall be not less than 2.5 mm in height before reduction from A1 size. Where a mixture of capital and lower-case letters are used, the height shall be not less than 3.5 mm on A1 sheets.

1.5.6 Electronic Formats

Drawing formats shall be:

- AutoCAD .dwg files, including all referenced files required. As-built plans to be a full set of all plans, updated to include as-built information, easements etc, and,
- .pdf copies of drawings, endorsed/certified as as-built drawings.

DXF files may be accepted (subject to compatibility with WDC system).

Particular requirements for AutoCad drawings include:

- Layouts shall be set up so they may be printed as they are required to be printed, i.e. with all necessary layers turned on and irrelevant information frozen. Layers that are required for the design but are not required to be printed shall have the 'DO NOT PRINT' symbol selected in the layer control area,
- All x-refs, pen assignments, images and special fonts used shall be included with the drawing file,
- Layouts shall be named to represent the content of each sheet (normally the sheet title),
- Different elements of the drawing shall be drawn on its own appropriately named layer, e.g. sewer manholes on a 'SWMH' layer),
- As-Built layouts shall have 'As-Built' incorporated in the title,
- Layouts should have line-type scale setting inset into them to ensure correct printing.

1.5.7 Electronic Asset Information Data Requirements

In addition to the above requirements, an Excel spreadsheet with As-Built asset information as detailed in Appendix B shall be provided.

1.6 CONTENT OF DRAWINGS

Drawings shall include:

General

- A locality plan of the site including major street names and other major features. The locality plan shall include a north point.
- Legal descriptions of the site, and adjacent properties,
- The overall extent of the works, including the relationship with works or services adjacent to the site. This includes clearly identifying existing works that will be modified, removed or abandoned.

Earthworks

- Earthworks drawings showing existing and proposed contours, areas of cut and fill, batter slopes, drainage details, silt control measures etc.

Roads and Access

- Design of roads, including plans, long and cross sections showing vertical and horizontal road geometry,

- Pavement details,
- Kerbing and side drains, berms, footpaths, cycleways, etc,
- Road marking, signs and signals and all road furniture, Details of information signs shall include the full layout, including sign text and colours,
- Proposed planting of berms.
- An electronic file of coordinates for road centrelines and edge of seal/kerblines,
- Details of accesses including berm crossings and drainage.

General Services

- Location of services in berms and accessways in relation to other services and site boundaries,

Stormwater

- A contour plan of the development site prior to any works commencing showing the location of existing flow paths, and a contour plan of the developed site showing the proposed stormwater works and flow paths,
- Plans and long sections of reticulation, showing the location of all sumps, manholes etc, pipe lengths, sizes, materials, cover, levels and grades of stormwater drains. Location and depth of services that cross existing or proposed drains/pipes,
- Plans, long sections and cross sections of all open drains and watercourses,
- Details of inlet/outlet structures including protective screens,
- Details of stormwater treatment/attenuation devices
- Floodplain / Secondary Flow Path levels and boundaries, and easement requirements.

Wastewater

- Plans and long sections showing the depth and location of all pipelines including lengths, sizes, materials, class of pipes, cover, levels and grades of wastewater reticulation. Location and depth of services that cross existing or proposed reticulation,
- Depth, location, and details of all access structures, service connections etc,
- Details of connection into the existing reticulation and other special connections,
- Special details, including pump stations, rising mains, air valves, odour control facilities etc.
- The make and model of all pumps, valves and other equipment
- Pipeline details including thrust blocks, special connections, pipeline bridges etc.

Water Supply

- The depth and location of all pipelines, including lengths, pressure class, sizes, materials and cover. Location and depth of services that cross existing or proposed reticulation,
- Depth and location of service connections, valves, hydrants, bends, tees, meters, meter boxes, backflow devices etc,
- Details of connection into existing reticulation and other special connections,
- Special details, including pump stations, reservoirs.
- Pipeline details including thrust blocks, pipeline bridges etc,
- The make and model of all pumps, valves and other equipment.
- Nominal static pressure at the connection point and at the lowest point in the works, design pressure and maximum design pressure.

Power, Telecommunications and Gas

- The depth and location of existing and proposed provision of power, telecommunications and gas services. Lighting provisions.

Reserves and Landscaping

- Details of proposed earthworks, landscaping, planting etc of reserve areas, including stormwater and recreational reserves.

1.7 AS-BUILT DRAWINGS, SCHEDULES OF ASSET INFORMATION AND OPERATION AND MAINTENANCE MANUALS

1.7.1 General

"As-Built" drawings, Schedules of Asset Information and Operation and Maintenance Manuals shall be provided on completion of construction work as described below.

The requirements for As-Built drawings, Asset Information and O&M Manuals apply to the installation or modification of all Council assets, irrespective of whether they are works associated with a Resource Consent or otherwise.

For Developments:
The 224c certificate for a development will not be issued until As-Built drawings, Schedules of Asset Information and O&M Manuals have been provided and approved.

For Whangarei District Council Contracts:
The Practical Completion Certificate will not be issued until As-Built drawings, Schedules of Asset Information and O&M Manuals have been provided and approved.

1.7.2 As-Built Drawings

As-Built drawings shall be provided in Hard Copy and Electronic formats, to the following requirements:

- Drafting Standards shall be as detailed in Section 1.5 of this standard. Drawings that use aerial photographs in the proposal drawings shall be provided without aerial photographs for the As-Built drawings.
- Drawing Content shall include:
  - All requirements of Section 1.6 of this standard. A full set of Construction drawings, including all sheets submitted for the proposal updated to include As-Built information shall be supplied. This shall include sheets that have not been amended since the application. This includes Index Sheets, Locality Plans, Earthworks, Long Sections, Cross Sections, Co-ordinate Sheets, Details etc,
  - As-built drawings shall include non-physical details such as the extent of overland flow paths,
  - All further requirements of the As Built checklists in Appendix B.
  - Specific requirements in the particular sections of this standard
  - All drawings required by the statutory consent authorities in the consent application(s).

The As-Built drawings shall show what has actually been constructed, including all approved changes made during construction. Drawings shall label roads with WDC approved road names, and parcels with house numbers. The drawings shall also accurately locate the position and depth of all existing services exposed during the construction.

Location and level data for both plans and asset schedules shall be to the co-ordinates and level requirements of Section 1.5.2, to the following accuracy:

- Levels accurate to 10 mm,
- Locations accurate to 100 mm.

As built drawings shall be adequately labelled and dated. The developer's representative shall certify the accuracy of the information.

1.7.3 Asset Information Schedule

An Asset Information Schedule shall be provided in the format required in **Appendix B**. It shall consist of a full inventory list of all Council assets that have been provided AND all assets that have been removed, The asset schedule shall be cross-referenced with the drawings using a simple sequential numbering system. Cross-reference numbers on as-built drawings shall be underlined to distinguish them from other numbers.

The Asset Information Schedule shall include:

- Component Type/Description
- Unit Type
- Installation Date
- Expected Life
- Location X,Y,Z Co-ordinates & inverts – for 'point data'. – For lines, pipes and mains, co-ordinates at the start, end, 20 m centres, change of material/size etc. shall be shown on plans,
- Material and class,
- Size,
- Quantity,
- Serial Number,
- Ground Surface description,
- Manufacturer.

1.7.4 Operation and Maintenance Manuals

Operation and Maintenance Manuals shall be provided for all mechanical equipment or installations, including sewer pump stations, water supply booster pumps, actuated valves, treatment facilities , water quality treatment devices, attenuation structures and outlet controls, etc.

1.8 RAMM DATA REQUIREMENTS

RAMM (Road Assessment and Maintenance Management) data is required as set out below for all roads or other assets such as car parks constructed or altered by applicants which are to be maintained by Council. RAMM data requirements are as set out in Whangarei District Council RAMM data forms.

For Developments:

The Whangarei District Council will use its RAMM Consultant to handle RAMM data capture for Council maintained road and parking assets on behalf of Council.

Developers are required to assist Council's Consultant by providing all information required for this work. This includes:

- All pavement details, including metal types, depths and sources of aggregate,
- Typical sections and plan views,
- Top surface and sealing data,
- Dates that each pavement layer, surfacing etc. are constructed,
- Details of subsurface drainage, geotextile layers, and all other buried features,
- Information on all structures, including bridges, retaining structures etc (Note that culverts with a waterway area greater than 3.4 m^2 are regarded as bridges under the TNZ bridge manual),
- Details of all road signs.

For roads, accessways and access lots serving 5 or more lots or dwelling units, which are intended to be named but not maintained by Council, the applicant shall supply the carriageway length, width, road name and street name blade, pole and fixing/mounting data only.

This information shall be available with the As-Built data above.

For Whangarei District Council Contracts:
Requirements for obtaining RAMM data shall be as set out in the particular Contract Conditions.
In general the Professional Services Consultant will be responsible for providing the RAMM data, with the Contractor assisting the Consultant with data capture.

RAMM data shall be presented using the Whangarei District Council Standard Forms, for:

- Carriageway,
- Pavement Layers,
- Traffic Facilities and Markings
- Signs,
- Drainage and Footpaths
- Crossings, features and minor structures.

RAMM data shall be provided to the requirements of the Council prior to the issue of the Practical Completion Certificate.

1.9 REGISTERED CONTRACTORS AND LICENSED CONTRACTORS

For some infrastructure services, the Whangarei District Council maintains a list of Contractors that are permitted to construct or work on Council Assets. Contractors on such a list may be either Registered or Licensed Contractors.

Registered Contractors are Contractors that demonstrate to Council that they have the resources and competence to carry out the type of work, that they have acceptable Health and Safety and management systems, and that they comply with all other requirements of the Council (e.g. insurances etc).

Licensed Contractors are generally a limited number of specialist contractors that the Council has approved to perform particular types of work (e.g. live connections to Water reticulation). Such work shall only be carried out by Licensed Contractors.

Where the Council maintains a list of Registered or Licensed Contractors for a particular type of work, only Registered or Licensed Contractors (as applicable) may carry out such work on Council assets or assets that will be transferred to Council ownership.

The Council Policy on Registered and Licensed Contractors, and the current list of Licensed contractors is available from the Council.

1.10 COLOUR OF PIPES AND DUCTS

Pipelines and ducts installed shall comply with the requirements of the utility service providers. In order to identify in-ground services, pipes with the colours in Table 1.3 shall be used where possible for the relevant services. Other services shall not use pipes with these colours (including the colour of stripes on pipes). Note also particular requirements for detection tapes identifying Council services.

The internal colour of wastewater and stormwater pipes shall be suitable for video inspection (normally black will not be approved).

TABLE 1.3 Colour of Pipes and Service Ducts

Service	Colour
Electricity	Orange
Telecommunications	Green
Gas	Yellow
Water	Blue
Wastewater	Light grey (Preferred)
Stormwater	Dark grey (Preferred)

(Ref. OSH "Guide for safety with underground services").

1.11 PROTECTION OF EXISTING SERVICES AND REPAIR OF DAMAGE

The developer and/or contractor shall take every care to protect existing services and private property from damage as a result of its operations. To this end:

- Steel-tracked machines shall only be permitted to run on sealed road carriageways if appropriate protection, such as rubber mats, is provided. Otherwise, rubber tyred machines are required;

- The contractor shall consult all utility service operators as to the location of buried services and take appropriate action to protect those services.

Damage caused by the works shall be the liability of the developer and shall be repaired on the written instruction of the Council or affected utility services operator. If remedial work is not commenced within 48 hours of the written instruction (or sooner if the circumstances warrant it) and completed as soon as practicable, the Council may carry out the work at the developer's cost. This provision includes the removal of mud and debris from existing roads and drains, which may be required daily in the interest of traffic safety.

The developers and its contractor shall hold appropriate insurance to cover it in the event of its operations damaging existing services, and shall indemnify Council against any claims associated with the works, whether during or after construction.

1.12 EMERGENCY PROCEDURE

If during the course of construction, a situation arises which may endanger the security of public or private property or the operation of a public facility, the Council may instruct the developer or Contractor to undertake such remedial measures as considered necessary to abate the danger.

Where the Council has to carry out emergency work on behalf of the developer, the cost of the work will be recovered from the developer.

The Council shall not enter into correspondence with any person other than the appointed representatives on any matter relating to a resource consent.

1.13 PARTICULAR REQUIREMENTS FOR RESOURCE CONSENT APPLICATIONS

1.13.1 Resource Consent Application

A Resource Consent is required for every subdivision, either as a controlled, restricted discretionary, discretionary or non-complying activity.

Reference to the Whangarei District Plan is required to establish requirements for a Resource Consent Application.

An 'Application Pack' for Resource Consents – Subdivision is available from the Whangarei District Council, or from the Council web-site (www.wdc.govt.nz). The Application Pack contains:

- Guides to assist in applying for a Resource Consent,
- Application Forms.

The Guide and Application Forms identify information requirements for the Application.

A formal application under the Resource Management Act must be made where a variation to standards in the District Plan or resource consent conditions is proposed. Where a developer wishes to take advantage of any discretion referred to in these standards, it must be specifically identified in the application.

1.13.2 Developer's Representative

The developer shall nominate a specialist representative to liaise with the Council. The developer's representative would generally be a Registered Surveyor, Resource Management/Planning Consultant or Chartered Professional Engineer, but may be a suitably qualified person in a related field, experienced in all phases of resource consent. The representative shall be available for site visits within 24 hours of being so requested by the Council.

The Representative shall provide, or arrange for suitably qualified and experienced persons to provide the following:

- Surveying and engineering reports, design, documentation and drawings. This may include the design and control of earthworks and assessment of site suitability including land stability, hazards etc. to be evaluated under the District Plan.
- Supervision of the works required by the approved engineering drawings and specifications.
- Certification that the works and authorised variations have been carried out in accordance with the approved documents and sound engineering practice.
- Preparation, certification and submission of "As-built" drawings of the completed works.

1.13.3 Fees and Charges

The applicant shall pay all fees and charges relating to the assessment of the application, review and approval of drawings and documents, inspections carried out, legal fees in connection with drainage easements, bonds, etc., and such other fees and charges where applicable.

Engineering plan inspection fees are to be paid prior to plan approval.

1.13.4 Cost of the Work and Council Contributions

The developer is responsible for all costs associated with the application and all construction work required. This includes provision and relocation of services, connections to existing services, and all other permanent or temporary work required for the development. It may also involve upgrading existing infrastructure required because of the effects of the development.

The developer shall pay all development contributions and other charges set by the Council.

The applicant should liaise with appropriate utility service operators prior to submitting a Resource Consent application to establish any additional requirements or costs.

In special circumstances, Council may contribute towards the cost of work in terms of an applicable policy, or as negotiated. Generally such contributions would cover the provision of services greater than required for the immediate proposal. The basis and timing of payment are subject to negotiation with Council. All such agreements shall be confirmed in writing prior to commencing work.

1.13.5 Approval by Council

Upon the granting of a resource consent, the engineering services shall be designed by an approved Professional (Refer Section 1.4). Three sets of engineering construction drawings and one set of specifications, calculations and other relevant supporting information shall be supplied to the Council.

The Council will review the engineering drawings, specifications, design calculations and reports. If the documentation is not acceptable, Council will return one set of drawings with Council comments. (Note - if preferred, Council will examine and comment on one set of documents and will receive the additional copies of the drawings for endorsement).

The developer shall revise the application as required and resubmit it to Council for endorsement. Such endorsement shall not relieve the developer of the responsibility to achieve the requirements of this standard and the District Plan.

Where a drawing is approved that either by omission or error does not comply with these Standards, the Council will require that the Standards are achieved.

Endorsement of drawings is subject to the payment of plan inspection fees.

The developer shall hold an endorsed copy of plans on site at all times during construction of the works.

1.13.6 Commencement of Work

No work associated with a resource consent shall commence until;

- The Council has granted the resource consent.
- All other statutory provisions have been met. (e.g. permit to disturb archaeological sites, building consents obtained etc.)
- The requirements of the approval, including engineering drawings, specifications, design calculations and reports for the work have been satisfied, and necessary fees paid.
- Any Council contribution toward the cost of work has been approved.

Any works undertaken prior to the final approval of engineering plans will be at the developers risk. The WDC reserves the right to reject such work, or request that the works to be opened up and / or tested for compliance / suitability.

The developers representative shall give the Council 24 hours notice of the intention to commence construction work.

The developer shall advise Council in writing the name, address and contact details of all contractors that will be carrying out work on the development or subdivision.

1.13.7 Variations to Approved Engineering Documentation

Where changes to the approved Engineering Documentation are required, the developer shall apply to the Council for approval of the change, and where required a Variation to the Consent.

The application shall include a statement on the effect of the variation on the original resource consent and documentation to support the need of a consent variation as a result. Such variations will be processed in the same way as new works. Work shall not proceed until the Council grants approval to the variation.

1.13.8 Inspection of the work

1.13.8.1 Site Inspections

The developer's representative shall notify the Council 24 hours prior to requiring site inspections, which are necessary at the following stages of the work:

- Completed earthworks and prepared subgrade,
- Verification of as-built drawings on-site prior to backfilling piped services and similar,
- Finished basecourse prior to the commencement of sealing,
- Prior to pouring any concrete,
- On completion of any service disconnections prior to backfilling,
- At all testing required by this Standard, including those noted below,
- At completion of all works when as-built drawings have been submitted and the site left neat and tidy.

1.13.8.2 Testing

Inspection/Testing shall include:

- Material testing,
- Fill compaction testing,
- CBR testing of road subgrade,
- Nuclear Densometer testing of road formation compaction,
- Clegg Hammer testing of Pavement,
- Pressure testing of pipelines,
- PE Pipe welding testing, including:
  - Calibration Certificate/Welders Registration,
  - Joint tensile testing,
  - Welding data-log records,
- Video inspection of all wastewater and stormwater pipelines,
- Disinfection testing of water mains,
- Hydrant flow testing,
- Tracer Cable/Detection Tape testing,
- Testing of manholes and other pipeline components,
- Other testing as directed by the Council, including Benkelman Beam tests.

The developer shall pre-test the work and prove it satisfactory before requesting an inspection by Council to observe the testing and approve the work. Work shall not proceed until Council's Representative has inspected the work, observed the required testing and approved the work, or Council has given written approval to proceed.

1.13.9 Connection to Existing Services

(Refer to Whangarei District Council forms WA, WWA and SWA)

The developer shall notify the intention to connect to Council owned services following successful testing of the reticulation. Following approval to connect the developer shall arrange for the connection to be made. For services where Council operates a Licensed Contractor system, connection shall only be made by a Licensed Contractor.

An authorised Council Officer/agent shall inspect connections prior to backfilling.

Where a connection is to be made within private property not owned by the developer, it is the developers responsibility to obtain the approval, and make all necessary arrangements with the property owner concerned. Evidence of that owner's approval will be required by the Council.

1.13.10 As - Built Drawings, Asset Information Schedules and O&M Manuals

As-Built Drawings, Asset Information Schedules and Operation and Maintenance Manuals shall be provided in compliance with Sections 1.6, 1.7 and 1.8 of this Standard.

The issuing of a 224 (c) certificate or release of a performance bond may be withheld if these are not prepared to the requirements of Council.

In the event of a service, including service connection, either not being provided although shown on the "As-built" drawings, or not in the position shown, the developer's representative shall provide or locate the service or, in the event that the service doesn't comply with these standards or the approved drawings, rectify the incorrect components. The Council shall then be provided with revised "As-Built" drawings as necessary.

1.13.11 Completion

On completion of the works, the developer shall provide the following:

- Geotechnical Reports and plans,
- All limitations on development of the properties, including hazards, easment requirements etc,
- As-built plans,
- Results of all testing,
- Video inspection records of all wastewater and stormwater reticulation,
- PE pipeline welding data logging results,
- Evidence that all infrastructure work has been completed to the requirements of the network utility operator, including all requirements for final completion (refer requirements in Section 1.13.13 below),
- Design Certificates,
- Completion certificates,
- Operation and Maintenance manuals required by the Council
- RAMM information for public roading assets,
- All Consent Notices have been registered against property titles,
- Bonds in terms of Section 1.13.15 are in place.

1.13.12 Defects Liability Period

The Developer shall be responsible for the performance of all works provided by the developer that will become Council assets, for a minimum defects liability period as follows:

- 12 months for roads and landscape planting, Where roading involves a second coat seal, the defects liability period for the sealing shall be for a period of not less than 2 months after the application of the second coat seal.
- 12 months for other services.
- The Council may require a maintenance period of 3 to 5 years as a condition of a Resource Consent for plant maintenance, and weed/pest control.

The defects liability period shall commence from the date that the final inspection is approved, or the date the resource consent completion or conditions certificate is issued, whichever is the latter.

1.13.13 Requirements for Final Completion

Prior to final acceptance at completion of the maintenance period, the developer shall satisfy the following requirements:

- Berm grass to be mown.
- Carriageways and footpaths swept.
- All sumps and piped disposal systems cleaned out.
- Planted areas to be left in a state suitable for ongoing maintenance – including:
  - All plants healthy
  - Depths of mulch as specified in plans
  - Grass established
  - Removal of all weeds and noxious vegetation from berms, reserves etc
- Any outstanding maintenance items completed
- Written approval from other utility service operators as necessary

1.13.14 Insurances

Where work is to be carried out on a dedicated road or reserve, or on a Council asset, the developer shall ensure that the following insurance is in place prior to commencing work:

- Public Liability Insurance in the name of the developer for an amount of $ 2,000,000. For developments where the value of work on public land or Council asset is low, Council may reduce the required value of the public liability insurance to relate to the risk, but not less than 150% of the value of this work. The Policy shall cover all insurable risks normally applicable to land development work until the end of the maintenance period. Such risks may include flooding due to burst water mains, property damage due to land slips or contamination of natural water due to overflowing sewerage reticulation.
- The developer's representative and IQPs shall hold current professional indemnity insurance with minimum cover of $200,000.
- The developer shall indemnify Council against any claims arising from insurable risks until the end of the maintenance period.

The developer shall ensure that its contractors also hold insurance cover appropriate to these requirements. The developer shall provide evidence of insurance cover prior to the commencement of the work.

1.13.15 Bonds

Bonds may be required in terms of Councils Resource Consent Operational Policies for Maintenance Work or Uncompleted Work.

General conditions relating to bonds are summarised as follows. The relevant policies shall be consulted to establish the full conditions:

- Generally only minor uncompleted works and where approved, carriageway sealing may be bonded. Critical infrastructure (e.g. road formation, water, wastewater, stormwater, power supply etc.) will not normally be bonded.
- The bond shall be an agreed cash deposit, or a bank bond from a New Zealand based Trading Bank
- No interest will be paid on bond monies,
- For physical work, the amount of the bond shall be 150% of the estimated value of the intended bonded engineering work, or as otherwise approved,
- For maintenance the amount of the bond shall be 5% of the estimated value of the intended bonded engineering work, , or as otherwise approved,
- The developer is responsible for providing all necessary documentation,
- The developer shall pay all processing fees, legal costs and disbursements relating to the bond,
- The bond may be registered against the title of the property.

1.13.15.1 Performance Bond

Performance Bonds may be required to ensure the performance, completion and/or maintenance of certain works under the Resource Management Act 1991. Performance bonds may be made a condition of consent in accordance with the applicable Resource Consent Operational Policy.

Performance Bonds may be applied if:

- Non-completion has the potential to result in adverse effects outside of the subject site boundary or expose council to possible financial and/or litigation claims,
- Work is to be undertaken on Council owned/administered land,
- A maintenance period is required on assets to be vested to Council,
- It is unreasonable to delay the issuing of 224 (c) certificate due to conditions of consent relating to planting/control,
- It is unreasonable to delay the issuing of 224 (c) certificate due to conditions of consent that cannot reasonably be completed by this stage, and which may result in adverse effects outside of the subject sites boundary.

The term of the bond shall be appropriate to the extent and scope of the consent condition, and in accordance with accepted industry practice.

The bond will be released on completion of all works, acceptance at the end of the maintenance period, and on payment of any applicable fees.

1.13.15.2 Uncompleted Works Bond

Uncompleted Works Bonds may be implemented to enable short-term deferral of certain physical works under the Resource Management Act 1991. Such bonds shall only be entered into if the application complies with the specific requirements of the applicable Resource Consent Operational Policy.

The main requirements are summarised below:

- Bonds are for engineering works required by conditions of an approved resource consent,
- Delayed implementation shall not result in adverse effects outside the boundary, prevent vehicular access to each lot from a road, inhibit occupation of lots for their proposed land use, or result in, or leave a hazard to public safety.
- The term of the bond shall not exceed 12 months

Where compliance with the conditions of resource consent is issued under bond, the balance of the construction work outstanding shall be completed within the term of the bond.
The bond for outstanding work is refundable upon confirmation of final inspection and acceptance by the Council following completion of the works, payment of all associated fees, and submission of a maintenance bond where appropriate.

The maintenance period for the work shall commence at the completion of the whole of the work, except as otherwise permitted.

2. SITE SUITABILITY AND EARTHWORKS

2.1 GENERAL REQUIREMENTS

2.1.1 General

This Section covers the requirements for the following:

- Assessment of land stability and suitability for the proposed use,
- Design and control of earthworks,
- Assessment of ground suitability for the construction of roads, buildings etc,
- Assessment of other hazards that may affect the development. This may include hazards identified in the District Plan or in Council Reports, or hazards identified as part of the site investigation.

2.2 REFERENCED DOCUMENTS

The following documents shall be read in conjunction with this section of these standards:

- Whangarei District Plan (WDC)
- Regional Soil and Water Plan for Northland (NRC)
- Regional Coastal Plan for Northland (NRC)
- NZS 4431:1989 Code of Practice for Earth Fill for Residential Development,
- WDC Coastal Structure Plan – Slope instability Potential and Effluent Disposal Potential, Oakura to Langs Beach.
- Stormwater Catchment Management Plans
- Coastal Hazard and Erosion Studies (WDC/Jeremy Gibbs)

The above documents will be added to from time to time as further investigations and reports are completed. The applicant is advised to obtain information from Council on any relevant documents applicable to the site.

The Council has copies of investigations carried out to support development proposals across the District. Reports on adjacent sites may be available, subject to limitations on their use.

2.2 TECHNICAL REQUIREMENTS

2.2.1 Preliminary Site Evaluation

The applicant shall obtain information available from the Council and other sources on hazards and development limitations that may affect the development.

Hazards identified by Council include:

- Coastal Erosion and Instability,
- Earth Movements
- Mine Zones,
- Flood Zones

Information on these hazards is available via the District Plan, the WDC GIS, or specific investigations/reports.

The applicant shall engage a geotechnical engineer to carry out a preliminary site evaluation and prepare a geotechnical assessment report, except where the applicant can otherwise demonstrate that the site is stable and suitable for the proposed use, and the proposed earthworks on the site are minor in scale.

An IQP shall carry out an evaluation as required on other hazards.

2.2.2 Coastal Areas

Minimum site levels in coastal areas shall take into account storm surge, tsunami hazards, erosion potential, climate change and sea level rise. The minimum floor level where there are no particular hazards should normally be RL 3.0, with an absolute minimum of RL 2.5. The level of the general site, parking areas and access roads shall provide for emergency access and use. These should normally have a minimum level of RL 2.5.

Specific investigation and design shall be carried out where there are particular hazards.

2.2.3 Geotechnical Assessment Report

The geological/geomorphological assessment should entail most or all of the following steps, and a brief report should specifically address the expected effects of the subdivisional and/or building development on the land.

The following risk levels are identified in WDC reports on slope stability. Where the site is outside of an area covered by such reports, an assessment shall be made by a geotechnical engineer as to which level is appropriate.

Low Risk Land

The geotechnical assessment of low risk land would be expected to include:

- Walk-over inspection of the site and the surrounding land
- Inspection of aerial photographs taken at various times to provide insight into the local geomorphology and evidence of any previous instability
- Review of geological data (maps, bulletins)
- Enquiry after local information about stability/instability of the ground
- Seek existing data about the soil and rock profile (look for nearby exposures) or perform some simple subsurface investigation
- Examination of the soil profile to confirm that if the soil is in-situ and not colluvium (slide debris)
- Examination of the existing survey records for evidence of movement (slippage or erosion)
- An opinion stated by a geotechnical specialist as to the stability of the land for development (including an assessment of the effects of development such as excavation, filling, removal of vegetation, disposal of stormwater or effluent wastewater into or over the area).

Moderate stability hazard

A geotechnical assessment on moderate risk land would be expected to include:

- Topographic survey (if not already available) or slope profiles.
- A description of the geology and geomorphology of the area, including comment on the areas surrounding the development site.
- Definition of the nature and continuity of the strata over the whole area of land which is proposed to be developed (buildings, access and services) and to a depth below which slipping is most unlikely, by means of test pit and/or drilling and/or augering (unless existing exposures are adequate).

- Assessment of the relative strength and the sensitivity of the soil in each stratum in which, or interface on which, sliding is possible.
- Assessment of likely groundwater levels and piezometric pressures in the strata during extreme infiltration conditions.
- An opinion stated by a geotechnical specialist as to the stability and suitability of the land for development. The stability of the whole slope (upon which the site may only form a part of) and the effects of the development (such as excavation, filling, removal of vegetation, disposal of stormwater or effluent waste water into or over the area) on this should be given.

<u>High stability hazard</u>

A geotechnical report on high landslip hazard areas land would be expected to include:

- Topographic Survey (if not already available)
- A description of the geology and geomorphology of the area and immediate surrounding areas.
- Definition of the nature and continuity of the strata over the whole area of land involved, and to a depth below which slipping is most likely, by means of test pits and/or continuous recovery core drilling (unless existing exposures are adequate).
- Determination of the peak and residual shear strength parameters (either from laboratory tests or back analysis of relevant slope failures) and the sensitivity of the soil in each stratum in which, or interface on which, sliding is possible.
- Assessment of groundwater levels and piezometric pressures in the strata during extreme infiltration conditions.
- Analysis of possible failure mechanisms, relevant to the specific geology and geomorphology of the site using effective stresses.
- An opinion stated by a geotechnical specialist as to the stability of the ground and the preventative (or remedial) measures to be incorporated in the development.
- The stability of the whole slope (upon which the development site may form only part of) and the effects of the development (such as excavation, filling, removal of vegetation, disposal of stormwater or effluent waste water into or over the area) on this should be given.

2.2.4 Stabilisation Works

Works may be required to protect or restore the land. These may include earthworks (to reduce slope angles or place buttress fills), drainage works (trench drains, buttress or counterfort drains aligned down the true slope angle are particularly effective), retaining structures, erosion protection structures, and planting.

Where a site requires works to ensure stability of a landform, such works shall be carried out as part of the subdivision or development.

2.2.5 Restrictions on Development

Where a suitability report recommends restrictions be applied to specific areas of a land development proposal, a plan defining those areas will be required to accompany the report. Any restrictions on development contained in the suitability report must be presented in tabular form with definite conclusions and recommendations to enable the report to be easily interpreted.

Reports will be used as the basis of a Consent Notice to be registered against the title of the land affected. Such reports are required prior to any resource consent being issued. (See Whangarei District Council Forms A, B and C.)

2.3 LANDFORM

The developed landform shall preserve natural features as much as practicable, including the retention of natural watercourses.

2.4 COMPACTION OF FILL MATERIAL

Compaction of fill material shall be as set out in NZS 4431, or as specified by the geotechnical engineer where NZS 4431 is not applicable.

2.5 EROSION, SEDIMENT AND DUST CONTROL

Land disturbance activities shall comply with the 'Environmental Standards for Land Disturbance Activities' in the NRC Regional Water and Soil Plan for Northland.

This will require detention ponds, silt fences etc. The use of flocculants may be required in surface water sediment control ponds depending on the sensitivity of the location and receiving environment.

All consents required for Land Disturbance activities shall be obtained from the Northland Regional Council.

Control of dust shall be considered in the planning and design of a project.

2.6 REPORT ON COMPLETION OF CONSTRUCTION

Where excavation or filling has been carried out, a report identifying the extent of the work and the inspection and test results shall be submitted on completion of construction and prior to the final inspection of the development. This shall be accompanied by a statement of professional opinion as to the compliance of the filled ground to the specification and the suitability of the area for development. (See Whangarei Distrct Council Forms A, B and C.)

3. ROADS AND ACCESS

3.1 GENERAL REQUIREMENTS

3.1.1 General

This Section covers the requirements for the design and construction of roads associated with land development.

The objective is to provide safe roads with appropriate operating speeds, and provide for utility services and environmental considerations.

3.1.2 Scope of Design

Road design shall provide for the various components of a road as follows:

- Road carriageway, bridges, culverts etc,
- Pedestrian and cycle facilities,
- Road lighting,
- Road marking and signs, (including name signs for public and private roads).
- Berm and amenity provisions,
- Vehicle parking and manoeuvring areas,
- Utility services,
- Stormwater control, including stormwater treatment and 'low-impact' design structures,
- Use as secondary flow paths for stormwater.

Roads shall include provision for future development outside of the property boundary, and impacts on the surrounding road network.

3.2 REFERENCED DOCUMENTS

The following documents shall be read in conjunction with this section of these standards:

- Whangarei District Plan (WDC)
- WDC Working Within Road Reserves Policy and Specification
- WDC Road Opening Notice
- WDC Road Naming Policy (April 2005)
- WDC RAMM data forms.
- Transit New Zealand (TNZ) Manuals and Technical Documents, as listed in the TNZ Standards, Criteria and Guidelines Manual, including:
  - AS/NZS Standards, - (AS/NZS 1158 Road Lighting),
  - TNZ Code of Practice - Temporary Traffic Management
  - Austroads Rural Road Design
  - Austroads Urban Road Design
  - Austroads Pavement Design, including NZ Supplement,
  - Austroads Pavement Design for Light Traffic (a supplement to Austroads Pavement Design Guide)
  - Austroads Guides to Traffic Engineering Practice
  - TNZ State Highway Geometric Design Manual
  - TNZ/LTSA – Manual of Traffic Signs and Markings (MOTSAM),
  - TNZ Bridge Manual, Austroads Waterway Design.
  - TNZ New Zealand Supplement to Austroads Guide Part 14: Bicycles

- TNZ /Transfund Specifications and Notes for Road Construction, Maintenance and Material Standards,
- LTSA Guidelines (RTS series) and Manuals,
- NZ Institute of Highway Technology approved Pavement Design Techniques,
- NZ Transport Strategy.
- Auckland Regional Council Technical Publication 10 (ARC TP 10) - Stormwater Treatment Devices Design Manual

Where aspects of the design are not covered by this section or the above documents, the following standards may be referenced. Adoption of any practises outside of the Council documentation must first be approved by the Roading Manager.

- NZS 4404:2004 Land Development and Subdivision Engineering,
- New Zealand Building Code (NZBC).

The most up to date of these publications shall supersede any conflicting requirements of older documents.

3.3 SUBMISSION OF APPLICATION

3.3.1 Supporting Information and Calculations

The design shall include site investigations, supporting information and calculations to demonstrate compliance with the design requirements. This shall include:

- Testing of the pavement subgrade,
- Assessment of traffic volumes
- Pavement design,
- Surfacing Design
- Design of surface drainage and other road components,
- Utility service locations.

The design shall be carried out by a qualified Professional, who shall provide a design certificate identifying the design standards used, and certifying that the design complies with these standards. Where required by the Roading Manager, the design and certification shall be carried out by an IQP.

3.3.2 Design Drawings and Specifications

Design drawings complying with the requirements of Sections 1.5 and 1.6 shall be provided for approval.

3.3.3 Approval of Design

The drawings and calculations will be reviewed by the Roading Manager or his/her representative**.** The completed form and the drawings showing any alterations shall be returned to the applicant's representative. 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 Roading Manager shall be deemed approved drawings. Unless specifically stated otherwise, the approval of drawings does not supersede the requirements or obligations of these standards.

3.4 DESIGN REQUIREMENTS

Road standards shall comply with Tables 3.1 to 3.5.

Table 3.1. MINIMUM WIDTH REQUIREMENTS – URBAN AND COMMERCIAL/INDUSTRIAL ENVIRONMENTS (Living 1, 2, All Business Environments)

Class		**Area Served / Traffic Volumes**	**Min. Road Reserve Width**	**Carriageway Width**				**Foot-path**	**Notes** – Also Refer Section 3.4.2 , 3.4.3
				Parking	Traffic	Cycles	**Total**		
PRIVATEWAY									
URBAN (Living 1 & 2 Environments)		1 – 4 lots	4.0		1 x 3.0	-	**3.0**	-	Provide turning areas, passing bays, and widening on curves. Legal width may need to be increased to include cut/fill batters and services as required.
		5 – 8 lots	6.0		1 x 4.5	-	**4.5**	1.0	
		> 8 lots	To the relevant road standard						
LOCAL ROADS									
URBAN (Living 1 & 2 Environments)	**Cul de sac**	Up to 150 m length	14.0			-	**7.5**	1 x 1.4	Special provision for parking may be required.
	Minor Residential Road	Up to 500 m length	18.0	1 x 2.5	2 x 3.0	-	**8.5**	2 x 1.4	
	Residential Road	Over 500 m length	21.0	2 x 2.5	2 x 3.0	-	**11.0**	2 x 1.4	May set parking bays into berm area.
SERVICE LANES									
INDUSTRIAL/COMMERCIAL (Business 1 to 4 (including Oil Refinery and Kauri Dairy Factory), Marsden Point Port and Airport Environments)			9.0		2 x 3.0	-	**6.0**	2 x 1.4	Provide mountable kerbs. Footpaths constructed to road crossing details.
COLLECTOR ROADS									
URBAN (Living 1 & 2 Environments), **INDUSTRIAL/COMMERCIAL** (Business 1 to 4 (including Oil Refinery and Kauri Dairy Factory), Marsden Point Port and Airport Environments)		1000 – 3000 vpd	23.0	2 x 2.5	2 x 3.5	2 x 1.0	**14.0**	2 x 1.4	Cycle provisions may be best marked for 2.5 m parking, and 4.5 m Wide Kerbside Lane as per Fig. 4-19 of NZ Supplement to Austroads Guide – Part 14. For main cycle routes, Arterial standards shall be applied.
ARTERIAL ROADS									
URBAN (Living 1 & 2 Environments), **INDUSTRIAL/COMMERCIAL** (Business 1 to 4 (including Oil Refinery and Kauri Dairy Factory), Marsden Point Port and Airport Environments)		3000 – 7000 vpd	24.0	2 x 2.2	2 x 3.5	2 x 1.8	**15.0**	2 x 1.4	Cycle lane layout as per Fig. 4-7, NZ Supplement to Austroads Guide – Part 14.
		> 7000 vpd	Specific Design						

Table 3.2. MINIMUM WIDTH REQUIREMENTS – RURAL ENVIRONMENTS (Countryside, Coastal Countryside and Living 3 Environments)

Class	**Area Served / Traffic Volumes**	**Min. Road Reserve Width**	**Carriageway**						**Notes** – Also Refer Section 3.4.2, 3.4.3
			Unsealed Shoulder	Sealed Shoulder	Lane Width	**Sealed Width** (see note)	Carriage-way width	Footpath (Ref. 3.4.7)	
PRIVATEWAY									Provide turning areas, passing bays, and widening on curves. Legal width may need to be increased to include cut/fill batters, swale drains and services as required. For up to 5 lots served, sealing of privateways is only required in Living 3 or where the gradient exceeds 18%.
Rural Privateways	2 lots	4.0	2 x 0.25	-	1 x 3.0	**(3.0)**	3.5		
	3 – 5 lots	6.0	2 x 0.25	-	1 x 4.0	**(4.0)**	4.5		
	6 – 8 lots	10.0	2 x 0.25	-	2 x 2.75	**5.5**	6.0		
	> 8 lots	To the relevant road standard							
LOCAL ROADS									
Local Road	0 – 300 vpd	20.0	2 x 0.5	2 x 0.5	2 x 2.5	**6.0**	7.0	(1.4)	Provide widening on curves. Footpaths are required in Living 3 Environment, and may be required in other Environments (Refer Section 3.4.7). Provision for parking may be required with close development. The Road Reserve width may need to be increased to include cut/fill batters, water tables and services as required
Sub Collector	300 – 700 vpd	20.0	2 x 0.5	2 x 0.5	2 x 3.0	**7.0**	8.0	(1.4)	
COLLECTOR ROADS									
Minor and Major Collector	700 – 2500 vpd	20.0	2 x 0.5	2 x 0.5	2 x 3.5	**8.0**	9.0	(1.4)	
ARTERIAL									
Arterial	> 2500 vpd	20.0	2 x 0.5	2 x 1.0	2 x 3.5	**9.0**	10.0	(1.4)	

Table 3.3 GEOMETRIC DESIGN REQUIREMENTS

Type	**Design Speed** (km/h)	**Gradient (%)**	**Max. Super-elevation**	**Recommended Min. Curve Radius (m)**
Privateways	-	0.4% -12.5% - 22%	-	8
Cul de sac	-	0.4% - 12.5%	6%	15
Local Residential Roads	30	0.4% - 12.5%	6%	45
Residential Collector & Arterial Industrial / Commercial Collector	50	0.4% - 10%	8% 6%	80
Industrial / Commercial Service Lane	-	0.4% – 10%	N/A	To Suit B Train
Rural Local & Sub-Collector	70	0.4% - 12.5%	To Specific Design	
Rural Minor Collector (700-1000 vpd)	70-100	0.4% - 10%		
Rural Major Collector and Arterial (>1000 vpd)	100	0.4% - 10%		

TABLE 3.4 WALKWAY AND CYCLEWAY REQUIREMENTS (2 WAY)
Applies to Walkways and Cycleways not adjacent to roads

Type	Min. (Preferred) Width (m)
Walkway	2.2 **(2.5)**
Cycleway	2.2 **(2.5)**
Combined Walkway and Cycleway	2.5 **(3.0)**

TABLE 3.5 RECOMMENDED WIDENING ON CURVES
Applies to Public Roads. Privateways serving less than 8 lots require specific consideration.

Curve Radius (m)	Widening (m) where normal width of 2 traffic lanes is:			
	6.0	6.5	7.0	7.5
30 - 50	2.0	1.5	1.5	1.0
50 - 100	1.5	1.0	1.0	-
100 - 250	1.0	1.0	-	-
250 - 750	1.0	0.5	-	-
>750	0.5	-	-	-

3.4.1 Privateways

Roads that serve eight or less separate titles shall be private accessways, except where the Council agrees that they become public road. This will normally be when:

- they extend an existing road, or
- they form the first section of a road that will ultimately serve a larger number of properties.

Private accessways serving more than eight dwelling units shall be formed to the requirements of the relevant road standard. The performance requirements of such an access shall be the same as for a public road.

3.4.2 Road Width Requirements

Road reserve widths may need to be increased from Tables 3.1 and 3.2 to provide for:

- Services, including pump stations, electricity transformers etc,
- Berms,
- Batters,
- Landscaping,
- Stormwater channels, swales etc,
- Stormwater treatment requirements (refer Section 3.4.10),
- Parking,
- To allow for long term needs.

The road reserve shall be located 0.5 metres outside the toes of earthwork cuts or fills unless the slope of the earthworks is 1V:4H (25%) or less in which case it can be located at the minimum distance from the centreline.

Privateways fronting a residential distributor road or larger shall have a minimum sealed width of 5.0 m (with a corresponding increase in legal width) for a minimum of 6 m from the boundary to allow easy entry and exit to the street.

Provision shall be made for additional parking and/or widening of the carriageway if further subdivision is possible.

Where particular constraints exist that make the required widths impracticable, the developer may apply for dispensation to these standards. The application should include the reasons for requiring the dispensation, and any measures proposed to mitigate the effects of the reduced standard.

3.4.3 Provision for Further Development

Where further development of a site or adjoining land is possible, consideration shall be given to the need or desirability of increasing the legal width of an access to permit such development in the future.

The Roading Manager may require a higher class of road than required for the particular development (including future stages of the development) to allow for development outside of the subject property. Council Policy in relation to cost sharing shall apply to such situations. The cost to Council shall be agreed with the Roading Manager prior to work commencing on site.

3.4.4 Public Transport and Cycling

Provision for public transport and cycling routes and facilities shall be incorporated in the design where required by the Roading Manager. Reference should be made to Section 3.2.5 of NZS 4404:2004 for guidance on Public Transport provisions.

Cycle lanes will be required on all residential collector and arterial roads, industrial/commercial collector roads, and where the road forms a strategic link with other cycle routes. Cycle provisions shall comply with Austroads Guide to Traffic Engineering Practice - Part 14 Bicycles, and the TNZ New Zealand Supplement.

3.4.5 Surfacing

A sealed surface is required for:

- All urban privateways,
- Rural privateways serving more than 5 lots, or with a gradient steeper than 18%,
- All urban and rural roads.

Council may by specific approval permit rural roads to be unsealed. Approval will not normally be given where the road will service properties that are predominantly urban, lifestyle, horticultural or similar, or that extend or join a sealed road. Approval for unsealed roads shall be confirmed at the time of resource consent application.

Where new unsealed roads or privateways intersect with sealed roads, the seal shall be extended at least 20m along the new road from the intersection.

3.4.6 Upgrading Existing Roads

Where lots front an existing road, or when upgrading of an existing road is required because of new or increased traffic, the developer shall upgrade the affected road to comply with this standard. This may include road intersection construction or modification, the provision of footpaths and upgrading drainage to the development frontage.

3.4.7 Rural Footpaths

Footpaths will normally be required in Living 3 Environment. These may be located adjacent to lot boundaries, separated from the carriageway by a watertable.

With Cluster development in Countryside and Coastal Countryside environments, the berm shall be formed and grassed so that it is suitable for pedestrian use.

In any Environment, provision of safety footpaths may be required because of the scale or type of development, and/or hazards from traffic.

3.4.8 Design Speed

The design speed for rural sub-collector and minor-collector roads may need to be increased from the speed in Table 3.3, to take account of the character of the development, e.g. it may need to be increased to 100 km/hr where development is rural in character, rather than semi-urban.

3.4.9 Traffic Calming

In residential streets, traffic calming measures may be used to enhance amenity values and safety, by limiting speeds and discouraging through traffic from minor roads. Traffic calming measures include providing horizontal bends of significant deviation (45° or more), provision of speed humps, traffic islands, raised pedestrian crossings, lane deflections, narrowing etc.

The provision of traffic calming measures should be discussed with the Roading Manager at an early stage in the design. The use of any such measure is subject to specific approval by the Roading Manager

3.4.10 Drainage

Surface drainage shall be incorporated in the design.

In urban areas this may be by kerb and channel or an alternative approved low-impact design. Alternative designs shall be adequately engineered, be designed to fit with the urban environment, and minimise maintenance requirements. Where there are particular maintenance or vehicle crossing requirements, these shall be included in Consent Notices on the relevant property titles. Sub-surface drainage shall be provided below pavement/kerb edges in terms of good engineering practice.

In Living 3 Environments, surface drainage should normally be to the same standard as urban areas.

In other rural areas, side drains shall be provided for stormwater, and to keep groundwater below the road pavement. Side drains shall be within the road reserve.

The drainage system shall include first flush treatment to Auckland Regional Council TP 10 standards. Where 'active' treatment devices are proposed, the type of device shall be approved by the Wastes and Drainage Manager. This is to rationalise maintenance requirements for such devices across the District.

3.4.11 Design Life

The design life of roads shall be as follows:

- Pavements - at least 25 years based on Equivalent Standard Axle (ESA) or equivalent design method.
- Surface and ground water drainage systems - not less than 100 years.
- Bridges and major culverts on public roads - not less than 100 years.
- Bridges and other structures on private accessways – not less than 100 years.

3.4.12 Vehicle Crossings

Where a site has frontage to more than one road, the vehicle crossing shall be onto the road that has the lower class in the roading hierarchy, except where access to the road with higher class is shown to be more appropriate, and with the approval of the Roading Manager. Note that the maintenance of vehicle crossings is the responsibility of the properties served.

The minimum distance of a vehicle crossing from an intersection is shown in TABLE 3.5. Distances are measured parallel to the centreline of the frontage road from the centreline of the intersecting road.

TABLE 3.5 - Minimum Distance of Vehicle Crossings from Intersections

	Intersecting Road Type (Distance in metres)		
Speed Limit 50 km/hr			
Frontage Road	**Arterial**	**Collector**	**Local**
Arterial	70	55	35
Collector	40	40	20
Local	25	25	10
Speed Limit Over 50 km/hr			
Arterial	180	180	90
Collector	75	60	60
Local	75	60	60

3.4.13 Roadside Hazards

The design shall include consideration of roadside hazards, particularly in high speed environments. The design shall consider ditches and roadside batters, culvert ends, posts, obstructions etc. Where required, slip bases on poles, the use of bevelled and grated culvert ends, pedestrian safety barriers and guardrails shall be provided.

3.4.14 State Highways

Properties that front a State Highway or access a side road intersecting with a State Highway will need to comply with the requirements of Transit New Zealand. Transit should be consulted before undertaking any planning associated with the site layout or access provisions.

3.5 GEOMETRIC DESIGN

3.5.1 General

The design shall be carried out be carried out by a suitably qualified and experienced Engineer experienced in road geometric design.

The Roading Manager may require the Developer to provide an independent Safety Audit of the design

3.5.2 Urban

Major collector and arterial roads shall be designed to 'Austroads *Guide to Traffic Engineering Practice*', incorporating horizontal transition curves.

Other urban roads and privateways may use circular curves with bend widening as required. Tables 3.3 to 3.6 in NZS 4404:2004 may be used for the horizontal and vertical design of urban roads without horizontal transition curves.

3.5.3 Rural

Rural roads shall be designed to TNZ *State Highway Geometric Design Manual* or Austroads *Guide to the Geometric Design of Rural Roads* except as modified by Table 3.2. Low speed rural roads and privateways may use circular curves without transition curves.

3.5.4 Sight Distances

Sight distances for stopping, intersections, overtaking, curves and obstructions shall comply with SHEET 15, and other relevant standards, including Austroads *Guide to Traffic Engineering Practice*.

3.6 PAVEMENT STRUCTURAL DESIGN

3.6.1 Design

Pavements shall be designed by a qualified professional (Refer to Section 1.4). The design shall be in accordance with the AUSTROADS Pavement Design Manual (including its New Zealand supplement) and relevant Transit New Zealand pavement materials standards. Pavement design for Local Roads may use Austroads 'Pavement Design for Light Traffic" supplement to the Austroads Pavement Design Guide. The design shall include adequate testing of the subgrade.

Calculations and investigations supporting the design, including testing of the subgrade shall be submitted to Council with the engineering drawings. Laboratory testing shall be undertaken by an IANZ (or equivalent) accredited laboratory.

The Design Engineer shall provide a Design Certificate for the design.

3.6.2 General

Generally flexible pavements shall be used for public roads. The Roading Manager may approve the use of other types of pavements, and the design methods to be used.

Pavements shall be designed for the specified design life, based on the subgrade strength and traffic loading.

Soaked CBR values of the pavement subgrade shall be used, and the pavement designed for the estimated number of vehicle loadings over a 25-year design life. The minimum design traffic for urban cul-de-sacs shall be 5,000 ESAs per lane. In other environments, design loads shall be determined from the known and/or predicted heavy vehicle usage of the road, with adequate justification provided with the application.

The following design methods for flexible pavements are acceptable;

- **Privateways serving up to 8 lots**.
  Subgrade CBR shall be determined using a Scala Penetrometer.

  The design may be a Specific Design using Mechanistic or Standard Chart Based Methods, or may use the following standard:

  Provided the subgrade CBR is greater than 7,
  - Sub-base - 100 mm thickness of GAP 65
  - Basecourse – 100 mm GAP 40
  - Sealed surface.

Where the subgrade CBR is less than 7, the pavement shall be specifically designed.

- **All other roads below Collector Class**.
  Design using either Mechanistic or Standard Chart Based Methods. Subgrade CBR determined using a Scala Penetrometer.

- **Collector Class and Above**
  Mechanistic Design Method. Laboratory CBR testing. The design shall be carried out by an IQP.

Concrete Privateways may be constructed to the details in SHEET 4.

3.7 INTERSECTION DESIGN

The kerb line radius at intersections shall be consistent with likely vehicle and pedestrian usage.

The minimum radius shall be:
- 8m for residential roads.
- 13.5 m for road intersections above Collector Class, and in Commercial/industrial zoning,
- Major industrial intersections shall be specifically designed for B-Train units.

Lot corners shall be splayed a minimum of 6 m. Acceleration and deceleration facilities shall be provided as necessary.

The preferred angle of intersection is 90°. The minimum angle of carriageway intersection should be 70° for non-arterial roads. Carriageway alignment may be offset from the road reserve alignment to improve the intersection angle. Tee intersections are preferred to cross intersections particularly from minor roads. Acute-angle, wye and multi-leg intersections are to be avoided.

Centre to centre distances between side roads shall be:
- 40 m when intersecting a local road,
- 150 m when intersecting a local distributor class road or higher.

The number of road intersections should be minimised. Intersections on curves, particularly on the inside of curves shall be avoided. The location of the intersections shall take into account the minimum sight distances. Early consultation with Council is recommended.

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

For major intersections with more than 3,000 vehicles per day, an independent safety audit of the design shall be submitted to Council with evidence that recommendations of the safety auditor have been implemented.

Roundabouts shall be subject to specific approval by the Roading Manager.

3.8 CUL DE SAC HEADS

Residential cul-de-sacs should comply with SHEET 10.

A central area may be provided for parking or planting. Where this is proposed, the layout shall be checked for access by heavy vehicles using tracking curves.

The minimum kerb gradient shall be 0.5%.

No exit roads should be avoided in Commercial/industrial areas. Where they are used in these locations a minimum turning circle radius of 15 m will be required.

Hammerhead or "T" cul-de-sacs may be approved where a standard circular head is unsuitable. The layout is subject to specific design. Compliance with Figure 3.5 in NZS 4404:2004 is an acceptable solution in residential areas.

Where a cul de sac is formed, and it is intended that the road will be extended as part of a future stage in a development, the provision for turning at the end of the cul de sac shall be specifically considered. The design shall be subject to specific approval by the Roading Manager.

3.9 BERMS, FOOTPATHS ETC

3.9.1 Urban Berms

The shape, slope and vegetation of berms shall be satisfactory for stormwater runoff, maintenance, location of services, landscaping and vehicle crossings to properties. To achieve satisfactory drainage, the crossfall of berms should be at least 1 in 30 (3%) but may be varied between 1 in 30 (3%) and 1 in 6 (17%). For berm crossfalls greater than 1 in 12.5 (8%), the designer shall produce cross sections to demonstrate crossings can be satisfactorily negotiated by a 90^{th} percentile car. Compliance with Figure 3.9 in NZS 4404:2004 is an acceptable solution.

The berm crossfall shall normally slope towards the road. Where this is not possible, a positive drainage system shall be provided that directs flow to a stormwater system. This may require the use of dished channels and sumps. Under no circumstances may water from the berm be concentrated onto any of the lots, or stormwater flow affect pedestrian traffic on footpaths.

Berms shall be topsoiled to a compacted depth of 100mm, and grassed. The whole of the berm area shall be suitable for mowing.

3.9.2 Rural Berms

In general, rural berms shall be constructed to the same standard as urban berms. The width of the berm shall not be less than 2 m between the roadside channel and road reserve boundary. Provision shall be made for footpaths in Living 3 Environment, and level berms suitable for pedestrian use in the vicinity of cluster developments in Countryside and Coastal Countryside Environments.

3.9.3 Footpaths

Footpaths shall comply with the following:

- The minimum width of footpaths shall be 1.4 m (not including kerb width). In areas of high pedestrian use, the Council may require local widening.
- Footpath crossfall shall be 3%.
- Slope should generally not exceed 12.5%. The design shall avoid steps or unevenness.
- The centreline radius of horizontal curves shall be no less than 3 metres.
- Footpath surfacing shall comply with D1/AS1 of the NZ Building Code for wet slip resistance for sloping surfaces.

Unless specifically approved, footpaths shall be concrete, with a broomed or exposed aggregate finish. The use of coloured exposed aggregate, patterned surfaces or other non-standard materials will require the specific approval of the Roading Manager.

The Roading Manager may approve:

- Interlocking pavers on 30 mm sand on 100 mm compacted basecourse,
- 25 mm M10 Asphaltic Concrete on seal coat on 150 mm compacted GAP 40 basecourse.

Note that the above standards may not be sufficient for footpaths where vehicles may access, e.g. vehicle crossings or footpaths to cul-de-sac heads. These will require specific consideration.

Paving units shall be readily available standard units, and shall comply with NZS 3116. These pavements shall be designed to have a 25 year life under all expected load conditions. The edges of the paved areas shall be adequately confined, normally by timber or concrete nibs.

Pram and wheelchair crossings shall be provided at all road intersections and pedestrian crossings. Where possible, sumps should be sited on the top side of the crossing. The crossing entrance shall be connected to the footpaths and have a maximum gradient of 1 in 8 (12.5%).

Construction Details are given in SHEET 9.

3.9.4 Pedestrian Accessways and Cycleways

Pedestrian accessways between roads shall be paved to their full width, in accordance with the requirements for footpaths including stormwater control and lighting. Both sides of pedestrian accessways shall be bounded by a Type 3 fence with mowing strip. They shall be provided with cycle barriers at each end suitable for disabled access.

Tracks for bicycle use shall be constructed to standards specified for footpaths. Where used by both pedestrians and cyclists, the minimum paved width shall be 2.5m assuming no side obstructions or walls. Where these are present, additional clearances should be provided. Stormwater disposal, fencing, handrails, and lighting shall be provided as appropriate to the specific situation.

3.9.5 Landscaping

Reference is made to Section 7 of this standard.

3.10 VEHICLE CROSSINGS

A vehicle crossing shall be provided between the kerb line and the boundary at the entrance to all entrance strips to rear lots, privateways and service lanes, and at any other place where the location of the future driveway to a lot can be determined with reasonable certainty.

Vehicle crossings shall be designed so that a 90^{th} percentile car may use them without grounding.

Vehicle crossings in urban areas shall normally be constructed in reinforced concrete with surface finish to match adjacent footpaths. Approval may be given for Interlocking pavers or Asphaltic Concrete.

Vehicle crossings in rural areas may be chip seal, asphaltic concrete or reinforced concrete. Where concrete is used, the start of the concrete shall be not less than 0.5 m from the existing edge of seal, or 0.5 m outside of the carriageway width required by this standard, whichever is the further. The area between the concrete crossing and edge of seal shall be sealed with 30 mm asphaltic concrete over a waterproofing seal coat.

A level area shall be provided at the intersection with the road, with adequate sight distances.

Where an unsealed accessway joins a sealed road, the accessway shall be sealed to at least the property boundary, to prevent metal migrating onto the road. Where accessways and driveways slope down towards a sealed road at a gradient of 8% or more, the accessway shall be sealed for a minimum distance of 10 metres from the edge of the road.

3.11 PRIVATE ACCESSWAYS

The maximum gradient shall be:

- 12.5% for the first 5 m from the boundary
- Remainder 22%. The maximum gradient should be restricted to straight sections of road where practical.

The minimum crossfall shall be 3%.

Corner splays for Privateways shall be a minimum of 3 m at intersections. For accesses constructed to Residential Road standards, corner splays shall be as for road intersections.

Where a private accessway is gated, the gates shall be located far enough from the road and provided with turning provisions, such that a 90th percentile car may enter the accessway and turn around, without passing the gates or affecting through traffic.

On Privateways less than 4.5 m in width, passing bays with a width of 6.0 m shall be provided. The spacing between bays should be approximately 50 m in urban areas, and 100 m in rural areas, however at the discretion of Council this may be adjusted based on development density and adequate visibility.

Where a private accessway contains:

- a public water main (as approved by the Water Services Manager – See Section 6.8.1), or
- a public sewer gravity main or rising main,

the accessway width shall be sufficient to allow maintenance access for these service mains clear of other services, using minimum clearances required by Table 6.6.

Where a Sewer Pump Station or Fire Hydrant is located within, or accessed via a private accessway, an adequate turning and parking area for fire appliances and maintenance vehicles in the vicinity of the pump station or hydrant shall be provided and the access designed to take heavy vehicles.

Surface water from an urban accessway shall be collected in a sump and directed to a stormwater reticulation system or approved outfall location. It shall not discharge over a footpath or directly onto a road carriageway. Where accesses fall away from the road, stormwater sumps shall be provided as necessary to ensure that stormwater from the access does not concentrate onto any lot.

Rural accesses may drain to a road side drain.

3.12 TRAFFIC SERVICES, SIGNAGE, AND ROAD FURNITURE

Road marking and traffic signs shall be provided, complying with the TNZ Manual of Traffic Signs and Markings (MOTSAM) and NZS 5414 : Specification for Construction of Traffic Signs. Signs shall include stop and give-way signs, keep left signs on islands, warning signs etc.

Name signs for Roads, Privateways, walkways, cycleways and service lanes shall be erected at all intersections. Name signs shall comply with the details in SHEETS 5 and 6.
"No exit" signs are to be erected on all cul-de-sacs or dead end roads. "Private Access" supplementary blades are to erected on all private roads and accessways.

All signs on urban State Highways, Arterial Roads and Local Roads shall have VIP standard or equivalent sheeting in accordance with AS/NZS 1906.1. All other signs shall have Class 2 sheeting.

Roadmarking includes marking of intersections, centrelines, parking areas etc. Rural roads shall be marked with a dotted centreline and white raised pavement markers at 20 metre intervals along the centreline. Edgelines are required in locations where additional delineation is necessary for safety reasons (e.g. on the outside of sharp bends).

3.13 ROAD NAMES

The provisions of the Whangarei District Council Road Naming Policy – April 2005 shall be followed, with AS/NZS 4819:2003 as a working guide to the naming policy.

The applicant shall identify all roads, privateways, accessway, rights-of-ways etc on the concept/survey plan submitted with the Resource Consent Application.

For each new legal or public road, service lane or public accessway, and each new private road or privateway (including private accessway, private access lot, private right of way etc) serving 5 or more lots or dwellings, the applicant shall submit three names in order of preference for Council approval. These names shall be submitted with a brief explanation of the reasons for the selection including any meaning and/or historical background with the Resource Consent Application. This is to be accompanied by a clearly marked locality map.

Council staff will check the names for relevance and duplication prior to submission to the Council. The Council's decision will be notified to the applicant so that provision of road name signage, etc. can be made by the Developer.

3.14 STREET LIGHTING

Street lighting shall be provided in all urban streets, walkways and cycleways, and areas set aside for frequent public use. It shall also be provided at major rural intersections.

Street lighting shall be designed by an IQP for the functional classification of the road to the illumination criteria of AS/NZS 1158.

Lighting columns shall normally be galvanised hollow steel. Lamps shall be down facing on outreach arms. Shielded fixtures shall be used where light spill may affect adjacent properties. Where there is a risk of vehicular impact, columns shall have shear bases.

The following guidelines should generally be followed:

- Mounting height not less than 8.5 m
- Standard 100W HP Sodium Lamps
- Cabling taken to the closest pillar box and a fuse provided at this location

A limited range of decorative lamps may be used with the approval of the Roading Manager.

3.15 BRIDGES AND CULVERTS

3.15.1 General

The design shall be carried out by an IQP, in accordance with the Transit New Zealand Bridge Manual. The design load shall be HN HO 72. Note that culverts with a waterway area greater than 3.4 m^2 are regarded as bridges under the TNZ bridge manual.

Appendix D of the Bridge Manual shall not be used for bridges on public roads, except with the specific consent of the Roading Manager.

The width shall accommodate the full carriageway width (2 way traffic) including cycle lanes and footpaths. Provision shall be made in the design for cables, pipelines etc.

Side barriers, including barriers to approaches as appropriate shall be provided. These may be W-section steel guardrail or concrete barriers. The design standards and details shall be confirmed with the Roading Manager at an early stage. Pedestrian barriers shall be provided at footpaths.

Wing walls, and scour protection shall be provided to protect batter slopes. Foundations shall be protected against settlement and scour. In order to mitigate blockages due to debris build-up during flood events, bridges and culverts shall be designed to minimise or eliminate obstructions including piers/supports etc within the 1:100 year ARI water level.

3.15.2 Bridges on Private Accessways

For bridges and other structures on private accessways serving up to 8 lots, the design requirements of Appendix D of the TNZ Bridge Manual may be used, subject to the following conditions:

- The access will not become a through route,
- The alignment has a speed value below 70 km/h,
- Use by logging trucks is unlikely,
- No significant overloads are expected to occur, or the bridge can be bypassed.

Appendix D allows the replacement of the HN design load with 0.85 HN. The HO load need not be considered.

The level of side protection shall be appropriate to the situation. The minimum acceptable shall be the provision of kerbs and marking posts where the height above the watercourse is no more than 1.0 m.

3.15.3 Waterway Design

Waterway design shall be carried out by an IQP in accordance with the Bridge Manual and Section 4 of this Manual.

Overall Design

The total waterway shall be designed to achieve:

- No heading up or increases to water levels upstream during a 10 year ARI flood event,
- Able to pass a 100 year ARI flood without significant damage to the road and waterway structures,
- Obstructions and risk of blockage in the waterway area are minimised.

Level of Serviceability to Traffic

The waterway shall achieve:

- on arterial road (> 2500 vpd), no interruption to traffic during a 100 year ARI flood event,
- for roads between 250 and 2500 vpd, no interruption to traffic during a 50 year ARI flood event.
- for minor roads (< 250 vpd), no interruption to traffic during a 10 year ARI flood event.

3.15.4 Consents
The Developer shall obtain all Resource Consents and Building Consents required for bridges, retaining walls and culverts.

Bridges, retaining walls etc, are classed as buildings under the Building Act, and therefore require a Building Consent before construction. All such structures shall be designed according to the requirements of the Building Act, and the construction shall be supervised by a suitably qualified person. The design and supervision of the construction shall be certified by the designer/construction supervisor as complying with the drawings and specifications, and the requirements of the Building Act. It is noted that public use of a building is not permitted until a Certificate for Public Use or Code Compliance Certificate is obtained.

3.15.5 Retaining Walls
Retaining walls shall be designed to carry all expected soil loads and overloads as described in the Bridge Manual with an adequate factor of safety.

3.16 ROAD DRAINAGE
Refer to Section 4 for the calculation and design of stormwater run-off, and treatment requirements.

3.16.1 Subsurface Drainage
Subsurface drains shall be provided on both sides of all urban roads except where it can be demonstrated that it is not necessary (e.g. low water table and ground with high permeability). Rural roads in cut will also normally require subsurface drainage.

Subsurface drains shall have adequate flushing locations, and shall discharge to the stormwater system.

3.16.2 Surface Drainage
The design shall generally comply with Transit New Zealand's guideline document "Highway Surface Drainage : Design Guide for Highways with a Positive Collection System". Section 4 of this standard should be referred to for additional requirements for surface water treatment.

3.16.3 Side Drains, Kerb and Channels
Water from roads shall be directed to side drains/water tables, kerbs and channels, swales or other approved system, sized to suit the flows, with discharge to sumps, drains or other approved outlets at regular intervals. All outlets shall be protected from scour, and located to minimise the risk of slope instability.

Kerb details are shown in SHEET 12. Mountable kerbs shall only be used on Service Lanes, or with specific consent of the Roading Manager.

3.16.4 Sumps
Sumps shall be provided to collect stormwater from channels. Stormwater treatment shall be incorporated into sumps using sump filters approved by the Council, where no other overall treatment mechanisms are proposed.

Treatment of the 'first flush' of stormwater shall comply with ARC TP10 standards. This will need to be considered in relation to overall treatment requirements.

Sumps shall be provided to accept the design flow, including overland flow intercepted by the road, based on the sump capacity (approximately 28 l/s for single back entry sump). The capacity of non-standard sumps and grates used on accessways etc. shall be established.

The maximum spacing of sumps is 90 m. Double sumps shall be provided at low points. Sumps shall also be provided where there is potential for ponding, where flow could leave the kerb and channel, and upstream of footpath crossing locations.

Sump leads shall be at least 300mm NB for single sumps. Double sumps shall have a single 375mm NB lead, or separate 300mm leads from each sump. Sump gratings shall be suitable for crossing by bicycles.

3.17 ROAD CONSTRUCTION

3.17.1 Pavement

This section applies to flexible pavements.

Road formation will normally consist of the sub-base constructed on the existing material (subgrade). A layer of filter fabric may be required to separate these layers. A basecourse layer is constructed over the sub-base, with surfacing laid on top.

Unsealed roads shall include an upper layer of well graded running course aggregate of maximum particle size 25mm, minimum thickness 50mm and containing sufficient fine material to bind the layer and confine large particles in the underlying structural pavement layer.

3.17.2 Material Standards

The pavement structural design shall conform to the requirements of Section 3.6 of this standard. The design may utilise high strength materials (e.g. TNZ M/4 basecourse), or lower strength modified materials (e.g. lime or cement stabilised GAP 40 basecourse).

The designer shall specify the material standards required by the design.

The applicant shall provide test data to confirm compliance with the material standards required for the design.

3.17.2.1 Standards for Unmodified Basecourse Materials

Basecourse material shall comply with TNZ M/4 requirements (all passing 40mm – AP40) or equivalent.

3.17.2.2 Standards for Local Materials in Modified Pavements

The material standards in Table 3.6 and grading limits in Table 3.7 have been found to be suitable for roads in the Whangarei District, when used in a lime stabilised pavement.

TABLE 3.6 Material Standards (Suitable for Lime Stabilised Pavements)

	Test	**Standard**
Crushing Resistance (kN)	TNZ M4	120
Quality Index	NZS 4407:1991 Test 3.11	AA, AB, AC, BA, or CA
Clay Index	NZS 4407 Test 3.5	>3.5, <8.0

California Bearing Ratio	Compacted to NZS 4402:1986, Test 4.1.3 Tested to NZS 4407, Test 3.15	Not less than 40%
Proportion of Broken Rock		For each aggregate fraction, not less than 50% by weight shall have 2 or more broken faces
Lime Reactivity	Quick Response Test in accordance with RRU Technical Recommendation No. 2	Lime Reactive

TABLE 3.7 Grading Limits (when delivered or following compaction)

Running Course	GAP 40 (Basecourse)	GAP 65 (Sub base)
100% of the material less than 19mm maximum size	100% of material less than 37.5mm maximum size	100% of material less than 75mm maximum size
60% max. passing a 4.75mm sieve	Between 63-81% passing a 19mm sieve	At least 45% passing a 19mm sieve
31% max. passing a 0.6mm sieve	12-25% passing a 1.18mm sieve	12-25% passing a 1.18mm sieve

3.17.3 Construction

The designer shall inspect and as necessary test the exposed subgrade to confirm that it is suitable for the design. Soft areas shall be removed and replaced with GAP aggregate. Wet areas shall be drained using subsoil drainage with an outlet to a sump or drainage channel. Outlets to a drainage channel shall have a concrete or grouted rock surround.

Compaction of pavement materials shall be carried out in layers not exceeding 150 mm thick.

The basecourse shall have a stone mosaic surface after sweeping.

Acceptance by Council is subject to completion of all testing, and presentation of test results. Normally Clegg Hammer testing will be carried out in the presence of Council staff.

The road shall be sealed as soon as possible after acceptance by Council, subject to suitable weather conditions.

3.17.4 Testing Prior to Sealing

TABLE 3.8 Pavement Test Requirements

Test	Standard	Requirement	Criteria
Pavement Layer Density (Nuclear	NZS 4407 Test 4.2.2	All roads that will become public roads. Frequency to TNZ B/2	Sub-base 98% Relative Density, Basecourse 100%

Densometer)			Relative Density
Clegg Hammer		All roads and privateways. At 20 metre centres at the edges and centre of pavements on completion of the pavement surface preparation.	No value less than 40
Benkelman Beam		As directed by the Council. At 10m cs, in the wheel track in both lanes.	95% comply with Table 3.9, with no value exceeding the standard by more than 25%.

TABLE 3.9 Benkelman Beam Standards

Road Type	Deflection
Cul-de-sac	2.0
Residential and Rural local Roads	1.5
Collector, Arterial Roads and Service Lanes	1.0

The designer shall identify all further testing as required by TNZ B/2 and provide all test results to the Council. This may include requirements for subgrade testing, pavement stabilisation, construction tolerances etc.

3.18 SURFACING

Acceptable road surfacing options are shown in Table 3.10.

TABLE 3.10 Acceptable Road Surfacing Options

Surfacing Option	Use	Limitations
30 mm (min.) Hot laid asphaltic concrete over waterproofing seal coat with grade 5 chip	• May be used in all locations • Required for Urban Collector and Arterial roads • Required for Cul de Sac heads • Acceptable option for steep roads / privateways, and tight corners.	• Seal thickness between 30 to 50 mm depending on traffic.
Chip Seal – Grade 3 with Grade 5 wet lock	• Urban and Rural roads except Residential Collector and Arterial • Normal urban and rural intersections	• Not suitable for intersections with high heavy vehicle usage. • Not suitable for accessways steeper than 18%, or tight corners (less than 30m radius).
Concrete Block Pavers	• Cul de sacs and privateways only	• Subject to specific approval on public roads.
Concrete	• Privateways	

The design of the seal surfacing shall be carried out by a suitably qualified Engineer, in accordance with the Transit New Zealand Guideline: “Bituminous Sealing Manual”.

Seal binder, seal chip and adhesion agents shall be in accordance with TNZ specifications M/1, M/6 and M/13. Chip seals shall be applied in accordance with TNZ P/3 (initial seals) or P/17 (reseals). Asphaltic concrete shall comply with TNZ M/10 and be constructed in accordance with TNZ P/9.

If special sealing measures are required at an intersection, the applicable intersection area shall include a distance of 20 metres beyond the intersecting roads or accesses.

Parking areas shall be surfaced with a chip seal followed by a Asphaltic concrete (AC) overlay, or higher standard of surfacing (eg concrete).

Pavement units to NZS 3116 may be approved for specific projects. Masonry units shall be readily available standard units, complying with NZS 3116. The design of the road shall be carried out by a suitably qualified person. Edges of the paved areas shall be adequately confined, normally by concrete nibs.

Concrete for roads and crossings shall come from a special grade plant as defined in NZS 3109.

The minimum concrete strength at 28 days shall comply with NZS be:

- Roads and Crossings, kerbs and channels where vehicles may cross 30 MPa
- Footpaths, Kerb and Channels (excluding mountable kerbs, dished channels etc) 20 MPa

3.19 SURFACE TOLERANCES AND FINISHING

The finished surface of the road shall have no abrupt or abnormal deviations, and no areas shall pond water.

The surface shall be of uniform texture, and satisfy density standards appropriate to the surfacing.

Skid resistance and surface texture of roads of collector class or higher, with a design speed exceeding 70 km/h shall satisfy TNZ T10.

3.20 COMPLETION

3.20.1 General

On completion of all other works, the berms shall be spread with first quality topsoil and compacted to a depth of 100 mm. The topsoil shall be graded to kerb top and footpath edges, and may be finished 15 mm high to allow for settlement except on the low side of the footpath where the topsoil shall be finished flush to prevent water ponding.

Superfluous vehicle entrance crossings and similar along the road frontage of any development are to be removed and any broken footpaths or other non-complying facilities or services be repaired as necessary at the applicants expense.

After topsoiling, the berms shall be sown with a seed mixture the generic characteristics of which are such that the grass cover is low growing, with a robust and deep rooting system, and well suited to the soil conditions. An 80% grass strike, must be achieved and the grassed areas shall be maintained free of excessive weed growth and shall be kept mown throughout the maintenance period.

All poles, sign posts, light standards, markers, power transformers, boxes, etc, set in grass berms shall be finished off with a concrete mowing strip surrounding the base, flush with finished ground level, 150 mm wide and 75 mm thick.

Sealed roads and privateways shall be swept, and all sumps shall be cleaned out.

3.20.2 As-Built Drawings and Schedule of Asset Information

A set of drawings and schedule of asset information shall be submitted as per Section 1.7 of this Standard. These shall clearly and accurately show the as-built locations and details of all infrastructure provided as part of the work, including any modifications made to the existing system.

The As Built drawings may be checked on site for accuracy on completion of the subdivision or development. A certificate of completion for the works will not be issued until acceptable As-Built drawings have been produced.

The drawings shall identify assets that have been removed or decommissioned.

3.20.3 RAMM Data

RAMM data shall be provided as required by Section 1.8 of this standard.

3.21 DEFECTS LIABILITY

A defects liability period of 12 months is required for road construction works. During this period, the Council will carry out normal maintenance work on the public roads. A Performance Bond will be required for the works in terms of Section 1.13 of this Standard.

3.22 DRAWINGS

The following drawings in APPENDIX A apply to this section:

SHEET 1	**STANDARD DRAWING SYMBOLS**
SHEET 2	**RURAL PRIVATEWAY CROSS SECTIONS**
SHEET 2A	**FURTHER NOTES TO RURAL PRIVATEWAY CROSS SECTIONS**
SHEET 3	**RURAL VEHICLE ENTRANCE CROSSING DETAILS**
SHEET 3A	**FURTHER NOTES TO RURAL VEHICLE ENTRANCE CROSSING DETAILS**
SHEET 4	**URBAN PRIVATEWAY CROSS SECTIONS**
SHEET 4A	**FURTHER NOTES TO URBAN PRIVATEWAY CROSS SECTIONS**
SHEET 5	**STANDARD STREET SIGNS**
SHEET 6	**STREET SIGNS – PRIVATE ROW, ACCESS LOT, COMMON AREA OR PRIVATE ROAD**
SHEET 7	**RESIDENTIAL AND COMMERCIAL AREA VEHICLE CROSSING DETAILS**
SHEET 8	**RURAL ROAD CROSS SECTIONS**
SHEET 9	**URBAN ROAD CROSS SECTIONS**
SHEET 10	**CUL DE SAC TURNING DETAILS**
SHEET 11	**RECOMMENDED SERVICE LOCATIONS**
SHEET 11A	**FURTHER NOTES TO RECOMMENDED SERVICE LOCATIONS**
SHEET 12	**KERB AND CHANNEL DETAILS**
SHEET 13	**TYPICAL KERB AND SUBSOIL DRAIN DETAILS**
SHEET 14	**PRAM CROSSING DETAILS**
SHEET 15	**TRAFFIC SIGHT LINES FOR NON-SIGNALISED INTERSECTIONS**
SHEET 16	**SCALA PENETROMETER CHART**
SHEET 17	**DESIGN CHART FOR FLEXIBLE PAVEMENTS**
SHEET 18	**PIPE BEDDING AND BACKFILL**
SHEET 19	**PIPE PROTECTION AND BULKHEADS**
SHEET 20	**INLET AND OUTLET STRUCTURES**
SHEET 22	**SUMP DETAILS**

4. STORMWATER DRAINAGE

4.1 GENERAL REQUIREMENTS

4.1.1 General

This Section covers the requirements for Stormwater Drainage works.

Stormwater drainage is required to collect and convey surface water run-off, and for groundwater control, in order to minimise adverse effects including flooding, erosion and sedimentation and water quality effects.

The stormwater system for a development, including any upgrading of existing downstream systems where required, shall provide:

- Piped reticulation and/or storage or an alternative low impact system through urban areas,
- Retention and enhancement of existing natural waterways through open space areas, including parks and reserves,
- Allowance for changes in weather patterns from global warming.

The piping of existing watercourses or open drains will not generally be permitted.

In rural areas, a discharge to an existing drainage channel may be approved, subject to appropriate conditions, and the principles set out above.

4.2 REFERENCED DOCUMENTS

The following documents shall be read in conjunction with this section of these standards:

- Whangarei District Plan (WDC)
- Regional Soil and Water Plan for Northland (NRC)
- Regional Coastal Plan for Northland (NRC)
- Transit New Zealand Bridge Manual (TNZ)
- Auckland Regional Council (ARC) Technical Publication (TP) No. 124, *Low Impact Design Manual for the Auckland Region*
- ARC TP No 10, *Design Guideline Manual, Stormwater Treatment Devices,*
- Auckland City Council 'On-site Stormwater Management Manual' and 'Soakage Design Manual',
- Ministry for the Environment, October 2004, *On-Site Stormwater Management Guideline*
- SNZ HB 44.2001, *Subdivision for People and the Environment*.
- WDC Catchment Drainage Plans, or Catchment Management Plans,
- WDC Stormwater/Surface Water By-Law (when adopted)
- WDC Sustainable Stormwater Drainage Guidance Document (when developed)

Where aspects of the design are not covered by this section or the above documents, the following standards may be referenced. Adoption of any practises outside of the Council documentation must first be approved by the Wastewater and Drainage Services Manager.

- NZS 4404:2004 Land Development and Subdivision Engineering,
- New Zealand Building Code (NZBC) - Approved Document Clause E1 – Surface Water (available on-line at: http://www.building.dbh.govt.nz/e/publish/compliance_docs_approved.shtml)

The most up to date of these publications shall supersede any conflicting requirements of older documents.

4.3 SUBMISSION OF APPLICATION

4.3.1 Supporting Information and Calculations

The application shall include supporting information and calculations that demonstrate that:

- The design is consistent with requirements for the whole of the catchment,
- Stormwater quality and quantity requirements are satisfied,
- Pipeline design provides the required level of service
- Secondary flow paths are available, and adequate for the design volumes. Flood heights shall be assessed and restrictions and/or easements required shall be identified.
- Overland flow paths including flood levels, flow path boundaries and easement requirements shall be clearly identified in Consent and As-Built drawings.

The design shall identify off-site effects, including changes to:

- flow peaks (where permitted) and frequency patterns,
- flood water levels,
- contamination levels and erosion, and
- concentration of stormwater on downstream properties.

Measures to mitigate any detrimental effects shall be identified

Operational and maintenance requirements for any water quantity and/or quality control structures shall be provided.

Catchment design shall be carried out by an Independent Qualified Person (IQP), experienced in catchment analysis who shall provide a design certificate identifying the design standards used, and certifying that the design complies with these standards. On completion of the works, the IQP shall certify that the completed works achieve the required design criteria.
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4.3.2 Design Drawings and Specifications

Design drawings complying with the requirements of Section 1.5 and 1.6 shall be provided for approval.

4.3.3 Approval of Design

The drawings and calculations will be reviewed by the Wastewater and Drainage Services Manager or his/her representative**.** The drawings showing any alterations shall be returned to the applicant's representative. 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 Wastewater and Drainage Services Manager or his / her representative shall be deemed approved drawings. Unless specifically stated otherwise, the approval of drawings does not supersede the requirements or obligations of these standards.

4.4 STORMWATER ASSESSMENT STRATEGY

The stormwater assessment strategy shall review options in the following order of priority:

Source Control
Sustainable systems within individual lots attending to both water quality and runoff volumes. Engineer designed infiltration techniques shall be used where ground stability and soil permeability permit their use. System types shall be identified and designed to enable consent notices to be applied to the titles with an approved mechanism in place to require their implementation.

Site Control
Attenuation, detention and treatment systems designed to receive runoff from the development as a whole or in part. Where it is intended to locate such systems in WDC reserves (existing or proposed) early discussion with the WDC Parks division is encouraged. Subject to suitable approved detailing and construction such systems may be vested with WDC with provision of suitable operation and maintenance documents in an approved format.

Regional Control
Either a developer funded upgrading of the entire downstream network to facilitate connection from the development or provision of an agreed contribution towards a WDC strategic attenuation provision where identified. This may require a comprehensive development assessment of the whole catchment.

The connection of a new development to an existing reticulated network, open drain or watercourse in an unattenuated and/or untreated state will not be considered unless:

- The options identified above have been evaluated and demonstrated as unworkable to the satisfaction of the WDC drainage engineer, and
- The effect of the discharge is no more than minor.

4.5 LOW-IMPACT DESIGN AND STORMWATER TREATMENT

The use of low impact design, including the use of grassed swales, open channels, ponds, wetlands, rain gardens, in-ground stormwater detention structures etc is promoted by the Council to reduce the impacts of stormwater discharge by improving quality and/or reducing quantity of the discharge. Such concepts need to be considered early in the design process.

Low Impact Design and/or Stormwater Treatment will be required as follows:

- By conditions of a Resource Consent (including conditions and recommendations in 'Catchment Drainage Plans' or Catchment Management Plans). Note that the WDC may impose additional conditions to those required by a Catchment Management Plan to resolve or prevent exacerbation of known problems within the catchment.
- To meet water quality guidelines in the Regional Water and Soil Plan for Northland and / or WDC held resource consent conditions for SW discharge,
- To comply with requirements of a relevant by-law,
- To restrict impacts on downstream properties from a change in use of land, or
- As required by the Wastes and Drainage Manager.

Well-designed and maintained alternative systems can enhance local amenity and ecological values.

Early consultation with the Council is recommended to identify the impact and suitability of the design, including maintenance requirements. Consultation is also required regarding the selection of proprietary stormwater treatment devices, so that the Council can standardise types across the District.

Reference should be made to:

- Auckland Regional Council (ARC) Technical Publication (TP) No. 124, *Low Impact Design Manual for the Auckland Region*
- ARC TP No 10, *Design Guideline Manual, Stormwater Treatment Devices,*
- SNZ HB 44.2001, *Subdivision for People and the Environment*.

4.6 NORTHLAND REGIONAL COUNCIL AUTHORISATION

Where a development requires connection to an existing and/or construction of a new piped or open channel disposal system, the following general requirements apply:

- Developments within catchments with operative Catchment Drainage or Management Plans (CDP or CMP) that comply with the requirements of the Plan, will not require separate resource consents for stormwater diversion and discharge from the Northland Regional Council. It should be noted that CDP/CMPs in the Whangarei District do not cover all urban areas.
- Where an operative CDP/CMP is not in place or the proposal is not consistent with an operative CDP/CMP, the applicant shall obtain all resource consents from the Northland Regional Council required for the work. Where a Consent is for a facility that will be taken over by the Council, the application shall be in the name of the District Council. The District Council shall be consulted about stormwater management at an early stage, before detailed design commences.
- In all circumstances, the relevant requirements of the Stormwater Bylaw shall be complied with.

The Council will advise whether the area of a development is covered by a CDP or CMP, and conditions associated with it. WDC reserves the right to apply surface water conditions / discharge constraints in addition to those imposed by NRC to safeguard elements of the WDC controlled downstream networks.

4.7 PRIMARY AND SECONDARY SYSTEMS

4.7.1 Catchment Boundaries

Catchment and sub-catchment boundaries shall be identified and shown on a plan, with catchment areas noted. This plan shall identify watercourses, reticulation, and secondary flow paths.

4.7.2 Primary and Secondary Systems

The stormwater system shall consist of:

- A primary system of pipes and/or waterways to cater for more frequent rainfall events, and
- A secondary system consisting of open channels, flood plains and overland flow paths to cater for higher intensity events, and blockages in the primary system (refer to Table 4.1).

Where a secondary system is not available, the primary system shall be designed to provide a level of protection required of secondary systems. This shall include an analysis of the effects of blockages of pipes and culverts. This is particularly important with smaller culvert sizes, or where there are grates on culvert inlets, and/or the culvert is in a location where it is likely to receive silt, vegetation or rubbish.

4.7.3 Secondary Flow Paths

Lots shall generally fall towards roadways, which may be used as secondary flow paths. Where secondary flow paths cannot be kept within roads, they should be kept on public land, such as accessways, parks and reserves, or designated by legal easements over private land. The location of easements shall be clearly shown on plans held by the asset owner. Where stormwater attenuation systems are provided within a development, they shall be designed to receive the maximum design flows from the secondary flow path.

The design of secondary flow paths shall include measures required to protect against instability and erosion. Ponding or secondary flow on roads shall be limited in height and velocity to ensure that carriageways are passable during high intensity events.

Where roads are used as secondary flow paths, the design shall ensure that such flow will not overflow onto adjacent properties, particularly where the properties are below the level of the road. This may require specific design of the berm to contain the flow, while ensuring that vehicles can cross the berm at driveway/accessway locations.

4.7.4 Easements

Easements in favour of the Whangarei District Council shall be registered against the relevant property title for:

- All pipelines of NB 375 or greater that cross private property,
- Secondary flow paths in private property,
- Waterways in private property that will be maintained by Council.

The width and formation of easements for pipelines and waterways in private property shall be suitable for maintenance purposes. For waterways, a (nominal minimum) 2.5m wide access strip to one continuous side of the watercourse will normally be required.

4.8 LEVEL OF SERVICE

4.8.1 Design Life

The asset life of stormwater drainage systems shall not be less than 100 years. The asset life of components of the systems, e.g. treatment devices etc, shall be noted in the application.

4.8.2 Design Storms

New systems shall be designed to cope with the design storms of at least the AEP in Table 4.1, with an allowance for effects of climate change. Primary and secondary flows, shall be increased by 20% to allow for climate change over the asset life. The design of storage / attenuation and treatment systems shall also include this increase in flow.

The design of the Primary system shall ensure that there is no surface flooding at the design storm for primary flow.

Secondary protection may be satisfied by a combination of:

- The primary system, and
- Secondary flow paths,
- Controlled flood plains and
- Setting of minimum floor levels.

Intensity/duration curves for Whangarei District are appended (APPENDIX C)

Requirements of NZBC Clause E1 in relation to buildings may also need to be considered.

Infill developments shall also be designed to the above standards. However the Council may permit minor infill developments to discharge into an existing system that does not comply with these standards where the development includes mitigation measures to limit the flow rate and volume to pre-development levels.

TABLE 4.1. Minimum AEP for Design Storms (All Environments)

Function	AEP (%)	Return Period (Years)
Primary Protection (Based on system/pipeline capacity)	20	5
Secondary Protection	1	100

4.8.3 Freeboard

The minimum freeboard above the calculated flood protection level shall be 0.5 m for habitable building floors, and 0.3 m for commercial and industrial buildings, unless specific assessment demonstrates that a different freeboard is appropriate. Minimum floor levels from flooding shall be identified for all lots where appropriate.

Specific consideration shall be given to access requirements to properties. Normally these should be above the flood protection level. Where this is not possible (e.g. the road/access forms the secondary flow path), the height and velocity of flow shall be such that carriageways are passable.

4.8.4 Tidal Areas

Minimum floor levels in tidal areas shall be set taking into account storm surge, tsunami hazards, climate change and sea level rise. Access for vehicles will also be required.

Specific investigations shall be carried out for particular sites. The minimum floor level permitted is RL 2.5m (assuming a flood level of RL 2.0m).

Flood level in the upper Whangarei Harbour for a 1% AEP event is estimated as RL 2.35m (including 0.2m sea level rise), indicating a 2.85m RL floor level. Additional allowance may be required for wave action. Wave run-up should also be provided for in coastal areas.

In most locations the minimum floor level for an area without particular hazards or direct exposure to the open sea should be at least RL 3.0.

4.8.5 Bridges and Large Culverts

Refer to section 3.15

4.8.6 Capacity and Future System Expansion

The design of primary and secondary stormwater systems within a development shall allow for flows from the whole of the upstream catchment area. The developer shall extend reticulation and secondary flow paths to a location on the upstream boundary of the development suitable for serving the upstream area.

As a minimum, the system shall be designed to receive both primary and secondary design flows from the upstream catchment in its current status, for the design storms required by Table 4.1. In addition, the system may be required to take account of increased flow from the potential development of this area.

The Council will provide information that it has available on the capacity of downstream reticulation. The developer shall review the capacity to determine its adequacy. If there is inadequate capacity, Council will advise what upgrading is necessary.

4.8.7 Council Design Input

The Council shall have the right to specify the diameters and classes of pipes to be used for all reticulation within the subdivision or development, and to specify connection points and reticulation alignment. It will provide on request details of the existing reticulation for design purposes.

The Council may also limit discharge rates and volumes from the development. This may involve limiting flows from a partially developed site proposed for subdivision to the lesser of the existing runoff from the site at its present level of development, or the calculated runoff for a rural condition, prior to any development on the site.

4.9 PIPE SELECTION

4.9.1 Pipe Materials and Class

Standard approved pipe materials are given in Table 4.2. Other materials shall only be used with the written approval of the Wastewater and Drainage Services Manager.

TABLE 4.2 - Pipe Material and Class for Stormwater Drainage

Material	Standard	Class (min.)	Notes
Concrete RRJ	NZS 7649	X	Class for shallow pipes or particular loading to be by specific design.
uPVC	AS/NZS 1260	SN 8	Class SN 40 required for road crossings with cover less than 1.2m
PE	AS/NZS 4130	SDR 17, SN 16	Black Outer, White or Brown Inner lining. Internal bead formed by welding shall be removed. Where the pipeline is installed by directional drilling or pipe bursting methods, the pipe class should be SDR 11.
PP (e.g. 'StormBoss' twin wall pipe)	AS/NZS 5065	SN 16	Subject to specific approval. Shall be shown to be capable of withstanding a jetting resistance to 4000psi (280 bar) without damage. Class SN 40 required for road crossings with cover less than 1.2m
Vitrified Clay (Extra Strength)	AS 1741		Subject to specific approval, for use where required for aggressive ground conditions

4.9.2 Culverts

Approved pipe materials may be used for culverts. In addition, reinforced box culverts designed for the imposed loads, and with suitable connection between units may be used.

Other materials may only be used for road culverts where the design life of the culvert is shown to be not less than 100 years, and with the written permission of Council.

4.10 LAYOUT OF RETICULATION

4.10.1 General

4.10.1.1 Gravity Pipelines

Where possible, reticulation is to be located in the road reserve or within other public land. Reticulation should not be located below the crown of the carriageway, and manholes within the carriageway should be avoided

In private property and other areas where development or building may occur, pipes shall be located clear of potential building sites and existing or proposed engineering features. Where practical, pipes shall run parallel to boundaries with an offset from the boundary between 1.0 m and 1.5 m.

Where possible, pipes shall be sited outside of the zone of influence of the foundations of existing structures. Where this is not possible, the pipe and structure shall be protected to details approved by the Council. The design shall include protection of the pipeline and structure, and maintenance access for the pipeline.

No structure shall be erected over any buried public sewer or stormwater system without prior written approval of Council's Wastes and Drainage Manager.

4.10.1.2 Curved Pipelines

Where practicable and economic, pipelines should be constructed in straight horizontal and vertical alignment between maintenance structures.

Subject to specific design, close control of installation to maintain grades and alignment, and accurate as-built plans, curved pipelines may be approved. Approval will normally be given where pipelines follow curved street alignments, or where savings in life-cycle costs can be demonstrated.

4.10.1.3 Pipeline Connections

Connections will normally be made into manholes. However direct connection of a minor pipeline into a major pipeline is permitted provided connection is made with a suitable junction, or via a saddle where the minor pipe diameter is not greater than half the major pipe diameter.

4.10.1.4 Maintenance Structures

All manhole and other maintenance structures shall be kept clear of boundaries, and where practicable, outside of carriageways and footpaths.

4.10.1.5 Minimum Pipe Sizes

Minimum pipe sizes unless otherwise specified shall be;

- Sump Outlets - 300 mm ID
- Double Sump outlets 375 mm ID
- Stormwater mains - 300 mm ID

4.10.2 Separation from other Services

Minimum clearances to Wastewater and Water services are given in Tables 5.6 and 6.6. These shall apply except with written agreement of the affected service owners.

4.10.3 Stormwater Near Trees and Existing Reticulation

Reference shall be made to Section 7.4 of this Standard for requirements regarding the location of trees close to reticulation. Where any pipes or cables are laid alongside existing reticulation then a

gap of at least 1 metre should be maintained where practicable so as not to disturb the existing trench. Root ingress protection to pipe joints shall be provided where joints occur within 5m of a tree canopy.

4.10.4 Pipe Cover

All reticulation located in areas not subject to traffic loading shall have a minimum of 600 mm of cover between the top of the pipe and finished ground level. Under carriageways the minimum depth shall be 900 mm (see SHEET 18).

Where the above minimum depths cannot be met, special protection of the pipe shall be provided.

Where the reticulation lines are located in the front yard of lots, the invert level shall be deep enough so as not to interfere with any future driveway construction.

4.11 SYSTEM COMPONENTS

4.11.1 Subsoil Drains

Subsoil drains shall be provided where required to control groundwater levels. They will normally be required under kerbs, and in locations where an open drain is filled. They may also be required for pipelines with cut-off walls.

Subsoil drains should be perforated or slotted, with smooth internal surfaces. Inspection points shall be provided at regular intervals. Subsoil drains shall discharge to a sump, manhole or watercourse. Outlets to a watercourse shall have a formed concrete or grouted rock outlet.

Free draining backfill shall be provided around subsoil drains.

4.11.2 Bulkheads

Bulkheads shall be provided on pipelines with steep grades, and where separation of formations is required. Bulkhead details shall be included in the drawings. Spacings shall be as follows:

TABLE 4.3 – Bulkhead Spacing

Grade %	Requirement	Spacing (S) (m)
15 - 35	Concrete Bulkhead	S = 100 / Grade (%)
> 35	Special Design	3.0

4.11.3 Manholes

4.11.3.1 General

Access chambers or manholes shall be provided at all changes of direction, gradient and pipe size, at branching lines and terminations.

4.11.3.2 Spacing

The maximum spacing shall be generally 120 m. Approval may be given for greater spacing for pipes larger than 1050 mm.

4.11.3.3 Details

Manholes shall be constructed in accordance with SHEET 23.

Normally manholes will be constructed in reinforced concrete, except where aggressive site conditions make them unsuitable.

Shallow manholes with a maximum depth of 1.2 m and maximum pipe size of 300 mm may use a 600 mm diameter manhole.

Standard manholes shall have a minimum internal diameter of 1050 mm. The size and layout shall be designed to ensure hydraulic efficiency. With larger pipes (generally larger than 600 mm), the size of the manhole will need to be increased to accommodate the reticulation.

With pipelines with internal diameter of 1.2 m or greater, access may be approved using offset 1050 mm risers factory joined to the pipeline. These may be used in conjunction with factory made mitre joints in the pipeline for direction changes.

Connections up to 300 mm diameter may have an open cascade of up to 2.0 m deep into a manhole. Manhole steps are to be kept clear of a cascade.

Where the pipe size changes at a manhole, the soffit of inlet pipes shall be no lower than the soffit of outlet pipes unless by specific approval.

Inlet pipes shall be cut back to the inside face of the manhole and plastered to a smooth finish. The base is to be benched and haunched with concrete to a plaster finish to accommodate the inlet and outlet pipes.

All chambers shall be made watertight.

4.11.4 Sumps

Sumps shall be provided as required to prevent the primary design flow from discharging over adjoining properties, or over footpaths. This includes surface drainage from vehicular and pedestrian accessways.

Sumps on public roads shall comply with Section 3.16.4 of this Standard.

Sumps on private accessways shall be capable of accepting the flow from the catchment area. The minimum grate size shall be 300 x 300 mm. Where an accessway is steep, or stormwater connections discharge onto the accessway, standard single or double sumps as required for roads, and detailed on SHEET 22 shall be used. Sump leads shall be adequate for the catchment area, but not less than 225 mm.

4.11.5 Inlet and Outlet Structures

All culvert and pipeline inlets and outlets shall be provided with adequate wingwalls, headwalls, aprons and scour protection, for erosion control, fill retention around the pipeline and pipeline support. With larger diameter pipes where there is a danger from access to the pipes, wingwalls with safety grates shall be provided.

Inlets shall have removable debris traps and/or pits. The effects of blockage shall be considered.
The design of debris traps on inlets to large pipes (>750mm) shall be to the approval of WDC. As a minimum they shall have a raked face and an access area above to permit screen clearing at times of high flows. Consideration should be given in the design of such screens to health and safety risks during maintenance operations.

The appearance of inlets and outlets in relation to the riparian landscape, and effects on in-stream values shall be considered.

4.11.6 Waterways

All waterways that will be maintained by the Council shall be protected by easement or located in land in public ownership.

4.11.6.1 Constructed Waterways

Where waterways are constructed, they shall be designed to be stable, not prone to scour and able to be maintained, with adequate access for maintenance machinery. Generally concrete lined waterways will not be permitted. Designs shall be suitable to support and facilitate the movement of aquatic life. Planting adjacent to the waterways must be suitable to stabilise the banks without causing a maintenance liability in the future by their presence.

4.11.6.2 Natural Waterways

Existing natural waterways should be retained, and piping avoided as much as possible. Reserves should be created around significant natural waterways. Where waterways have been modified, they should be restored and enhanced. In catchments where a comprehensive resource consent is held for stormwater and the waterway is not regarded as significant in drainage or ecology terms the diversion of waterways is at the discretion of WDC.

Culverting or piping of existing waterways will require specific approval of the Wastes and Drainage Manager. This will generally not be given unless special requirements merit consideration. The layout of lots may not provide sufficient justification.

Existing vegetation to waterway banks should be maintained and protected to prevent bank scour. Removal of vegetation and replacement with engineered banks to prevent scour will not generally be acceptable. Retention of existing trees and bush cover adjacent to waterways is encouraged.

4.11.7 Connections

Connections shall be provided to all new urban lots, and to rural lots where a stormwater system with adequate capacity is available, subject to the principles set out above.

Where stormwater reticulation is available, connections shall be made directly to stormwater mains, rather than via a kerb connection. Where this is not practicable, connections may discharge to a waterway, to a roadside kerb, or to an approved stormwater treatment/retention system.

Discharge via a kerb connection will only be permitted where the road has full kerb and channel and where it can be demonstrated that other properties adjacent to the road will not be compromised by the discharge.

The minimum connection size shall be:

- 100 mm for each residential allotment.
- 150 mm for a commercial/industrial lot. The connection shall be designed to suit the potential site coverage, and where known, the intended use of the property. **The minimum connection size will only be suitable for small lots**.

Where discharge rate controls are applied, the Council may approve alternative connection sizes.

Connections shall be sited clear of obstructions and known developments and accessible for maintenance.

Direct connection of minor pipelines to major pipelines is acceptable, provided:

- Connection is via a suitable junction or saddle,
- The distance between the connection and the closest inspection point is not greater than 11 m.

Connections shall be sealed with removable caps until required. Their location shall be accurately measured and shown on as-built plans.

4.11.8 Soak Pits

Soak pits may be approved where a geotechnical investigation demonstrates that soils are suitable for soakage. Refer to E1/VM1 of the Approved Document for Clause E1 of the NZBC. Soak pits shall not be used in areas subject to instability.

4.11.9 Stormwater Detention Areas

The requirement for stormwater detention, and the design parameters shall be established as part of the stormwater analysis carried out by an IQP.

Stormwater detention areas shall be contained within legal boundaries of a drainage reserve. They shall not be included in local purpose reserves.

All weather, legal access to the area from a road shall be provided for maintenance. Hazards from the area shall be identified and mitigated. The requirement for fencing complying with the Fencing of Swimming Pools Act 1987 shall be established, and provided as necessary.

4.12 DESIGN

4.12.1 General Requirements

In general, stormwater systems should be designed so that the full development will not result in any increase in discharge rates or reduced quality, compared to the pre-development situation. This may require on-site detention systems.

The design shall specifically cover the provision of sumps, culvert inlets etc. to ensure that the design surface flow can enter the system. Particular attention shall be paid to inlet assessment when looking at flow conditions for pipes (i.e. providing adequate head to achieve design flows).

4.12.2 Design Methods

4.12.2.1 Small Urban Catchments

For small urban areas, particularly infill developments with a catchment of less than 2.5 ha, the primary design flow (post development) may be taken as 210 litres/sec/hectare for the design of pipelines. This will be conservative for most situations, and savings may be available by using specific design. Consideration shall be given to secondary flow paths. A full design may be required to establish effects on downstream reticulation and for flow mitigation measures.

4.12.2.2 Specific Design

The design of a stormwater system not covered by the above method will require specific design. The design shall be carried out by an IQP (refer to glossary for definition), experienced in catchment design.

This standard does not cover the detailed methodology to be followed in the design.

NZS 4404:2004 Section 4.3.12, in conjunction with *Verification Method E1 / VM1 o*f the *Approved Documents for New Zealand Building Code* is an approved means of compliance. Other methods, e.g. the *Procedure for Hydrological Design for Urban Stormwater Systems* by the New Zealand Institution of Engineers, or a proprietary computer model may also be approved. If a computer network model is used, it shall be MOUSE or a programme that produces outputs that are consistent with MOUSE.

For large catchments with significant storage elements, specific design using unsteady flow modelling shall be used.

APPENDIX C gives the Intensity Duration Curves and Runoff Coefficients to be used in the design, unless acceptable alternative data is provided. Acceptable alternatives include analyses of a specific site based on information provided by NIWA, and/or verified research studies of particular soil or site conditions.

The design shall take into account the following:

- Estimation of Surface Run-off,
- Critical storm duration in relation to storage provisions where applicable,
- Rainfall Intensity and Time of Concentration,
- Sizing of the stormwater drainage components based on hydraulic capacity, including analysis of full pipe and part pipe flows,
- Analysis of energy loss through structures (Manholes, bends, inlets etc.)
- Determination of water surface profiles in a stormwater drainage system,
- Outfall water levels,
- Allowance for climate change (refer Section 4.8.2).

4.12.3 Gradients and Acceptable Flow Velocities

Pipes shall be kept as steep as possible in flat areas to control silt deposition. The velocity should be at least 0.6 m/s at a flow of 50% of a 2-year return period storm.

Erosion of concrete pipes should be considered where the pipe gradient is steeper than 1 in 3.

4.12.4 Outlet and Backflow Effects

Outlet design and water level conditions shall be taken into account in the design of discharges to stormwater systems and waterways.

Where stormwater discharges to tidal waters, the design shall assume a tide level of Mean High Water Spring (MHWS)

4.12.5 Culvert Design

The design of culverts shall consider the effects of inlet and tailwater controls. An acceptable method of assessing flows with inlet and outlet control is given in the *Approved Documents for New Zealand Building Code, Verification Method E1 / VM1.*

4.12.6 Secondary Flow Paths

The design shall include a full analysis of overland flow paths. This shall include preparation of plans, long sections and cross sections showing design water levels for a 1% AEP storm. Where the secondary flow path is in private property, limitations on development shall be noted.

4.13 STORMWATER QUALITY CONTROL

The following summarises requirements of the Northland Regional Council in relation to stormwater quality control.

All new subdivision developments or re-developments, and all other new stormwater systems, shall as a minimum:

- *Incorporate stormwater runoff control measures that, where practicable, use infiltration facilities as the primary methods of stormwater disposal in permeable soil types, including but not restricted to, porous pavements, grassed swales, and riparian zones,,*
- *Limit areas of impermeable surfaces in carparking areas, driveways, roading and residential lots,*
- *Incorporate secondary flow paths for storm events greater than the primary design flow (1:100 year flood event) ,*
- *Retention of designated flood prone areas,*
- *Discourage piping and lining of larger drains where open channels and/or grass swales can provide the required drainage paths,*
- *Require, as far as practicable, the retention of natural stream channels.*
- *The discharge of any stormwater should not cause the quality of the water to fall below the water quality guidelines given in section 7.6 of the* Regional Water and Soil Plan for Northland*.*

It is emphasised that applicants shall always refer to the Regional Council and CDPs before commencing the design of a new system. It is expected that all discharges should be treated in line with the requirements of the ARC TP 10 standard.

It is noted that the District Council commenced, in 2001, a monitoring programme of the waterways in its urban drainage areas. Information from that monitoring will be made available to applicants to assist them in the design of the on-site measures.

4.14 INSPECTION AND TESTING

4.14.1 Pipeline Pressure Test

A pipeline pressure test will not normally be required. However the Council reserves the right to require a low-pressure air test of the reticulation.

4.14.2 CCTV Inspection

The whole of the reticulation shall be inspected and recorded by CCTV. Inspection records shall comply with NZWWA 'New Zealand Pipe Inspection Manual'.

4.14.3 Manholes

All manholes shall be visually inspected to ensure the standard of construction and finishing is acceptable.

4.14.4 Marking of Connections

All connections shall be sealed with an approved plug or cap, and be marked with a 100x50H4 treated stake painted red, extending from invert level of the pipe to 600 mm above ground level. Exposed surfaces of manhole covers shall be painted red.

4.15 COMPLETION

4.15.1 As-Built Drawings

A set of drawings and a schedule of asset information shall be submitted as per Section 1.7 of this Standard. This shall clearly and accurately show the as-built locations and details of all stormwater infrastructure provided as part of the work, including any modifications made to the existing system.

Additional requirements for stormwater include:

- Plans shall identify catchment and sub-catchment boundaries, watercourses, reticulation, and secondary flow paths.
- The area of catchments and sub-catchments shall be shown.
- Drawings shall include plans, long sections and cross sections showing design water levels for a 1% AEP storm. Where the secondary flow path is in private property, limitations on development shall be noted.
- Minimum floor levels shall be specified for lots that may be affected by secondary flow paths or tidal effects.

The As Built drawings may be checked on site for accuracy on completion of the subdivision or development. A certificate of completion for the works will not be issued until acceptable As-Built drawings have been produced.

The drawings shall identify assets that have been removed or decommissioned.

4.15.2 Operation and Maintenance Manuals

Full details of all stormwater treatment facilities, and all other mechanical installations shall be provided, including complete O & M Manuals in PDF format, plus 3 hard copies, The O&M Manuals shall include:

- As-built drawings,
- Equipment List, with make, model and serial numbers,
- Equipment supplier details,
- Maintenance schedules.

4.16 DEFECTS LIABILITY

A Performance Bond will be required for the works in terms of Section 1.13 of this Standard.

4.17 DRAWINGS

The following drawings in APPENDIX A apply to this section:

SHEET 1	**STANDARD DRAWING SYMBOLS**
SHEET 11	**RECOMMENDED SERVICE LOCATIONS**
SHEET 12	**KERB AND CHANNEL DETAILS**
SHEET 13	**TYPICAL KERB AND SUBSOIL DRAIN DETAILS**
SHEET 18	**PIPE BEDDING AND BACKFILL**
SHEET 19	**PIPE PROTECTION AND BULKHEADS**
SHEET 20	**INLET AND OUTLET STRUCTURES**
SHEET 21	**LAMPHOLES, STORMWATER AND SEWER CONNECTIONS**
SHEET 22	**SUMP DETAILS**
SHEET 23	**STANDARD PRECAST MANHOLES**

5. WASTEWATER RETICULATION AND TREATMENT

5.1 GENERAL REQUIREMENTS

This Section covers the requirements for wastewater disposal, and the design and construction of public wastewater reticulation systems, including associated pump stations and rising mains.

This Standard covers conventional reticulation. Alternative reticulation systems (e.g. EDS or Suction systems) shall be subject to specific approval and agreement on design standards.

Where a public wastewater scheme is available, connection to it will be required. Where an existing wastewater disposal scheme is not available, an alternative method of disposal must be available. This will normally be by on-site treatment and disposal.

5.2 REFERENCED DOCUMENTS

The following documents shall be read in conjunction with this section of these standards:

- Whangarei District Council Proposed District Plan (WDC)
- Regional Soil and Water Plan for Northland (NRC)
- Regional Coastal Plan for Northland (NRC)
- WDC Coastal Structure Plan – Slope instability Potential and Effluent Disposal Potential, Oakura to Langs Beach.
- Whangarei District Council Wastewater Asset Management Plan,
- WDC Wastewater Pumping Stations Electrical Engineering Systems.

The above documents will be added to from time to time as further investigations and reports are completed. The applicant is advised to obtain information from Council on any relevant documents applicable to the site.

Where aspects of the design are not covered by this section or the above Council documents the following standards may be referenced. Adoption of any practises outside of the Council documentation shall first be approved by the Council.

- NZS 4404:2004 Land Development and Subdivision Engineering
- WSA 02 – Sewerage Code of Australia
- WSA 04 – Sewage Pumping Code of Australia
- Guide for Safety with Underground Services – Occupational Health and Safety.

The most up to date of these publications shall supersede any conflicting requirements of older documents.

5.3 SUBMISSION OF APPLICATION

5.3.1 Supporting Information and Calculations

The application shall include supporting information and calculations that demonstrate that:

- the existing wastewater reticulation and treatment system that the development will connect to is adequate to serve the proposed development,
- the proposed reticulation is adequate to serve the proposed development, and where required by the Council, the potential upstream catchment.

Conventional gravity reticulation with up to 150 mm pipelines, not requiring specific hydraulic design, and strictly complying with the provisions of this standard may be designed by a suitably qualified & experienced person.

All other systems, including gravity pipelines serving more than 250 lots, pump stations, pressure mains, above-ground structures, pipes where the minimum cover is not achieved, siphons etc. shall be designed by an Independent Qualified Person (IQP) who shall provide a design certificate identifying the design standards used, and certifying that the design complies with these standards.

The design shall include:

- Pipe sizes, material, and layout of the reticulation,
- Hydraulic design, including providing adequate capacity and self-cleaning velocity,
- Service connection locations to serve the buildable area with a gravity connection,
- Design of pump stations and rising mains.
- Preparation of plans and specifications.

5.3.2 Design Drawings and Specifications

Design drawings complying with the requirements of Sections 1.5 and 1.6 shall be provided for approval.

5.3.3 Approval of Design

The drawings and calculations will be will be reviewed by the Wastewater and Drainage Services Manager or his/her representative**.** The completed form and the drawings showing any alterations shall be returned to the developers representative. 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 Wastewater and Drainage Services Manager shall be deemed approved drawings. Unless specifically stated otherwise, the approval of drawings does not supersede the requirements or obligations of these standards.

5.4 WASTEWATER TREATMENT AND DISPOSAL

5.4.1 Connection to Existing Wastewater Scheme

All lots within the 'Area of Benefit' of a sewerage scheme shall be provided with a gravity connection to the Council system unless the Council confirms in writing that a connection is unwarranted, unavailable or unsuitable. Where properties are adjacent to an area of benefit, Council may approve a connection, or require that a connection to the system be provided.

5.4.2 Alternative Treatment and Disposal Options

5.4.2.1 Individual On-Site Treatment and Disposal

Where a connection to an existing scheme is not available, the lot size complies with minimum requirements in the District Plan for on-site disposal of wastewater, and there are no factors that may preclude or limit its use, on-site disposal will normally be approved.

If the lot size is less than 2000 m^3, or the available area for disposal is limited due to the topography, high ground-water table or hazards such as flooding or instability, the applicant shall demonstrate for each lot that:

- the site is suitable for the disposal system proposed, and
- adequate area including reserve area is available.

This will require an investigation carried out by an IQP, using the Site-and-Soil Evaluation Procedures of AS/NZS 1547:2000, and the performance requirements in Northland Regional Council Regional Plans.

Reference should be made to the WDC Hazard Plans (e.g. *Coastal Structure Plan – Slope instability Potential and Effluent Disposal Potential, Oakura to Langs Beach (Tonkin and Taylor 2005)*). The requirements regarding soil suitability for effluent disposal and lot sizes will be the basis for evaluation of the suitability of a site for on-site treatment and disposal.

5.4.2.2 Provision of New Treatment and Disposal Scheme

Council may approve the provision of a new wastewater scheme to serve a development, subject to the following:

- The new system has obtained all required Resource Consents from the Northland Regional Council,
- Adequate provisions for operation and maintenance of the system are in place.

Council may agree to take over future responsibility for the management and maintenance of a new system that serves more than 15 households. Specific negotiation will be required to determine the financial, technical and legal aspects of such an agreement.

In general the following will also be required:

- All parts of the new system comply with this standard, except as specifically agreed,
- Building consent and all associated code-compliance certificates are obtained,
- As Built drawings, Producer Statements from the designer and construction supervisors, and a management plan approved by the Northland Regional Council are provided,
- Sufficient land area is designated to accommodate a treatment and disposal system with capacity for flows from the ultimate catchment development;

5.4.3 Disconnections

Council approval is required for disconnection from the wastewater network to ensure that the disconnection is carried out appropriately and the old connection blanked off in a way that prevents infiltration entering the network and/or leaks occurring from the connection location.

A Council inspecting officer shall inspect all disconnections before back-filling takes place.

5.5 CONSENTS

All Building Consents and Resource Consents for the wastewater system shall be obtained, including consents for stream crossings, pump station discharges etc.

5.6 LEVEL OF SERVICE

5.6.1 Design Life

The asset life of wastewater supply systems shall not be less than 100 years. The asset life of components of the systems, e.g. pumps, valves etc shall be noted in the application.

5.6.2 Service Requirements

Where a wastewater system is available, or where a system is to be provided as part of a subdivision or development, it shall have adequate capacity to service the full catchment, long service life, a low level of infiltration, and resistance to entry of tree roots.

5.6.3 Capacity and Future System Expansion

The development shall be reticulated with a piped system adequate to transport the design flow without surcharging.

The wastewater reticulation shall be constructed to the upstream boundaries of the approved development at the applicants expense and shall be capable of serving the entire subdivision or development and any undeveloped land beyond, when that land is developed to its ultimate development intensity.

Where future upstream development is possible, the depth and alignment of the reticulation shall be suitable for such development.

5.6.4 Infiltration Minimisation

The reticulation shall be designed, detailed, constructed and tested to ensure that there is zero pipeline infiltration at commissioning and a low level of infiltration/exfiltration over the life of the system. Testing shall include all components of the system, including manholes.

The use of sealed maintenance and inspection structures to replace manholes, in accordance with this standard is required.

5.6.5 Council Design Input

The Council shall have the right to specify the diameters and classes of pipes to be used for all reticulation within the subdivision or development, and to specify connection points and reticulation alignment. It will provide on request details of the existing reticulation for design purposes. Where necessary, Council will investigate the capacity of the downstream wastewater reticulation and treatment facilities to determine their adequacy, at the applicant's expense.

5.7 PIPE SELECTION

5.7.1 Pipe Materials and Class

Standard approved pipe materials are given in Table 5.1. Other materials shall only be used with the written approval of the Wastewater and Drainage Services Manager.

Pressure pipelines (Rising Mains) shall meet the material, construction and testing requirements of Principal Water Mains, as set out in Section 6 of this Standard. For PE pipes, the internal bead formed by welding shall be removed.

Blue coloured pipes shall not be used for sewer pipelines.

5.7.2 Pipe Bridges

Pipe bridges shall be specifically designed for the particular environment. Piles may be concrete or timber. The developer is responsible for obtaining all building consents and resource consents. Pipelines across bridges (normally rising mains) will normally use Ductile Iron or coated steel pipes.

Timber piles shall be H6 treated. No cutting, notching or boring after treatment is permitted in areas in contact with soil or water. Cut or bored areas shall be resealed using a suitable preservative treatment.

TABLE 5.1 Pipe Material and Class for Gravity Reticulation

Material	Standard	Class (min.)	Notes
uPVC	AS/NZS 1260	SN 8	Class SN 40 required for road crossings with cover less than 1.2m
	AS/NZS 1477	PN 9	PN 16 required for road crossings with cover less than 1.2m
mPVC	AS/NZS 4765	As for uPVC	
PE (min. Gradient 1%)	AS/NZS 4130	SDR 17, SN 16	Subject to approval. Black Outer, White or Brown Inner lining. Internal bead formed by welding shall be removed. Where the pipeline is installed by directional drilling or pipe bursting methods, the pipe class should be SDR 11.
Vitrified Clay	AS 1741		Subject to specific approval, for use where required for aggressive wastes only
Ductile Iron	AS 2280	K9	Cement Lined, externally coated appropriate to the environment (min. two-coat epoxy and wrapped in Denso tape). Approved for above ground installation.
Steel	NZS 4442	4.2mm wall thickness.	Requires specific approval. Concrete lined, external coated appropriate to the environment (min. two-coat epoxy and wrapped in Denso tape). Only approved for above ground installation.
Concrete RRJ	NZS 7649		Requires specific approval. Only permitted in special circumstances. May require internal lining or other protection. Roller Compacted concrete pipes may be required to be individually tested.
PP (e.g. 'SewerBoss' twin wall pipe)	AS/NZS 5065	SN 8	Class SN 40 required for road crossings with cover less than 1.2m Shall be shown to be capable of withstanding a jetting resistance to 4000psi (280 bar) without damage. .

5.8 DESIGN FLOW

The design shall provide for domestic wastewater, industrial wastewater, infiltration and direct inflow of stormwater as below:

5.8.1 Residential flows

- Average Dry Weather Flow – 200 litres/day/person
- Dry weather diurnal PF of 2.5
- Dilution/infiltration factor of 2 for wet weather
- Number of people per dwelling of 4.0. In areas with high seasonal populations the Council may require this to be increased.

In practical terms, unless the catchment is likely to exceed 250 dwelling units, and where no industrial or commercial flow, or flow from a pumping station is involved, 150 mm diameter pipes laid in accordance with Table 5.5 will be adequate without specific hydraulic design.

Where a catchment is outside of the above limitations, a specific hydraulic design shall be carried out.

5.8.2 Industrial/commercial flows

- For individual industries, specific assessment shall be carried out of the wastewater flows.
- When assessing the ultimate development flows from a wider area, the flow rates in Table 5.2 may be used as a design basis. The sensitivity of the pipe sizes and capacity of reticulation components shall be determined to ensure sufficient capacity is available in the event of heavier-than-expected flows.

TABLE 5.2. **Design dry weather wastewater flow rates for Industrial/commercial flows** (Includes Business 1 to 4, Marsden Point Port and Airport Environments).

Minimum Design Flows	Flow Rates (litres/sec/ha)
Light water usage	0.4
Medium water usage	0.7
Heavy water usage	1.3

These flows include both sanitary wastewater and trade wastes, and include peaking factors. Allowance needs to be made for inflow/infiltration in wet weather.

5.8.3 Hydraulic design

The hydraulic design shall be based on either the Colebrook-White formula or the Manning formula. Material coefficients for pipes up to DN 300 are given in Table 5.3.

These values take into account joints, slime, debris etc.

TABLE 5.3. Coefficients for Gravity Lines

Material	Colebrook-White K (mm)	Manning
VC	1.5	0.013
PVC	0.6	0.011
PE	0.6	0.011
Cement Lining (DI & Steel, Concrete)	1.5	0.012

5.8.4 Minimum Pipe Sizes

Minimum pipe sizes are given in Table 5.4.

TABLE 5.4. Minimum Pipe Sizes for Gravity Wastewater Reticulation and Property Connections

Pipe	Minimum Size ID (mm)
• Connection serving 1 dwelling unit • Connection to in-fill development, serving up to 3 dwelling units, via an inspection chamber (subject to Council Approval)	DN 100
• Connection serving more than 1 dwelling unit • Connection serving Commercial and Industrial lots • Reticulation serving Residential lots	DN 150

5.8.5 Limitation on Pipe Size Reduction

Pipe size shall not be reduced on any downstream section.

5.8.6 Minimum Grades for Self-cleaning

Self-cleaning shall be achieved by providing minimum grades specified in table 5.5.

TABLE 5.5. Minimum Grades for Wastewater pipes

Pipe Size	Location	Minimum Grade	
Connections and Permanent Ends of Reticulation		**(%)**	
DN 100	Property Connection	1.65	1:60
DN 150	Property Connection	1.20	1:83
DN 150, 225 & 300	Permanent upstream ends of reticulation with 10 or less residential lots	1.00	1:100
Wastewater Pipes – Reticulation with greater than 10 residential lots (except PE Pipelines and pipes installed by trenchless methods)			
150	Recommended minimum Absolute Minimum Grade	0.67 0.55	1:150 1:180
225		0.33	1:300
300		0.25	1:400
PE pipes, and Pipes Installed by Trenchless Methods			
All	To suit installation method but not less than	1.00	1:100

5.8.7 Maximum Velocity

The preferred maximum velocity for peak wet weather flow s 3.0 m/s. In steep slopes where this flow velocity will be exceeded, specific design procedures shall be used.

5.8.8 Rising Mains

Pumping velocities in rising mains shall be in the range 1.0 to 2.0 metres per second.

The effect of water hammer pressures on rising mains shall be addressed and measures to limit its impact incorporated in the design as necessary. Rising mains shall be rated appropriate to the maximum design head (including water hammer), but not less than PN9.

The design shall include the requirement for air valves, including odour considerations.

5.9 LAYOUT OF RETICULATION

5.9.1 General

5.9.1.1 Gravity Pipelines

Gravity pipelines may be located within roads, public reserves and private property.

Wherever possible, reticulation is to be located in the road berms. Crossings of roads, railway lines, creeks, drains and underground services shall be at right angles as far as possible.

In private property and other areas where development or building may occur, pipes shall be located clear of potential building sites and existing or proposed engineering features. Where practical, pipes shall run parallel to boundaries with an offset from the boundary between 1.0 m and 1.5 m..

Where possible, pipes shall be sited outside of the zone of influence of the foundations of existing structures. Where this is not possible, the pipe and structure shall be protected to details approved by the Council. The design shall include protection of the pipeline and structure, and maintenance access for the pipeline.

No structure shall be erected over any buried public sewer or stormwater system without prior written approval of Council's Wastes and Drainage Manager.

5.9.1.2 Curved Pipelines

Where practicable and economic, pipelines should be constructed in straight horizontal and vertical alignment between maintenance structures.

Subject to specific design, close control of installation to maintain grades and alignment, and accurate as-built plans, curved pipelines may be approved. Approval will normally be given where pipelines follow curved street alignments, or where there will be savings in life-cycle costs.

5.9.1.3 Maintenance Structures

All manhole and other maintenance structures shall be kept clear of boundaries, and where practicable, outside of carriageways and footpaths.

They shall be located as far as possible:

- Where long term, safe access is available,
- Clear of floodways, stormwater detention areas, stormwater secondary flow paths and inter-tidal regions.

A minimum clearance of 1.0 m from openings should be provided around maintenance structures, for maintenance purposes.

The top of manholes and maintenance structures in areas subject to flooding shall be 300 mm above the 1 in 100 year flood level. Where this is not practicable, watertight, bolt-down covers shall be used, and all manhole components tied together.

Easements in favour of Council may be required by the Council to allow vehicle access to maintenance points of the reticulation.

5.9.1.4 Pump Stations

Where practicable, pumping stations shall be avoided in favour of gravity systems. Pump stations serving less than six household equivalents will not generally be taken over by the Council.

Public pump stations shall be sited on a separate lot vested in Council. The site for a temporary pumping station may be an easement registered in favour of Council rather than a separate lot. The site shall be fenced with Type 3 fence in accordance with SHEET 30, with a 3 metre wide gate.

Council may permit Pump Stations to be sited in roads or public reserves, subject to specific approval. Pump stations, including associated parking areas shall not be located where they will affect pedestrian or vehicular traffic. In particular, valve and pump station lids shall be kept clear of carriageways, footpaths and driveway locations.

Pump Stations shall be provided with all-weather vehicle access and provision for parking of maintenance vehicles. The construction of the access shall be to the relevant right-of-way standard, and shall include provision for turning as required. The access shall be vested in Council, or have an easement in favour of Council.

5.9.1.5 Pressure Pipelines (Rising Mains)

Rising mains will normally only be permitted to be located in roads, public reserves and access lots. Where rising mains cross private property, including access lots, an easement in favour of Council over the pipeline alignment will be required.

Short rising mains with consistent flow where retention times in the main are low, may discharge to gravity reticulation via a manhole. In all other situations, rising mains should discharge to a downstream pump station or treatment plant, to minimise the potential for odours in gravity reticulation. Where this is not possible, pump stations shall be provided with an automatic system that will dose the pump station with water to ensure that the station pumps at least four cycles per day.

5.9.2 Separation from other Services

Minimum clearances to other services shall not be less than given in Table 5.6, except with written agreement of the Wastes and Drainage Manager, and other affected service owners. All wastewater mains shall be laid at a lower level than water mains to avoid cross contamination.

TABLE 5.6 – Separation Distances

Utility (Existing Service)	Minimum Horizontal Clearance (mm) New Main Size ≤ DN 300	Minimum Vertical Clearance[1] (mm)
Gas mains	300[2]	150
Telecommunications conduits & cables	300[2]	150
Electricity conduits and cables	500	225
Stormwater drains	300[2]	150[3]
Water Mains	1000/600[4]	500[3]

Notes

1) Vertical clearance apply when water mains cross another utility service, except in the case of water mains when a vertical clearance shall always be maintained, even when the main and wastewater pipe are parallel. The watermain should always be located above the wastewater pipe to minimize the possibility of backflow contamination in the event of a main break.
2) Clearance can be reduced further to 150mm for distances of up to 2m when passing installations such as pole, pits and small structures, providing the structure is not destabilized in the process.
3) When a wastewater pipe is at the minimum vertical clearance below the water main (500mm), maintain a minimum horizontal clearance of 1000mm. This minimum horizontal clearance can be progressively reduced to 600mm as the vertical clearance is increased to 750mm.
4) Where a main crosses other services, it shall cross at an angle as near as possible to 90^{o}.
5) Clearance shall be measured from the outside of each pipe or duct.

5.9.3 Wastewater Mains Near Trees and Existing Reticulation

Reference shall be made to Section 7.4 of this Standard for requirements regarding the location of trees close to reticulation. Where any pipes or cables are laid alongside existing reticulation then a gap of at least 1 metre should be maintained where practicable so as not to disturb the existing trench. Root ingress protection to pipe joints shall be provided where joints occur within 5m of a tree canopy.

5.9.4 Pipe Cover

All reticulation located in areas not subject to traffic loading shall have a minimum of 600 mm of cover between the top of the pipe and finished ground level. Under carriageways the minimum depth shall be 900 mm (see SHEET 18). Pipes under carriageways with cover of less than 1.2 m shall be SN 40 or PN 16.

Where the above minimum depths cannot be met, special protection of the pipe shall be provided. This shall be by reinforced concrete slab protection in areas subject to traffic loading, and by unreinforced concrete slab protection in other areas (see SHEET 19).

Where the reticulation lines are located in the front yard of lots, the invert level shall be deep enough so as not to interfere with any future driveway construction.

5.9.5 Easements

Easements in favour of Council are required for all public gravity reticulation greater than 150mm diameter and all rising mains located in private property. Easements may be required for access to maintenance structures.

5.10 MAINTENANCE STRUCTURES

5.10.1 General

Maintenance structures shall be provided for access and maintenance of the reticulation. They shall be suitable for normal maintenance activities, including water jetting and video inspections. Preference will be given to structures that will minimise the potential for infiltration.

Types of maintenance structures are:

- Manhole (MH)
- Maintenance Shaft (MS)
- Terminal Maintenance Shaft (TMS)

Maintenance Structures shall be provided at the following locations:

TABLE 5.7 – Maintenance Structure Requirements

Maintenance Structure Locations	Acceptable Option		
	MH	MS	TMS
Intersection of reticulation mains (excludes property connections),	Yes	No	No
Change of pipe grade (Level invert)	Yes	With DN 150 pipe only, using a vertical bend	No
Change of pipe grade at different invert level	Yes	No	No
Changes in pipe size	Yes	No	No
Changes in horizontal direction (except using curved pipes)	Yes	Use prefabricated units or horizontal bends, Max. 33° deflection	Yes for DN 150 pipe only
Change of pipe material	Yes	No	No
Upstream ends of reticulation	Yes	Yes	Yes
Location of discharge of a pressure main into a gravity pipe	Yes – Must include a vent	No	No
Note: Manholes are the only option where personnel entry is required, DN 100 connections may be made to any maintenance structure, or at any point along a main using a proprietary junction, London Junctions or Rodding Eyes may not be used instead of a maintenance structure at the end of a main.			

5.10.2 Spacing

Maximum spacings shall be as follows:

TABLE 5.8 – Maintenance Structure Spacing

Application	Maximum Spacing
Between any two MSs, or TMS and MS.	120 m
Between TMS and MH (no intermediate MSs)	150 m
Between last MS or TMS and MH (with intermediate MSs)	240 m
Between MHs (with intermediate MSs)	400 m

5.10.3 Manholes

Manholes shall be constructed in accordance with SHEET 23.

5.10.3.1 Access

Covers shall be cast iron, watertight, with a clear opening of 600 mm diameter. Lids shall be lockable. Stepped rungs shall not be installed in manholes. Standing areas with a minimum working space of 750 mm clear of obstructions at the base shall be provided.

5.10.3.2 Design

The maximum deflection through a manhole for pipe sizes 150 – 300 mm DN shall be:

- 120° for standard manhole with internal fall along MH channel,
- 150° with drop manhole.

Channels in the manhole base shall have a minimum internal radius (in plan) of 300 mm.

The minimum internal fall through a manhole joining pipes of the same diameter shall comply with Table 5.9.

TABLE 5.9 – Fall through Manholes

Deflection Angle at MH	Minimum Internal Fall (mm)
0 to 30	30
>30 to 60	50
>60 to 120	80

Where the internal fall across a manhole is greater than can be accommodated with fall across the base of a manhole, a drop manhole shall be provided.

5.10.3.3 Steep Grades

Where practicable, steep grades > 7% shall be 'graded out' at the design phase. Where this is not possible, the following precautions should be taken:

- The steep grade of an inlet pipe is to be continuous through the manhole,
- The minimum depth to invert of the manhole shall be:
  - 1.5 m for DN 150 and 225
  - 2.0 m for DN 300
- Change of direction not to exceed 45°,
- No drop junctions or verticals in the manhole,
- Inside radius of channel in manhole to be greater than 6 times pipe diameter,
- Benching to be taken to 150mm above the top of the inlet pipe.

5.10.3.4 Construction

Manholes shall have pre-cast bases, except where this is not practical.

The height of the bottom riser shall be the maximum available to suit the manhole depth. The minimum riser joint spacing in manholes shall be 2.5 m. Openings created in manholes for pipeline entry shall be drilled to the minimum size practical. Details shall ensure that manholes do not allow infiltration at joints or lid. Lids shall be raised at least 50mm above the surrounding ground surface.

Where pipe sizes change at the manhole, the soffit of the inlet pipe should be at least as high as the soffit of the outlet pipe.

Where manholes are constructed in soft or unsuitable ground, the area under the manhole shall be undercut and backfilled with suitable hardfill to the satisfaction of the Council in order to provide an adequate foundation for the manhole base. Any excavation to a greater depth than necessary shall be made good with weak mix concrete.

5.10.4 Maintenance Shafts (MS)

Maintenance Shafts shall comply with AS/NZS 4999, and be constructed in accordance with SHEET 24.

Maintenance shafts shall be used on DN 150 and DN 225 pipes where access below ground will not be required, subject to the restrictions in Table 5.7.

The maximum depth of a maintenance shaft shall be within the allowable depth of the pipeline and MS, but not more than 3.6 m.

The deviation of the riser shaft from vertical shall not exceed 300 mm, measured at the surface. At changes in grade, the MS should be located on the pipe with flatter gradient.

Directional and gradient changes may be made as follows:

- Using close-coupled bends immediately adjacent to the MS. The maximum horizontal deviation shall be 33°.
- Using specially manufactured MS units to suit design requirements. The maximum horizontal deviation shall be 90°.

Maintenance Shafts shall not be located in carriageways or heavily trafficked areas.

Maintenance shafts shall have sealed, removable access covers, with a separate cast iron manhole cover and frame set in a concrete surround at ground level.

5.10.5 Terminal Maintenance Shafts (TMS)

Terminal Maintenance Shafts may be used as terminating structures on DN 150 and DN 225 pipes where access below ground will not be required, subject to the restrictions in Table 5.7.

The maximum depth of a TMS shall be within the allowable depth of the pipeline and TMS, but not more than 3.6 m.

The deviation of the riser shaft from vertical shall not exceed 300 mm, measured at the surface.

Up to two property connections may discharge directly to the riser shaft. Where a property connection is directly ahead of the terminal maintenance structure, a MS may be used instead of a TMS, with a reducer immediately upstream of the MS to accept the connection.

Terminal Maintenance Shafts shall not be located in carriageways or heavily trafficked areas.

Maintenance shafts shall have sealed, removable access covers, with a separate cast iron manhole cover and frame set in a concrete surround at ground level.

5.10.6 Connections

A 100 mm diameter service connection shall be provided for each residential allotment. The size of a connection for a commercial/industrial lot shall be designed to suit the intended use. Connections shall be sited clear of obstructions and known developments and accessible for maintenance.

Connection locations and details shall be as per SHEET 21.

Connections shall be positioned at sufficient depth to enable the entire buildable area of the property to be served, allowing for allowable minimum grades and cover provisions in private foul water drains. The depth of the connection should not be less than 600 mm and generally not exceed 1500 mm. Exemptions or variations will require specific Council approval.

A connection shall not cross more than one lot boundary. To achieve this, a 150 mm (min.) branch sewer with a TMS may be used. This condition may be relaxed for minor "infill" development to take account of the layout of existing reticulation at the discretion of Council.

Where an existing or proposed sewer is more than 4.5 m deep, connections shall be made to a shallower branch sewer laid from a manhole on the deep sewer.

5.10.7 Marking

A detection tape shall be laid directly above all new sewers and rising mains. The tape shall have "sewerage" written on it in white, be located at a depth of between 200 and 250mm below the finished surface level and contain sufficient metal to be detectable from the surface by a standard metal detector.

5.11 PUMP STATIONS

5.11.1 General Requirements

Sewage Pumping Stations and rising mains shall be designed by an IQP. The design shall be subject to the Engineer's specific approval.

Except where site conditions or specific design requirements preclude their use, Modular Package Pump Stations constructed of GRP or PE, complying with these standards shall be used. A list of approved designs is available from the Council. The use of alternative types including individually constructed pump stations is subject to specific approval.

Flygt 'TOPS' pump station bases shall be used in pump stations.

Electrical and control systems shall strictly comply with the 'WDC Wastewater Pumping Stations Electrical Engineering Systems' Standard.

Pump Stations shall meet the following general requirements:

1. The pump station shall consist of an underground pump well, a separate valve chamber that can drain into the pump chamber, emergency storage, a water supply and electrical control cabinet. The station shall be designed for all imposed loads, including floatation.
2. Pump stations are to be designed and constructed to ensure that no stormwater enters, either through the wall or the roof and lid. The lids and the electrical control cabinet are to be a minimum of 100mm above the general ground level, with the surrounding ground graded away from the station. In areas subject to flooding the top surface shall be 300 mm above the 1 in 100 year flood level.
3. Pump and Valve chambers shall have sealed, lockable lids that can be readily opened by one person. Lid details shall comply with 'Manukau City Council' details (ref. Manukau Engineering Quality Standards) unless otherwise approved. Openings shall be a minimum of 600x600. Pump chamber lids shall be provided with stainless steel safety grids with a grid size of 100 x 100 mm. Where a pump station is within 50 m of the boundary of a residential dwelling or accommodation unit, lids shall be insulated.
4. All lifting chains, guide rails, fittings, connections, nuts, bolts etc in the pump station shall be 316 Stainless Steel,
5. Pump chamber pipework shall be Ductile Iron with a two-coat epoxy coating. For small diameter pipework where DI is not available, stainless steel pipework shall be used.

6. Concrete in pump stations shall be suitable for sewer pump stations, and shall be lined with an epoxy or similar lining. The concrete strength, admixtures and lining specification shall be supplied.
7. Pumps shall be "Flygt" 3 phase submersible type design, located on guide rails. Specific approval by the Waste and Drainage Manager will be required for alternative pump types.
8. The preferred impellor type where the rising main size is 90 mm PE or greater is an Open Self cleaning channel impeller i.e. Flygt 'N' Pump or equivalent. Shrouded single or multi-channel impellers e.g. Flygt 'C' pumps, shall be capable of passing a 75mm diameter solid. For a rising main size of less than 90 mm PE pipe, grinder cutter pumps e.g. Flygt 'M' pumps shall be used.
9. There shall be a minimum of two pumps (duty and standby) in all pump stations, with automatic changeover of the pumps if the duty pump blocks or breaks down.
10. Access to pump stations shall be suitable for vehicles with a lifting gantry to install or remove pumps and equipment. Where this is not possible, the wet well shall be provided with a suitable lifting arm or gantry for servicing the pumps.
11. Float cables and lifting chains shall have hook plates.
12. Non-return and isolating valves for each pump shall be located in the valve chamber. The isolating valve shall be a resilient seated gate valve complying with AS/NZS 2638.2 (anti-clockwise closing) installed downstream of the non-return valve. Non-return valves shall be ball-valves with full-bore opening or swing check valves with external handles.
13. The capacity of the wet-well between start and stop levels shall be such as to limit pump starts to no more than fifteen per hour.
14. Pump chambers shall have a single inlet pipe, from an upstream 'satellite' manhole.
15. Pump Stations shall have emergency storage in case of mechanical or electrical failure or blockage of the pumps or rising main. The storage must be located at such a level as to prevent overflow from any manholes, gully traps, pump station lids or any other outlet from the system. Storage tanks shall be provided with a lockable, hinged, water tight lid with a minimum opening of 600x600, and able to be opened by one person by hand.
16. All pump stations shall have an approved and controlled overflow system that discharges in such a manner to ensure maximum storage is used prior to discharge. Overflows shall be screened.
17. All pump stations shall be reviewed for the potential for odours, and the effects of odours on adjacent dwellings. Odour mitigation shall be provided appropriate to the risk. Wet wells shall be fan-forced ventilated to provide a minimum of four air changes per hour, with a vent stack.
18. The electrical supply shall be underground,
19. Lighting shall be provided to illuminate the wet well covers and control cabinet.
20. Suitable low maintenance landscaping shall be provided on the pump station site around the wet well area.
21. A standard 1800mm high three rail wooden perimeter fence or approved alternative shall be provided.
22. Pump stations shall be provided with an automatic wet well cleaning system,,
23. An Operating and Maintenance Manual shall be provided that covers all aspects of the design and operation of the stations including:
    - Design calculations, including pipe and fitting head-loss assumptions and pump curves,
    - A plan of the design catchment,
    - As Built drawings including circuit diagrams and switch locations,
    - Pump details, pump duty information, float switch levels,
    - Contingency measures for emergency overflows,
    - Operation and maintenance procedures,
    - Other relevant data and information.

24. Pump stations shall be tested and commissioned in the presence of Council strictly in accordance with the 'WDC Wastewater Pumping Stations Electrical Engineering Systems' Standard.

5.11.2 Compliance with the NRC Regional Water and Soil Plan for Northland

Where a pump station is required, the applicant shall obtain all Resource Consents for its installation and use.

Pump Stations shall strictly comply with the requirements for a Controlled activity in the Rules for Sewage Discharges in the Regional Water and Soil Plan, as follows.

> ***15.2 Controlled Activities***
> ***The unplanned discharge of raw sewage from a sewage pump station or contributing pipe network onto or into land or into water is a controlled activity*** *provided that:*
>
> *a) Each sewage pump station in the sewerage system has an automatic control and alarm system that provides:*
> *i. Immediate notification of pump failure;*
> *ii. Automatic switching to a standby pump;*
> *iii. Immediate notification of station failure to pump sewage;*
> *iv. Notification when a system overflow is imminent, where imminent is not less than five minutes; and*
> *v. Power supply backup for the alarm system.*
>
> *b) Each sewage pumping station has at least one dedicated standby pump that will activate in the event of failure of the duty pump(s). The capacity of the standby pump(s) shall be at least equal to that of the largest pump in the station.*
> *c) The sewage pump station has a storage capacity of not less than 12 hours (based on the average dry weather flow) to reduce the frequency of overflows of sewage. For the purpose of determining compliance with condition (c) the storage volume provided shall be that calculated from the pump high level alarm point to the lowest point at which an overflow will occur, including any storage provided in the upstream reticulation.*

Note that where particular constraints exist – e.g. a sensitive receiving environment such as a bathing area or marine farm, the Consent Conditions may require a greater storage capacity.

5.11.3 Hydraulic Design

Each pump shall :

- provide pumping velocities in the rising main in the range 1.0 to 2.0 metres per second;
- pump stations and rising mains shall be designed to provide for the peak wet weather flow from the ultimate catchment development, without utilising the required emergency storage capacity.

Material coefficients shall use the values given in Section 5.8.3 (old pipes). The design shall be checked for coefficients appropriate for new pipes.

Where possible, the rising main should be sized, and the pump controlled, such that the volume of the rising main is pumped at least once each day, preferably each pump cycle. If there is insufficient inflow into the pump station to achieve this, then measures shall be incorporated into the design to control odours at the outlet of the rising main. These may include:

- Regular flushing of the main with clean water, to clear the full volume of the main. Appropriate controls will be necessary to ensure that water is only introduced when the sewage inflow is inadequate,
- Design the outlet chamber to minimise effects from the discharge. This may include separation from dwellings, ventilation, and/or the use of odour control devices.

5.11.4 Flow Monitoring

Pump stations with an ultimate design flow of 10 l/sec or greater shall be provided with Mag-Flow meters on the rising main, connected to Council's telemetry system. The system shall record instantaneous flow and totalised flows.

5.11.5 Electrical and Control

The Developer shall arrange for the power supply to a pump station. The power supply for public pump stations shall be transferred to Council following testing and commissioning of the pump station.

The electrical switch box shall be located in a safe position as close as practicable to the pump chamber. It shall be fabricated Aluminium or Stainless Steel, or Aluminium Montrose type. In accordance with WDC Planning requirements, the maximum height of the electrical/control box shall be 1.5m, with coverage of not more than 3.0 m^2. Vents etc. should be incorporated in telemetry masts.

The electrical and control system shall strictly comply with the 'WDC Wastewater Pumping Stations Electrical Engineering Systems' Standard.

5.11.6 Telemetry

All pump stations and treatment facilities shall be connected to the Council telemetry system. Council's nominated sub-contractor shall confirm whether satisfactory radio network communications are available at the site. If not, alternative communication system (e.g. telephone land-line with autodialer, or cell phone) shall be provided.

5.11.7 Water Supply

Fresh water shall be supplied from a standard 25mm ID connection at a minimum static pressure of 300 kPa. If the water supply is taken from Council's drinking water network, backflow prevention shall be provided in accordance with the Council requirements and NZ Building Code Approved Documents for a high-hazard installation (RPZD). The water connection outlet shall terminate in the valve chamber.

The developer shall apply for the connection, and pay all costs and provide installation drawings, including all requirements of Section 6.14.2.

5.11.8 Private Pump Stations

Private pump stations may be permitted where it is not practical or economic to provide a gravity connection to a public sewer. Normally, proprietary pump stations will be used, with grinder pumps. Pump stations serving less than the equivalent of six residential lots will generally not be taken over by Council.

5.12 ODOUR CONTROL

Odour control systems shall be provided at all pump stations, vents and air valves that are likely to cause odour problems.

Pump stations wet wells shall be force-ventilated to provide at least 4 air changes per hour. The vent discharge shall be a minimum of 3.6 m high. The standard system uses a column with an in-line fan with explosion proof motor.

5.13 CONTRACTOR QUALIFICATIONS

Reference should be made to Section 1.9 regarding Registered and Licensed Contractors.

Only Contractors, Registered with the Whangarei District Council shall install or work on wastewater assets that will become part of the public system. The scope of work that a Registered Contractor is permitted to perform shall be in terms of their Approval.

5.14 INSPECTION AND TESTING

5.14.1 Gravity Sewer Reticulation

All sewer pipes, including connections, shall be pre-tested during construction. The applicant shall in all cases give at least 1 working day's notice to the Council before filling any trench or testing any pipeline or structure. On substantial completion of all other associated engineering work there shall be a final test carried out to the approval of the Council.

Testing shall include CCTV inspection and pressure testing.

The whole of the reticulation shall be inspected by CCTV. Inspection records shall comply with NZWWA 'New Zealand Pipe Inspection Manual'.

The pipeline pressure test procedure for PVC pipes is as follows:

(a) The pipeline under test shall be effectively plugged, particular care being taken to fix the plugs against movement, and air introduced by suitable means (such as hand pumps) until a pressure of 300 mm of water is indicated by a suitable manometer (such as a U-tube) connected to the system.

(b) After the air has attained a uniform temperature, as indicated by the pressure becoming steady, the source of air supply shall be physically disconnected and the pressure drop measured after a test period of five minutes.

(c) The wetting of pipelines before test, where applicable and practicable, is recommended.

(d) The acceptance limit shall be a pressure drop not exceeding 20 mm in 5 minutes.

In wet conditions, should the low pressure air test pass and there be signs of infiltration, this shall not exceed 600 ml/ hr/25 mm pipe diameter/1000 metres length of pipe.

Should any leaks be discovered, these shall be made good by the Contractors who shall then arrange for the test to be reapplied.

For PE pipes the type of test will depend on the length and diameter of pipe to be tested. The Contractor shall confirm with Council which test is required in accordance with the manufacturer's requirements. For smaller diameter pipes over short distances (in the order of 200 m), a 'Bounce' test may be used. Outside of this, a data logger test including calculations of n_1 and n_2 shall be used. For all tests, the Contractor shall supply a graph or data logger printout of the pressure test, and demonstrate compliance with the requirements.

New sewer reticulation must be completely and permanently isolated from Council's "live" sewer reticulation until such time as all the foregoing tests are passed, and authority from the Council to connect to the live sewer, is obtained. Connection shall only be carried out by a Registered Contractor.

5.14.2 Manholes

All manholes shall be watertight and tests shall be carried out to confirm that. The test shall involve 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.

5.14.3 Rising Mains

Rising mains shall be tested using the test prescribed for water pipes, with the test pressure being 1.5 times the maximum working pressure or the maximum pressure rating of the pipe, whichever is less.

5.15 COMPLETION

All connections shall be sealed with an approved plug or cap, and be marked with a 100x50H4 treated stake painted white, extending from invert level of the pipe to 600 mm above ground level. Exposed surfaces of manhole covers shall be painted white.

5.15.1 As-Built Drawings and Schedule of Asset Information

A set of drawings and a schedule of asset information shall be submitted as per Section 1.7 of this Standard. These shall clearly and accurately show the as-built locations and details of all wastewater infrastructure provided as part of the work, including any modifications made to the existing system.

The As Built drawings may be checked on site for accuracy on completion of the subdivision or development. A certificate of completion for the works will not be issued until acceptable As-Built drawings have been produced.

The drawings shall identify assets that have been removed or decommissioned.

5.15.2 Operation and Maintenance Manuals

Full details of all pump stations, air valves, odour control facilities and treatment facilities shall be provided, including complete O & M Manuals in PDF format, plus 3 hard copies, The O&M Manuals shall include:

- As-built drawings,
- Equipment List, with make, model and serial numbers,
- Equipment supplier details,
- Pump curves, with design flow/head identified,
- Electrical layout,
- Control logic,
- As-built levels of control switches,
- Maintenance schedules.

5.16 DEFECTS LIABILITY

A Performance Bond will be required for the works in terms of Section 1.13 of this Standard.

5.17 DRAWINGS

The following drawings in APPENDIX A apply to this section:

SHEET 1	**STANDARD DRAWING SYMBOLS**
SHEET 11	**RECOMMENDED SERVICE LOCATIONS**
SHEET 18	**PIPE BEDDING AND BACKFILL**
SHEET 19	**PIPE PROTECTION AND BULKHEADS**
SHEET 21	**LAMPHOLES, STORMWATER AND SEWER CONNECTIONS**
SHEET 23	**STANDARD PRECAST MANHOLES**
SHEET 24	**SEWER MAINTENANCE SHAFT DETAILS**
SHEET 25	**SATELLITE MANHOLE DETAIL**
SHEET 26	**SEWER PUMP STATION TYPICAL DETAILS**
SHEET 27	**SEWER PUMP STATION METAL WORK DETAILS**
SHEET 28	**RPZ WATER CONNECTION**

6. WATER SUPPLY AND RETICULATION

6.1 GENERAL REQUIREMENTS

This section covers the requirements for connection to Council's water reticulation system.

In general, a connection to the Council system shall be provided to all lots within Living and Business Environments unless the Council confirms in writing that a connection is unwarranted, unavailable or unsuitable.

Connections in other Environments will be subject to the availability of a water supply. However Council may require that a water supply is provided to a development, regardless of the Environment, if in the opinion of the Water Services Manager the connection would be a logical extension of an existing supply.

6.2 REFERENCED DOCUMENTS

The following documents shall be read in conjunction with this section of these standards:

- Whangarei District Council Water Supply Bylaws 2005
- Whangarei District Council Specification for the Installation of Water Mains
- Whangarei District Council Water Services Approved Materials List (including supplementary)
- Whangarei District Council Water Services Hygiene Code of Practice
- Whangarei District Council Specification for the Installation of Water Service Connections.
- Whangarei District Council Backflow Prevention and Cross Connection Control Policy
- Whangarei District Council Water Services Asset Management Plan
- Whangarei District Council Water Pumping Station Electrical Engineering Systems (when developed)
- Whangarei District Council Specification for Registered and Licensed Contractors for Water Supply

Where aspects of the design are not covered by this section or the above Council documents the following standards may be referenced. Adoption of any practises outside of the Council documentation must first be approved in writing by the Water Services Manager.

- NZS 4404:2004 Land Development and Subdivision Engineering
- SNZ PAS 4509:2003 New Zealand Fire Service Fire Fighting Water Supplies Code of Practice
- Guide for Safety with Underground Services – Occupational Health and Safety.

The most up to date of these publications shall supersede any conflicting requirements of older documents.

6.3 SUBMISSION OF APPLICATION

6.3.1 Supporting Information and Calculations

The application shall include supporting information and calculations for the following:

- An analysis of the water demand for consumption and fire fighting. Fire fighting flows for industrial land shall be obtained from NZS PAS 4509:2003, based on type and size of industry,
- Establish that the existing water supply reticulation is adequate to serve the proposed development,

- Where the proposal would use more than 10% of the capacity of the existing water source and/or treatment facilities, the existing water source and/or treatment facilities are adequate to serve the proposed development,
- The proposed water reticulation is adequate to serve the proposed development,
- The proposal has no more than minor effects on the environment and other water users,
- Potential water hammer effects are considered and appropriate measures included,
- Required pressures and flows can be met from all hydrants and service connections.

For industrial uses, the type and size of industry used to establish water use and the Water Supply Classification for fire fighting supply shall be identified. This information will be put on the relevant property files.

6.3.2 Design Drawings and Specifications

Design drawings complying with the requirements of Section 1.5 and 1.6 shall be provided for approval.

6.3.3 Approval of Design

The drawings and calculations will be will be reviewed by the Water Services Manager or his/her representative. The completed form and the drawings will be returned to the developers 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 Water Services Manager or authorised representative shall be deemed approved drawings. Unless specifically stated otherwise, the approval of drawings does not supersede the requirements or obligations of these standards.

6.3.4 Disconnections

Council approval is required for disconnections from the water supply network to ensure that the disconnection is carried out appropriately and the old connection blanked off in a way that prevents any possibility of contaminated water entering the network and/or leaks occurring from the redundant fittings and pipework.

A Council inspecting officer shall inspect all disconnections before back-filling takes place.

6.4 LEVEL OF SERVICE

6.4.1 Design Life

The asset life of water supply systems shall not be less than 100 years. The asset life of components of the systems, e.g. pumps, valves etc shall be noted in the application.

6.4.2 Design tolerance

The location and levels of water mains and fittings shall be specified in metres to one decimal place for horizontal alignment and two decimal places for vertical alignment.

6.4.3 Service Requirements

Where a water supply is available, or where a supply and reticulation system is to be provided as part of a subdivision or development, it shall be adequate for fire fighting purposes and for estimated domestic, commercial and industrial consumption. The design shall conform with the New Zealand Fire Service Fire Fighting Water Supplies Code of Practice SNZ PAS 4509:2003. or current revision.

For large industrial sites, the requirements of SNZ PAS 4509:2003 may not be able to be met from existing Water Services infrastructure. In such cases, the developer may need to provide a

supplementary supply. The Developer shall establish requirements and obtain approval for such a supply from the Fire Service, and provide evidence of this approval with the Consent Application.

6.4.4 Capacity and Future System Expansion

Developments shall comply with structure plan requirements and pipe sizes set by Water Services in order to provide an integrated approach to development.

The effect on existing and potential future development in an area shall be taken into account when determining whether there is capacity to serve a subdivision. The Water Services Manager has the discretion to make a final decision on water availability.

The water supply system shall be constructed to a connection point approved by the Council. Where development beyond the property boundaries is possible, the reticulation shall be extended to the boundaries of the approved development at the developers expense. The supply shall be capable of serving the entire subdivision or development and any undeveloped land beyond, when that land is developed to the ultimate development intensity. Where applicable, the developer shall provide a blanked off connection to serve future development.

6.4.5 Private Water Supply Systems

At Council's discretion, small isolated subdivisions or similar outside existing reticulated areas may be served by private water supply systems. These systems will only be approved as potable water supplies if they are able to comply with the New Zealand Drinking Water Standards 2005 (NZDWS), and operation and monitoring systems are put in place to ensure compliance with the NZDWS.

The applicant is advised to consult with the Water Services Manager, New Zealand Fire Service, Northland Health and the Northland Regional Council regarding any necessary approvals.

6.4.6 Council Design Input

The Council shall have the right to specify the diameters and classes of pipes to be used for all reticulation within the subdivision or development, and to specify connection points and reticulation alignment. It will provide on request details of the working pressure or pressures at the point or points of connection to the existing reticulation for design purposes, and where available, the capacity of existing water supply facilities.

Where further information is required for the design, the developer shall consult with the Water Services Manager regarding payment of costs associated with such investigations. Such investigations may involve data logging at a hydrant over peak periods.

6.5 SCOPE OF DESIGN

The scope of design shall include:

- Pipe sizes, material, and layout of the reticulation,
- Hydraulic design,
- Service connection locations,
- Types and locations of valves, hydrants etc.
- Thrust Blocks and anchors,
- Preparation of plans and specifications. Except for small, infill developments, water reticulation shall be on a separate plan from other services, presented in a clear and legible manner.

The hydraulic design of reticulation, outside the scope of simplified methods in this Standard, shall be carried out by an Independent Qualified Person (IQP), experienced in the design of water

reticulation systems, who shall provide a design certificate identifying the design standards used, and certifying that the design complies with these standards.

Where the existing reticulation or a proposed extension cannot comply with the minimum flow or operating pressure requirements, the applicant may be required to provide and install elevated storage and/or booster pumping systems to the approval of the Council. Where pressures are likely to exceed recommended levels Council may require that a pressure-reducing device be installed to ensure acceptable working pressures.

6.6 PIPE SELECTION

6.6.1 Sizing of Mains

The development shall be reticulated with a piped water system adequate to supply all domestic, commercial and industrial consumption for the economic life of the development, and for fire fighting purposes for that class of development.

The water demands for commercial and industrial areas, and for irrigation shall be analysed and specifically allowed for in the design.

For design purposes a static pressure of either 40m or the actual static pressure in the existing main, whichever is the lesser, shall be used.

6.6.2 Standard Pipe Sizes

Principal mains shall be standardized as DN 100, 150, 200, 250, 300, 375, 450, 525 and 575mm nominal internal diameter only. Where required, the Water Services Manager shall specify the diameter of larger pipes.

Reference to the diameters of pipes shall specify whether the inside (ID) or outside (OD) diameters are being referred to.

6.6.3 Minimum Pipe Sizes

Minimum Pipe sizes shall be as set out in Table 6.1.

TABLE 6.1. Minimum Water Supply Pipe Sizes

Reticulation Hierarchy	Minimum I D (mm)
Industrial Area Main (Business 4)	150
Industrial Rider Mains	100
Principal Main (other environments)	100
Residential Rider Main	50
Residential Service Connection	20

6.6.4 Pipe Class

Standard approved pipe classes are given in Table 6.2. Other classes shall not be used, except with the written approval of the Water Services Manager.

TABLE 6.2 – Pipe Classes

Class of Pipe and Fittings	Maximum Working Pressure	
	Head (m)	KPa
Class 12 (PN12.5)	120	1200
Class 16 (PN16)	160	1600

6.6.5 Pipe Materials

The following pipe materials are approved for use:

- PE80 / PE100 to AS/NZS 4130
- Ductile Iron to AS 2280
- Steel to NZS 4442

All water mains shall be constructed using PE80 unless otherwise approved by the Water Services Manager.

PE pipes shall conform with the following requirements:

- Rider mains and service connections of 50mm ID and under shall use solid blue PE80 pipe.
- PE 80 water mains with a nominal ID of 100mm or greater shall be black internally with a blue outer skin. The blue outer skin shall be co-extruded with the internal material, and have a thickness equivalent to 10% of the pipe wall thickness unless otherwise approved by the Water Services Manager. The developer shall provide evidence of the blue outer skin thickness.
- PE 100 may be permitted for pipe sizes greater than 200 mm ID. It shall also be blue skinned to a thickness of 10% of the pipe wall thickness unless otherwise approved by the Water Services Manager.

Steel or ductile iron will normally only be approved where the use of PE is not appropriate, e.g. in above ground applications. The use of steel or ductile iron is subject to specific approval and tight quality control of fabrication and construction. Steel and ductile iron pipes shall have a spun concrete lining not less than 6 mm thick, and an external coating of extruded blue HDPE. Care shall be taken not to damage the coating during handling and installation. No welding is permitted after the protective coatings have been installed on the pipes.

Note:

- **PVC is not an acceptable pipe material**.
- Blue or black with blue stripe pipes or ducts may not be used for any other application other than potable water supply with the Whangarei District Council.

6.6.6 Pipe Bridges

Pipe bridges shall be specifically designed by an IQP for the particular environment. Pipe bridges shall be designed for a life of 100 years. Normally piles will be concrete. Approval for timber piles will be at the discretion of the Water Services Manager. The developer is responsible for obtaining all building consents and resource consents. Pipelines across bridges will normally use Ductile Iron or coated steel pipes.

Where approved, timber piles shall be H6 treated. No cutting, notching or boring after treatment is permitted in areas in contact with soil or water. Cut or bored areas shall be resealed using a suitable preservative treatment.

6.7 FLOW CAPACITY

6.7.1 Domestic Demand

The design shall provide for annual, seasonal and peak demand. A minimum domestic demand of 300 litres/head/day shall be designed for.

6.7.2 Peak Flows

Peak flows shall be calculated as follows

Peak Day Demand (over a 12 month period) = Average Day Demand x PF

a) PF = 2 for populations below 2,000

Peak Hourly Demand = Average Hourly Demand (on peak day) x PF (over a 24 hour period)

b) PF = 5 for populations below 2,000

For populations above 2000, the PF may be obtained from NZS 4404:2004.

6.7.3 Minimum Flows

The minimum flow for an individual 20mm ID residential connection shall be 25 litres per minute at the meter location.

6.7.4 Pressure Fluctuations

The design shall ensure that large pressure fluctuations due to variations in usage are avoided. Unless dispensation is given by the Water Services Manager, head losses in existing and new mains at peak demand shall be limited to:

- DN less than or equal to 150mm - 5 metres per 1000 metres of pipeline,
- DN greater than or equal to 200 - 3metres per 1000 metres

6.7.5 Flow Velocities

Pipe lines shall normally be designed for flow velocities within the range of 0.5 – 2.0 m/s. This may be increased up to 3.5m/s at the discretion of the Water Services Manager

6.7.6 Operating Pressures

The minimum service water pressure, in other than fire fighting conditions, shall be 250 kPa at ground level within the building envelope of each lot.

Where this pressure cannot be met at the house site, a booster pumping system may be required. Where the fire fighting capabilities are sufficient, private pumps, serving up to 5 lots, jointly maintained by the owners may be provided. The requirement for joint maintenance responsibilities shall be registered on the affected property titles.

Where such pumping is not economic or practicable and fire fighting capabilities are sufficient, the Water Services Manager may agree to register a Low Pressure Consent Notice on the property titles affected.

The maximum static water pressure shall be 600 kPa except where approved by the Water Services Manager. In cases where the static pressure exceeds 600 kPa, a pressure reducing value may be required.

The preferred operating pressure in the reticulation system is 400KPa. The Council may require that a PRV be installed to reduce the pressure in a large development to 400 kPa or below.

6.7.7 Fire Risk Classification

A normal single residential property will have a classification W3. Other buildings with a sprinkler system fitted to an approved standard will also have a classification of W3.

All other buildings are classified according to Table 1, SNZ PAS 4509:2003 (page 12,13).

6.7.8 Fire Fighting Water Requirements

The minimum standard of water supply for fire fighting shall be as set out in Table 6.3. The required flow is to be obtained from the maximum number of fire hydrants as scheduled within an accessible distance of 270m of any fire risk. The accessible distance is via a route from the fire hydrant to the property, following roads, driveways or right of ways.

The water supply requirements for fire protection systems must be considered in addition to fire fighting water supplies. All fire fighting water requirements should be considered additional to the expected daily demand.

The minimum fire fighting residual running water pressure shall be 100 kPa at any fire hydrant.

For Industrial Subdivisions, the water supply classification to which the system has been designed shall be stated. Following approval, this classification shall be registered against all property titles as a consent notice, with a rider that the design does not necessarily account for future consumption from other large users.

Where a development is of such a nature that the required flows cannot be achieved, even with the installation of pumps, without serious negative effects on the system, the developer shall install sprinklers or provide an alternative means of fire fighting to the satisfaction of the NZ Fire Service.

TABLE 6.3. Simplified method for determining fire fighting supplies

Water Supply Classification	Water flow within an accessible distance of 135m (l/s)	Additional water flow required within an accessible distance of 270m (l/s)	Water Storage Time (min)	Water Storage Volume (m3)	Maximum number of fire hydrants to provide flow
W1	12.5		15	11	1
W2	12.5		30	23	1
W3	12.5	12.5	30	45	2
W4	25	25	60	180	3
W5	50	50	90	540	4
W6	75	75	120	1080	6
W7	100	100	180	2160	8
W8	As calculated				

(Refer to Table 1, SNZ/ PAS 4509:2003 for Water Supply Classification)

6.7.9 Dedicated Sprinkler and Fire Fighting Watermains

Approval for dedicated sprinkler and fire fighting watermains will be given at the discretion of the Water Services Manager.

All dedicated watermains for sprinkler systems must have a Council approved testable double check (or RPZ) detector backflow prevention device together with isolation valves for testing, located within, but as close as possible to the property boundary.

All dedicated fire fighting watermains with hydrants connected to them shall have an RPZ backflow prevention device together with isolation valves for testing located within, but as close as possible to the property boundary together with an electromagnetic water meter, or NZ Insurance Council approved meter. The backflow prevention device must be mounted above ground level, protected by a cage to avoid damage.

6.7.10 Empirical Guide for Sizing of Mains

TABLE 6.4. Maximum number of connections to Rider mains.

Principal Main Working Pressure	>400kPa		< 400 kPa	
50 mm internal diameter (min)	One End Supply	Two End Supply	One End Supply	Two End Supply
No. of domestic service connections	15	30	7	15

TABLE 6.5. Maximum number of connections to Principal mains (including from Rider Mains)

Capacity of main (single direction feed only)

Nominal Diameter of Main DN	Residential (lots)	Rural Residential (lots)	General Light Industry (ha)	High Usage Industry (ha)
100	40	10		
150	160	125	23	
200	400	290	52	10
250	650	470	84	24
300	1000	670	120	35
375	1600	1070	195	55

6.8 LAYOUT OF RETICULATION

6.8.1 General

Mains and Rider mains shall follow public roads where possible.

A principal main fitted with fire hydrants shall be laid on one side of all through streets and one side of every cul-de-sac. Principal mains shall be laid on both sides of State Highways. Council may also require principal mains on both sides of arterial and dual carriageway streets, and industrial subdivisions.

A rider main shall be laid along the road frontage of all lots not fronted by a principal main including the circular head of cul-de-sacs. Rider Mains shall be designed as ring mains, with a connection to a principal main at both ends as shown in SHEET 25.

Mains and rider mains will not normally be permitted to be laid across private property or down right of ways. However where appropriate and with the prior approval of the Water Services Manager, a private way or road may be reticulated with a Council maintained reticulation system. The criteria for granting such approval will be based on the number and length of connections required, or to provide fire cover to meet the requirements of the Fire Fighting Code of Practice. Reference should be made to Section 6.11.3 for fire cover criteria. In such cases, an easement in favour of Council over the private way or road will be required and the main may be required to be laid in a duct. Details on points of supply are given in WDC Water Services Bylaws.

Where a private access will contain a Council maintained water main, the minimum clearances required by Table 6.6 shall be provided, to allow maintenance access clear of other services.

Note: This may require the legal width of the access to be greater than the minimum specified in Section 3 of this Standard.

Valves and surface boxes should be located in berms, clear of carriageways where possible.

6.8.2 Separation from other Services

All water mains shall be laid at a higher level than sewers to avoid cross contamination. They shall not be laid in the same trench as sewers or stormwater drains, nor pass through manholes. Where practicable, water mains should have a spacing of at least 500mm or three times their diameter, whichever is the greater, between their outside edge and any other service, or as shown on SHEET 11 where applicable as agreed with the Water Services Manager.

TABLE 6.6. Clearances to Other Services

Utility (Existing Service)	Minimum Horizontal Clearance (mm) New Main Size		Minimum Vertical Clearance[1] (mm)
	200 and less	Over 200	
Water mains greater than DN 375	600	600	500
Water mains of DN 375 or less	300[2]	600	150
Gas mains	300[2]	600	150
Telecommunications conduits & cables	300[2]	600	150
Electricity conduits and cables	500	1000	225
Stormwater mains	300[2]	600	150[3]
Wastewater pipes	1000/600[4]	1000/600[4]	500[3]
Kerbs	150	600[5]	150 (where possible)

Notes

1) Vertical clearance apply when water mains cross another utility service, except in the case of wastewater when a vertical clearance shall always be maintained, even when the main and wastewater pipe are parallel. The main should always be located above the wastewater pipe to minimize the possibility of backflow contamination in the event of a main break.
2) Clearance can be reduced further to 150mm for distances of up to 2m when passing installations such as pole, pits and small structures, providing the structure is not destabilized in the process.
3) Water mains should always cross over wastewater and stormwater drains.
4) When a wastewater pipe is at the minimum vertical clearance below the water main (500mm), maintain a minimum horizontal clearance of 1000mm. This minimum horizontal clearance can be progressively reduced to 600mm as the vertical clearance is increased to 750mm.
5) Clearance from the kerb and channel shall be measured from the nearest edge of the concrete. For water mains DN 375 and less clearances can be progressively reduced until the minimum of 150mm is reached for mains of DN 200 and less.
6) Where a main crosses other services, it shall cross at an angle as near as possible to 90^{o}.
7) Clearance shall be measured from the outside of each pipe or duct.

6.8.3 Water Mains Near Trees and Existing Reticulation

Reference shall be made to Section 7.5 of this Standard for requirements regarding the location of trees close to water reticulation. Where any pipes or cables are laid alongside existing water reticulation then a gap of at least 1 metre is to be maintained where practicable so as not to disturb the existing trench.

6.8.4 Pipe Cover

All reticulation located in areas not subject to traffic loading shall have a minimum of 600 mm of cover between the top of the pipe and finished ground level. Under carriageways this distance shall be increased to 900 mm. In all other circumstances not meeting the minimum requirements stated then special protection of the pipe is to be provided, subject to Council approval. Details of pipe protection are shown on SHEET 19. The Council may specify a greater depth if required. Where excavations for entrances to developments encounter existing water supply lines, those lines shall be relocated to comply with the depth requirements of this document.

The sections of pipe adjacent to a carriageway crossing shall be gradually deepened either side of the carriageway, to allow the required cover to be achieved under the carriageway without provision of vertical bends. Air valves may be required on the resulting crests in the pipe.

All pipes less than 500mm under carriageways shall be laid in a larger protective duct. Service connections shall not be less than 600 mm under footpaths and berms terminating at a meter manifold as per SHEET 26.

6.8.5 Work on Existing Water Mains

Where work is required on or over existing water mains, the developer may be required to lower, move or protect the main to ensure cover and separation distances are met. Only Licensed Contractors will be permitted to work on existing live water mains. The developer shall pay the full cost of this work.

6.8.6 Thrust and Anchor Blocks

On all mains exceeding 50mm diameter where no end restraint is available, concrete anchor blocks shall be provided at all valves, bends, tees, reducers and dead ends. Generally anchor/thrust blocks are not required on PE mains, except where a connection is made to an unrestrained pipe or fitting.

The size of the bearing surfaces shall be specifically designed. SHEETS 27 & 28 give guidelines for shape and size for a soil with a bearing pressure of 100 kPa and a design pressure of 1500 KPa. The concrete shall be ordinary grade concrete supplied from a graded plant, and have a minimum compressive strength of 17.5Mpa at 28 days, unless otherwise approved by the Water Services Manager. All anchor blocks must be poured using adequate formwork, with the bearing surface poured against an undisturbed soil surface. A protective wrapping shall be provided between the pipe and concrete. Reference should be made to drawings WS-003, 004 & 005 in NZS 4404:2004 for typical thrust block locations when used with pipes without end restraint.

If reticulation is being extended from the end of an existing pipe with a blank cap and thrust block, the thrust block shall be removed and the new pipe continued in the same alignment as the original pipe.

6.9 VALVES AND FITTINGS

6.9.1 General

All valves and fittings shall be in accordance with the Whangarei District Council's approved materials list, the main points of which are summarised below.

Pipe fittings above ground, or in non-aggressive ground conditions, shall be ductile iron to AS 1831, powder coated with Rilsan 11 or approved equivalent to AS/NZS 4158. Where applicable they shall comply with AS/NZS 2280.

Flanges shall be to AS 4087 PN16 . Fittings laid adjacent to other fittings shall have flanged joints. Where fittings are located in on-line positions, flexible (gibault) joints may be permitted subject to approval of the Council (Note that gibault joints may not be used on PE pipe)..

All bolts and nuts shall have washers and be 316 stainless (see specifications for mains), plus protective wrapping. This shall be "Denso" primer paste covered with "Denso" tape wrap , followed by "Denso" MP/HD tape or "Greensleeve" over wrap, or approved alternatives complying with the same standards.

6.9.2 Sluice Valves and Peet Valves

6.9.2.1 Type

Sluice Valves used on principal mains shall be ductile iron Resilient Seated valves to AS 2638.2 – 1999 and fully nylon coated to AS/NZS 4158. They shall be bi-directional, anti-clockwise closing, have raised flange faces to AS 4087 and shall be provided with cast iron spindle caps. The depth to the top of the spindle shall be where practicable between 75mm and 250mm and the spindle shall be truly vertical. Where depth to the spindle exceeds 500mm a spindle extension shall be used to bring the top of the spindle between 75mm and 250mm of the surface.

Peet Valves used on rider mains shall be ductile iron Resilient Seated valves to AS 2638.2 – 1999 and fully nylon coated to AS/NZS 4158. They shall be clockwise closing with a ductile iron handwheel. They shall have a threaded end connections to which a 63mm PE compression coupling can be screwed.

Butterfly valves shall only be used with the specific approval of the Water Services Manager. They shall be anti-clockwise closing, and fitted with travel stops, and shall be fitted with a special type of spindle or cap dolly, which differs from those for sluice valves.

6.9.2.2 Location

The location of valves shall be so arranged that a shut down of any section of water main will affect as small an area as practicable. Valves located at intersections shall be fixed on all legs of a tee or cross installation and shall where possible be located in berm areas free of the carriageway.

A peet valve is required on rider mains at the connection to the principal main. Where there are more than 15 connections on the rider main, an isolating peet valve should be provided in the middle of the rider main.

The valve layout on the principal and rider mains should enable the rider main to be flushed through the nearest hydrant. Where this is not possible a scour valve may be required. Air release valves may also be required at high points.

Where the rider main is a continuation from the end of the principle main in the same direction, the end of the principle main shall be provided with a peet valve immediately after the reducer.

TABLE 6.7 – Stop Valve Spacing Criteria

Water Main Size DN	Number of Property Service Connections (nominal)	Maximum Spacing of Stop Valves (m)
150 or smaller	40	300*
200-300	100	750
375 or greater	150	1000
*In rural areas, the maximum spacing may be increased to 500m.		

6.9.3 Air Release and Scour Valves

Air Release and Scour Valves shall be located as required by the Water Services Manager. Air release valves shall be ductile iron and of the combination type as per the approved materials list. They shall be installed in a fully draining box as per SHEETS 26 & 29. A connection to a suitable drainage system shall be provided for all scour points where practicable.

6.9.4 Pressure Reducing Valves

Pressure reducing valves may be required by the Water Services Manager where water pressure is greater than 600 kPa, and a significant number of properties are affected or potentially affected (typically over a distance of 500 m, and affecting greater than 40 lots).

Pressure Reducing Valves shall be installed as per SHEET 31. Pressure gauges are required upstream and downstream of the valve. Only Cla-Val valves shall be used as specified by Water Services.

The valve shall be installed in an approved chamber with isolating valves to allow removal.

6.10 VALVE MARKING

The position of all valves on water mains shall be indicated by a white plastic indicator post to the Council's approval bearing the inscribed letters 'SV', 'AV', 'BV' or 'PV' in black to indicate either sluice valves, air valves, butterfly valves or peet valves, respectively. The name of the valve shall also be stencilled on the top of the marker post in adhesive black lettering along with the size of the main on which it is situated and the distance of the post from the main. The name can be obtained from the Water Services Manager.

There shall also be a rectangle painted on the kerb in a direct line between the valve and the marker post. This rectangle shall be white unless the valve is to be normally closed in which case it shall be red. In all cases the colour of the marker post and valve box lid shall match the rectangle.

The location of valves shall be marked in carriageways using Thermoplastic lid coating.

6.11 HYDRANTS

6.11.1 General

All mains of 100mm diameter or greater shall be provided with hydrants.

6.11.2 Type

Hydrants shall be ductile iron, clockwise closing, screw down type generally in accordance with B.S. 750:1984, and shall wherever practicable be tall pattern. Hydrants and hydrant risers are to be fully coated inside and out with blue nylon to AS/NZS 4158. The hydrant stopper shall be resilient seated and encapsulated in Nitrile or EPDM rubber. Spindles shall be non rising stainless steel or DR brass, stem seals shall be nitrile rubber ' O' rings (gland packing is not acceptable). Hydrant Tees shall be ductile iron and coated in Rilsan 11 or approved alternative complying with AS/NZS 4158:1997. The sealing cup washer shall be of nitrite rubber and the gland seal shall be either of braided PTFE yarn or a minimum of two captive 'O' sealing rings.

Hydrants shall not be self-draining.

6.11.3 Position

Hydrants shall be fixed opposite the common boundaries of lots and spaced at intervals not exceeding 135m within residential areas and 90m within commercial and industrial areas. The terminal hydrant shall be within 135m of the furthermost portion of any building site along a route that is fully accessible*. In a cul-de sacs or other terminal streets the last hydrant shall be as per SHEET 25 and not be more than 65m from the end of the street. Where a private way is more than 65m long a hydrant shall be provided at the street end of the private way or on the other side of the street immediately opposite the entrance. The Council may require a 100 mm diameter principal main with hydrant to be constructed within a private way or private road to ensure fire coverage. In this instance an adequate turning and parking area for fire appliances in the vicinity of the hydrant shall be provided and the access designed to take heavy vehicles.

Where an isolated risk is identified such as a school or large industrial complex, a private fire line may be constructed onto that lot. No reticulation shall be taken off this line. Meter and backflow requirements shall be as specified in Section 6.7.9.

Hydrants must be readily accessible* for fire appliances and should generally be positioned near street and private way intersections and at least 6m from any building. Hydrant risers shall be used where necessary to ensure that the top of the spindle is not less than 75 mm nor greater than 250 mm below finished surface level. Hydrants are required at all dead ends, high points for the purpose

of air release, and low points to enable mains flushing if a normal washout cannot be fitted. Refer also to Air Release and Scour Valves.

* The definition of accessible is a route from the fire hydrant to the building or building site following roads, driveways or right of ways.

6.11.4 Marking

The location marking of fire hydrants shall be to NZS4501:1972. Markings in carriageways and footpaths shall use yellow Thermoplastic Hydrant Markers, and blue 'Cats-Eye' markers shall be located on the hydrant side of the road centreline. Yellow plastic marker posts to the Council's approval shall be fixed 225 mm from the street boundary at the closest point to and facing the hydrant, with the top of the post 600 mm above finished ground level. A concrete mowing strip 150 mm wide shall surround the post when it is set in the grassed berm. The hydrant name (top number), correct main size in millimetres (middle number) and the distance between marker and hydrant in metres (bottom number) shall be attached to the post using black adhesive lettering near the top of the post. The hydrant name shall be allocated by the Water Services Manager.

6.12 SURFACE BOXES

All valves and hydrants shall be accessible via surface boxes, details of these are shown on SHEETS 27 and 29. All boxes shall be cast iron or ductile iron and be directly above the valve or hydrant. The longer side of the boxes shall run parallel to the water main. The box shall be supported on concrete risers sized to provided unobstructed access to the valve or hydrant. In the case of hydrants, this shall include easy access for standpipes and installation of data logging equipment. Care shall be taken to ensure loading from traffic is not transmitted via the box and surrounds to the pipe or fittings. Where a valve is particularly deep, a length of 150mm PVC pipe shall be used to direct the valve key to the spindle. This does not remove the requirement for concrete surrounds. All surface boxes shall be heavy duty. Hydrant boxes in road carriageways shall be manufactured to BS 750. Hydrant boxes in arterial roads and State Highways shall be Motorway Grade.

All surface boxes shall be correctly coloured using thermoplastic in carriageways and footpaths, and paint in berms.

6.13 BULK WATER METERS

The Water Services Manager may require the provision of a bulk water meter at the connection point of the reticulation. This will normally only be required where there are greater than 20 industrial connections, 40 commercial or 150 residential connections.

The meter shall be a full bore 'Aquamag' meter with data logger.

6.14 SERVICE CONNECTIONS

6.14.1 General

A service connection shall be provided for each single lot or residential unit with individual street frontage. The connection shall be perpendicular to the main or ridermain and terminate 100 mm from the boundary with a Water Services approved manifold (Acuflo) including diaphragm isolation valve and dual check valve and blue meter box with base. The manifold shall be blanked off with a brass plug and 5mm hole drilled in the cap of the manifold. Refer to SHEET ***.

For private ways and private roads, a single connection, with size determined as for a rider main is to be provided within the legal road not exceeding 500 mm from the road boundary. A peet valve is to be installed at the junction to the main. At the road boundary a multiple meter box shall be

provided and sized according to the table on SHEET 26. Separate connections shall then be provided to each lot from the box. The lot number of each connection shall be clearly marked within the box. Where lots are situated up a private way or similar, connections shall split either side where practicable to avoid passing under the roadway and be extended to beyond the shared access.

Where a Council maintained water main is provided along a private access or road, connections may be provided from this main to each property.

Backflow prevention shall be provided at all metered connections in accordance with clause 6.14.4

6.14.2 Meters

Meters are not to be installed during subdivision or development but are to be applied for separately for each lot using a Public Utility Service Connection Form.

The only exceptions to this are for water supplies for public assets that will be maintained by Council in future (e.g. a sewer pumping station or irrigation system for a reserve). In these instances an application shall be made to Water Services for the connection, including written confirmation from the relevant Council Division that will be paying for the water. The correct utility as-built form shall still be submitted to the Water Services Division as per the specification for service connections. However, the meters and backflow preventers shall be installed at the time of connection. **Note:** the developer shall apply for these connections, and pay all costs, including Development Contributions for the connections.

For connection sizes up to 20mm, meters shall be Class C manifold type meters. For connections larger than 20mm diameter, the advice of the Water Services Manager shall be sought as to the type of meter and backflow preventer.

6.14.3 Connection to water main

Service connection to a principal main or rider main shall be with an electrofusion tapping saddle. Tapping saddles on PE80/PE100 pipes shall be with ball valves or self-tapping ferrules at the point of connection, installed strictly in accordance with the manufacturer's instructions. Connection between the tapping saddle and the service connection shall be made using an approved compression fitting.

All materials and fittings must be approved by the Water Services Manager and installed strictly in accordance with the manufacturers recommendations.

The tapping saddle for each service connection shall be sited at the central point of the front boundary or house site, and clear of any driveways or access ways. The position shall be marked on the kerb with a 125 mm square of blue paint; in addition a notch 12mm wide and 12mm deep shall be cut in the top of the kerb before painting. Service connections laid across roads or driveways shall be laid in a larger duct. Service connections shall be PE80 PN12 pipe of 20mm internal diameter unless otherwise approved by the Water Services Manager. All fittings used shall be mechanical and comply with WIS 4/2401 and are to be as per the Water Services Approved Materials List.

6.14.4 Backflow Prevention

All connections shall be provided with a dual check valve Backflow Preventer, as a minimum. These shall be installed in the manifold. Where the Water Supply Protection Regulations 1961 require a greater level of protection, they shall be installed appropriate to the level of contamination risk. For sewer pumping stations a reduced pressure zone backflow preventer shall be installed,

above ground, in a protective cage. All backflow preventers must be installed with isolating valves and be fully testable. The general layout for the installation of a backflow preventer is shown on SHEET 26. More details of where backflow preventers are required can be found in the Whangarei District Council Backflow Prevention and Cross Connection Control Policy and the Whangarei District Council Water Supply Bylaw.

6.15 PUMP STATION AND RESERVOIRS

A pump station may need to be provided where an increase in pressure is required. Where possible the pump station should be linked to an appropriate sized reservoir. Where no reservoir site is available a pressure sustaining system may be used. Pump Stations shall be designed in accordance with SHEET 32, and other WDC Water Supply Pumping Station documents.

The design of these components must be approved by the Water Services Manager or authorised representative. Pumps shall be capable of maintaining the pressures and flows required, with reserve capacity. A standby pump must be provided.

Reservoirs shall be of concrete construction. They shall be sized to provide:

- A fire fighting supply as specified in the New Zealand Fire Service Fire Fighting Water Supplies Code of Practice SNZ PAS 4509:2003, with a minimum of one hours supply.
- Sufficient storage for two days supply at maximum daily demand, plus additional future demand as assessed by the Council.

A Council approved telemetry link will need to be provided for control of pumps and reservoir levels. The reservoir and pump station site shall be vested in the Council. An access and water supply easement will also be required where the supply line runs over private property.

6.16 CONTRACTOR QUALIFICATIONS

Reference should be made to Section 1.9 regarding Registered and Licensed Contractors.

Only Contractors, Registered with the Whangarei District Council shall install or work on water assets that will become part of the public system. The scope of work that a Registered Contractor is permitted to perform shall be in terms of their Approval.

Registered Contractors shall comply with the following:

- Be familiar with this Standard and relevant related documents, and be suitably experienced and qualified to work with the relevant pipe materials.
- Have staff that have successfully completed an approved welding course recognised by the NZWWA to undertake jointing procedures on polyethylene pipes (PE80/PE100) of greater than 63mm OD.
- Have staff that have completed the relevant unit standards in Water Reticulation as required by WDC Specification for Registered and Licensed Contractors for Water Supply
- Be a Whangarei District Council Certified Health and Safety approved Contractor
- They must strictly follow the provisions of the Whangarei District Council's Hygiene Code.
- Hold insurance as required by Section 1.13.14.

Connections to live water pipelines shall only be undertaken by Licensed Contractors to the WDC Water Services Division, who have been approved to work on live reticulation.

For work on live water mains, Licensed Contractors must have passed the National Certificate in Water Reticulation (or relevant sections) and be in possession of their *Blue Card* at all times.

Contractors who produce workmanship of a substandard quality or fail to comply with these standards will be removed form the Registered Contractor list.

6.17 PIPELINE CONSTRUCTION

6.17.1 Jointing

Pipe laying and jointing shall be as recommended by the manufacturer, and as required by the applicable Standard for the type and class of pipe.

Joints in PE pipes of greater than 50mm ID shall be welded joints unless the Water Services Manager approves the use of mechanical fittings.

100 mm ID pipes (125mm OD), may be supplied in coils, and joined using electrofusion couplers.

Where pipe is supplied in 6 m or 12 m lengths, and the pipeline length is greater than 50 m, joints shall be butt welded.

Only pipes of the same Melt Flow Index shall be welded together. Pipes from different suppliers or different batches shall not be welded.

Welding (butt or electrofusion) of PE pipes shall be undertaken by a suitably qualified contractor using calibrated and data logged welding machines. Only persons who have successfully completed a NZWWA approved welding course and are registered to weld polyethylene pipe shall be allowed to do so. Prior to commencing work, the following shall be provided:

- Copy of current calibration certificate, not more than 12 months old.
- Registration number of welder, and current certification (not older than 24 months)

All welding of PE pipe must be data logged. Welding must take place in a covered environment to avoid contamination of weld faces and prepared pipe.

For all electrofusion welds, a mechanical scraper with winding mechanism shall be used to ensure even finishing. Hand scraping of pipe ends is not acceptable.

Electrofusion welds shall be undertaken using clamps where practicable and the equipment correctly calibrated.

For welded pipelines, one or more welded joints shall be removed for tensile testing. The test sample(s) shall be sent to an approved laboratory for testing at the contractors expense. If a test weld fails, two additional welds shall be tested. If one of the additional welds also fails the pipe must be removed and condemned and a new line laid.

The jointing of flanged fittings to PE pipe shall be with stub flanges and backing rings. Backing rings shall be mild steel and plastic coated with Rilsan 11 or approved alternative, and be to the AS/NZS 4158 standard. The thickness of the backing rings shall be as shown in Table 6.8.

TABLE 6.8. Thickness of Backing rings on PE water pipe joints.

Pipe Outside Diameter (mm)	Backing Ring Thickness (mm)
125	16
180	16
250	16
315	20

For pipes over 180mm OD, slim flanges with reinforced faces shall be used. Gaskets must be used for all flanged connections.

During transportation and on site storage temporary capping of all pipes as per the Whangarei District Council's Hygiene Code is required. The pipes shall be inspected externally immediately prior to laying to check for damage in accordance with the manufacturers specifications. An internal inspection should also be carried out and adequate protection against the ingress of debris shall be made as laying proceeds. Temporary caps shall be placed over all open ends during construction.

6.17.2 Water Main Installation

Pipe bedding and backfill requirements are detailed on SHEET 18.

All pipes shall be laid so that the identification code is uppermost where practical, and shall be evenly supported along their length. All mains and rider mains installed by trenching shall be thoroughly bedded and protected by a well hand-compacted granular material. The particle size range of this material shall be as shown on SHEET 18 and shall meet the requirements of the compaction test given in Appendix B of NZS 7643 regardless of pipe material. The bedding material shall be placed in layers of less than 100mm and shall surround the pipe by at least 100 mm in all directions.

Reinstatement of trenches in existing carriageways shall comply with the requirements of the WDC Working Within Road Reserves Policy and Specification

6.17.3 Detection Tape

A metallic detection tape and tracer cable shall be laid directly above all new non-metallic water mains including rider mains.

Detection tape shall have "water" written on it in blue, be located at a depth of between 200 and 250mm below the finished surface level and contain sufficient metal to be detectable from the surface by a standard metal detector.

Tracer cable shall also be attached to all principal mains and rider mains. 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. The tracer cable shall be connected to all surface boxes, and electrically tested for continuity by a Registered Electrician following installation and backfilling. Records of the electrical continuity test shall be provided by the Contractor.

6.17.4 Special Measures in Aggressive Ground Conditions

Where aggressive soil conditions are likely to be encountered, only approved Water Services materials are to be used. For metal components, the approved materials are stainless steel complying with NZS 3604 Grade 316, Ductile Iron coated to NZS 4158 or aluminium-bronze. Additionally, all metal shall have a molybond coating corrosion protected with "Denso" primer paste covered with "Denso" tape wrap , followed by "Denso" MP/HD tape or "Greensleeve" over wrap, or approved alternative complying with the same standards.

The Water Services Manager shall be the sole judge as to what constitutes "aggressive" ground conditions.

6.18 DISINFECTION AND TESTING

6.18.1 Pressure Testing

On completion of the pipe laying and jointing, sufficient backfill materials shall be placed over the pipes to prevent movement during pressure testing, leaving joints, fittings and anchor blocks visible.

No connections of a permanent nature between existing mains and the new work will be allowed at this stage. PE80 rider mains shall not to be connected to the mains before testing, but shall be tested separately. Service connections shall be included within the test.

To complete the preliminary test the new reticulation system shall be swabbed and any air eliminated using a temporary supply. All valves on the new main shall be fully opened and all hydrants, stop taps and valves on the consumer end of the service pipes shall be shut. Water for tests may be obtained from the existing system provided prior Water Services Division approval is obtained and a metered standpipe with a check valve is used. Standpipes are available from the Water Services Division.

A visual inspection of the line including joints and fittings shall be made and any apparent flaws and leaks shall be remedied. The pipe shall be left full overnight before pressure testing.

Pressure tests shall be carried out using an approved pressure pump at a steady rate without shock loading. Pressure gauges used shall be accurate and read to a minimum of 10kPa intervals. **NB:** Gauges shall be calibrated on an annual basis, with test certificates available for all equipment on request.

The Contractor shall give the Water Services Manager at least 24 hours notice before carrying out testing. The test shall be carried out in the presence of a Council representative and a data logger shall be used to verify the results.

The test pressure shall be 1.25 x the rated pressure of the pipe. Test sections shall not exceed 500m in length. The specified test pressure is the pressure to be applied at the lowest point in the section. If the pressure gauge is not located at the lowest point a correction shall be made for the difference in levels. Pressure testing against valves will not be permitted.

For PE80 or PE 100 pipe the type of test will depend on the length and diameter of pipe to be tested. The Contractor shall confirm with the Water Services Manager which test is required in accordance with the manufacturer's requirements and the "Whangarei District Council Specification for the Installation of Water Mains". The Contractor shall supply a graph or data logger printout of the pressure test and show calculations n_1 and n_2 where applicable.

The applicants, its representatives and contractors are reminded of their obligations under the Resource Management Act in terms of the discharge of testing water into natural water courses. It will only be acceptable to discharge the water into a Council-managed stormwater system if it is of a quality that would comply with the requirements of the relevant Catchment Drainage Plan or the rules in the *Northland Regional Council Water and Soil Plan for Northland).* Testing water shall not be discharged into a Council-managed sewerage system.

6.18.2 Disinfection

After backfilling and before being put into service, all pipes, valves, house connections and other fittings shall be disinfected. All disinfection testing will be at the developer's cost.

Disinfection Testing shall be carried out by persons who have successfully completed NZQA Unit Standard 19209 - Water Reticulation (Demonstrate knowledge of water reticulation system cleaning and disinfection).

The main shall firstly be swabbed with a suitable swab if not already done prior to pressure testing. The main shall then be drained and slowly filled with potable water to which sufficient free chlorine is added to produce a concentration of 50 parts per million in the main. It is recommended this be done via a water tanker of known volume.

The point of water application shall be at the beginning of the section of main to be sterilised.

The main shall be left full of the chlorinated water for 24 hours, during which time all valves, hydrants and other fittings on the section shall be operated.

The residual chloride concentration must not be less than 20 ppm after 24 hours.

The main shall then be flushed out until the chlorine concentration of the issuing water is between 2 and 0.2 parts per million.

If the chlorination is found to be unsatisfactory, the Contractor shall repeat the procedure until the water is of acceptable quality.

The testing of the chlorine concentration is to be carried out on site by the Whangarei District Council Wastewater laboratory or other approved laboratory. It is the Contractors responsibility to organise the laboratory representative to be on site. At least 24 hours notice is required for the initial chlorine application. The representative shall return 24 hours later for the second residual chlorine test and will stay on site while the line is flushed until the chlorine concentration is between 2 and 0.2ppm.

The laboratory will then issue the Council a report in writing confirming the tests.

Chlorine may be added to the pipe in one of the following ways:

a) Chloride of lime solution
b) Calcium hypochlorite solution
c) Sodium hypochlorite solution
d) HTH dry chlorine granules dissolved in water before put into the main

NB: The chlorine solution must not be discharged into the stormwater system.

Following approval by the Council of the tests and provided all other aspects of the pipework are satisfactory Form WB will be completed by a Water Services representative.

Upon completion of Form WB the applicant shall keep the new reticulation continuously charged with water under pressure and obtain Council approval to connect to the existing reticulation. This is requested by notifying Water Services in writing and providing a copy of form WB, the test results and a sketch of the connection detail. The Licensed Contractor who will undertake the work must be identified and the Council file and property identification numbers shown. The connection shall only be made by the (Council approved) contractor shown in the application. Upon connection the new reticulation is to be flushed to the satisfaction of the Council, and left operational.

If the main to be connected is deemed by the Water Services Manager to be critical, then only the Reticulation Maintenance Contractor may undertake the connection.

All costs associated with connection to the existing system shall be met by the developer.

6.18.3 Hydrant Flow Test

Following completion of the pipe test and connection to the main, the developer may be required to provide certification from the Fire Service or other approved independent certifier, of the static pressure, the maximum flow and the residual pressure at maximum flow for each hydrant.

6.19 COMPLETION

6.19.1 As-Built Drawings and Schedule of Asset Information

A set of drawings and a schedule of asset information shall be submitted as per Section 1.7 of this Standard, and the checklist attached to Form WC. These shall clearly and accurately show the as-built locations and details of all water infrastructure provided as part of the work, including any modifications made to the existing system.

Weld data logging information for all welds shall be submitted with As-Built drawings.

Additional information required for all hydrants, valves and meter box locations is as follows:

(i) Position - from LH, RH and front boundary of adjacent lot.
(ii) Location - xyz co-ordinates.
(iii) Item - hydrant, sluice valve, peet valve, pressure reducing valve.
(iv) Make, model - depth to spindle/handle.
(v) Date installed.
(vi) For Hydrants - static pressure
- residual pressure
- maximum flow rate
(vii) For valves - Number of turns to fully open.

The As Built drawings may be checked on site for accuracy on completion of the subdivision or development. A certificate of completion for the works will not be issued until acceptable As-Built drawings have been produced and the requirements of Form WC met.

6.19.2 Operation and Maintenance Manuals

Full details of all mechanical plant, including pump stations and treatment facilities shall be provided, including complete O & M Manuals in PDF format, plus 3 hard copies, The O&M Manuals shall include:

- As-built drawings,
- Equipment List, with make, model and serial numbers,
- Equipment supplier details,
- Pump curves, with design flow/head identified,
- Electrical layout,
- Control logic,
- Maintenance schedules.

6.20 DEFECTS LIABILITY

A Performance Bond will be required for the works in terms of Section 1.13 of this Standard.

6.21 DRAWINGS

The following drawings in APPENDIX A apply to this section:

SHEET 1	**STANDARD DRAWING SYMBOLS**
SHEET 11	**RECOMMENDED SERVICE LOCATIONS**
SHEET 18	**PIPE BEDDING AND BACKFILL**
SHEET 19	**PIPE PROTECTION AND BULKHEAD DETAILS**
SHEET 28	**RPZ WATER CONNECTION**
SHEET 29	**WATER PIPELINE DETAILS**
SHEET 30	**MULTIPLE WATER CONNECTIONS & BACKFLOW PREVENTERS**
SHEET 31	**SINGLE METER BOX CONNECTION**
SHEET 32	**ANCHOR BLOCK AND VALVE INSTALLATION DETAILS**
SHEET 33	**ANCHOR BLOCK DIMENSIONS**
SHEET 34	**AIR VALVE DETAILS**
SHEET 35	**VALVE AND HYDRANT MARKERS**
SHEET 36	**MAGFLOW AND PRESSURE REDUCING VALVE INSTALLATION**
SHEET 37	**WATER SUPPLY PUMP STATION DETAILS**

7. RESERVES AND LANDSCAPE DESIGN AND PRACTICE

7.1 GENERAL REQUIREMENTS

This Section covers the requirements for the design of landscaping within parks, recreation and other reserves in the District. It should be read in conjunction with Parts 7 and 8 of NZS4404: 2004.

7.2 REFERENCED DOCUMENTS

The following documents shall be read in conjunction with this section of these standards:

- NZS 4404:2004 Land Development and Subdivision Engineering
- SNZ HB 8630:2004 Tracks and Outdoor Visitor Structure Standard.
- New Zealand Urban Design Protocol (Mfe, 2005)

7.3 SUBMISSION OF APPLICATION

7.3.1 Supporting Information and Calculations

The application shall include the following:

- Plans showing existing mature trees and bush areas within the site, and proposed modifications or enhancements to these areas,
- A landscape assessment of all areas to be designated as reserve,
- A development plan for reserves,
- Plans illustrating street planting, reserve planting, the alignment of footpaths, location of park furniture, facilities structures, play equipment, lighting and landscape features such as mounding, stormwater ponds etc. proposed for the development,
- Requirement for irrigation or other services.
- Fencing provisions

7.3.2 Design Drawings and Specifications

Design drawings shall comply with the requirements of Section 1.5 and 1.6.

7.3.3 Approval of Design

The Parks 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 Manager or authorised representative shall be deemed approved drawings. Unless specifically stated otherwise, the approval of drawings does not supersede the requirements or obligations of these standards.

7.4 GENERAL

7.4.1 Concept stage

Landscape design has application at all levels of the subdivision and development process. At the initial concept stage it may be important to establish objectives for overall landscape design including open space connections, access to and location of watercourses, protection of remnant vegetation, and provision of reserves and streetscape to provide a framework of coherence and amenity. At a more detailed level landscape plantings may need to be located to minimise effects on vehicle sight lines.

7.4.2 Compatibility with engineering design

Landscape design should be considered in the early stages of a development to ensure that any landscape conditions and objectives are compatible with subsequent engineering design and works. Landscape design is intended to enhance the character and environment of a development, to strengthen existing neighbourhood character and unify those areas into an integrated district. Landscape design may not be applicable to all developments and must be assessed in accordance with the scale of the development, identification of positive effects that landscaping may provide and local conditions.

7.4.3 Long-term public benefit

Any landscaping shall provide maximum long-term public benefit with minimum ongoing maintenance costs, while giving due regard to the safe use of public assets.

7.4.4 Conservation

Areas of natural significance, with inherent or potential conservation values, may be vested in Council as reserves. Alternatively, they may be vested with the Queen Elizabeth II Trust as Open Space Covenant, or as WDC Conservation Covenants.

Natural areas shall be weed and pest free, and a conservation plan prepared for the area, in accordance with Resource Consent requirements.

7.4.5 Recreation reserves

Recreation reserves to be vested in Whangarei District Council shall comply with Part 8 of NZS4044: 2004.

Functional and aesthetic opportunities

Landscaping provides a range of functional and aesthetic opportunities for environmental enhancement:

Functional:

- Defines space
- Provides shade, shelter and privacy
- Screens unsightly outlooks
- Ameliorates noise and pollution
- Assists driver recognition of road bends, junctions and roading hierarchy
- Reduces glare and reflection
- Assists in the control of erosion
- Creates physical barriers
- Provides recreation and amenity value.

Aesthetic:

- Frames views
- Emphasises landform and landscape features
- Provides visual unity in the environment
- Reduces the visual impact of the roadway
- Softens hard surfaces and bleak areas
- Provides colour, form and texture
- Provides visual lineage within and between regions
- Provides identity and environment

7.4.6 Urban Design Protocol

Where appropriate, the design should have regard to the principles detailed in the **New Zealand Urban Design Protocol** (Mfe, 2005)

7.5 DESIGN

7.5.1 Disability Access

Parks shall be designed for access by people with disabilities from common entry points. This will be reflected in the width and gradients of paths, and access to structures or other areas.

7.5.2 Location in Relation to Piped Services

Trees, street gardens and reserve plantings shall be located so as not to compromise the integrity and efficient operation of infrastructural services. As such if particular landscape conditions or objectives are required for a subdivision or development then these will need to be taken into account prior to undertaking detailed engineering design.

Of particular importance is the effect of tree roots on the operation and maintenance of piped services. Trees shall not be planted where piped services will be within the dripline, unless specific consideration by a arborist confirms that the root system is unlikely to affect the services, and that excavation to maintain the service will not affect the tree.

7.5.3 Sight Lines

The minimum separation and sight distances detailed in Figures 7.1 and 7.2 of NZS 4404:2004 should be adhered to for tree and shrub planting.

Alternative location and design proposals should also be considered, such as provision of trees in a dedicated "non-services" berm, either side of a footpath. "Curved" footpaths allow for tree planting in groups and can help accentuate road perception particularly at intersections. Strategically placed, grouped plantings of trees are often of greater benefit and impact than individual trees placed outside each house.

7.5.4 Tree/plant size

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. Plants should not exceed 450 mm in height in the sight triangle of intersections, or other traffic or vehicle/pedestrian conflict areas, unless tree planting provides for eventual clear trunking to a high canopy, or planting does not interfere with sight lines.

The minimum planting size of a landscape tree is 1.5 m tall at the time of planting unless the local conditions of a site require consideration of alternatives, e.g., an exposed site may require small, well-hardened trees.

7.5.5 Species selection

Species are to be selected with regard to overall composition, low maintenance and longevity. It is recommended that the applicant and/or consultant meet with the Council's Parks and Reserves Division prior to lodgement to discuss issues such as species selection, location etc.

The number of species used should ensure a unified result and species choice in street gardens to complement street planting, environment, and scale of surroundings. The following matters are to be considered for correct species selection:

- Suitability to environmental conditions e.g. ground moisture, wind, etc;

- Tolerance to amenity situation;
- Pest and disease resistance;
- Non-suckering habit;
- Longevity;
- Shading consistent with location;
- Minimum maintenance requirements;
- Toxicity of leaves, flowers, seeds and bark in areas likely to be used by young children.

7.5.6 Quality Control

All plants shall be sound, healthy, vigorous and free of any defects which may be detrimental to plant growth and development. In addition plants should have vigorous root and branch systems and plants supplied in pots must not be root bound. Defects may include but are not limited to the following:

Pests	Denuded bark
Diseases	Form not consistent with species
Sun scalds	Multileaders
Abrasions	Dead wood
Cankers	Girdling roots
Cracks	Weed and parasites
Excess dead leaf material	Breakages
Plants not hardened off	Spent flowerheads
Tree proportion (i.e trunk calliper/tree size)	Frost damage

Generally only species adapted to the site conditions shall be planted.

7.5.7 Landscaping structures

Landscaping structures include (but) are not limited to) sculptures, walls, fences, screens, bollards, entranceways, posts, etc, and could be made from materials such as concrete, brick, stone, rock and timber. The design of the landscape must be considered as an integral part of the development and surroundings to fulfil both functional and aesthetic requirements. Durability and maintenance requirements must be considered.

Landscape Structures must comply with the requirements of SNZ HB 8630:2004 – Tracks and Outdoor Visitor Structure Standard.

Structures must be located so that they do not obstruct the sight lines for intersections, pedestrian crossings and signs. The separation distances must be considered together with trees and other landscaping features.

Entranceway wall structures must be located fully on private land. Any other immovable landscape structure (e.g. boulders) is not to be located so as to prevent access to underground services.

Structures must be designed to safely withstand appropriate loadings and must not be a hazard to traffic. The developer is responsible for gaining any necessary building consents in respect of proposed structures, including retaining walls. All retaining walls including those not requiring a building consent shall be constructed to resist lateral earth pressures and those from any surcharge loading that may be present.

7.5.8 Irrigation Provision

The Council may require provision for permanent irrigation of street gardens.

Provision for irrigation during the establishment of plants is acceptable for gardens that are not otherwise irrigated.

All connections shall be provided with a water meter. The developer shall apply for, and pay all costs associated with the water connection, including Development Contributions.

7.6 CONSTRUCTION

The requirements detailed in NZS4404: 2004, Section 7.4 Construction and Part 8: Reserves apply to the implementation of landscape works within parks, recreation, stormwater drainage, road and other reserves.

The Council may vary the length of time required for maintenance of landscaped areas by the developer / applicant from that detailed in NZS4404: 2004.

7.6.1 Earthworks

All earthworks within reserve areas require the approval of the District Council prior to commencement. All earthworks shall comply with the Environmental Standards for Land Disturbance Activities contained within the Operative Regional Water and Soil Plan for Northland (Northland Regional Council).

The requirements regarding finished gradients and profiles as detailed in NZS4404: 2004 (Section 8.3.2) apply.

7.1.1 Stormwater Drainage

Section 3 of this Standard applies to all stormwater ponds and other devices.

Where reserves incorporate stormwater retention ponds, wetlands, or other such stormwater systems, these shall be identified, and impacts and maintenance requirements detailed.

Reserves that are provided for stormwater control, including stormwater retention ponds shall be created as drainage reserves, with separate titles.

7.6.2 Fencing

All fencing in reserves should meet the standards specified in Figures 8.1 and 8.2 of NZS 4404:2004.

7.7 COMPLETION

7.7.1 As-Built Drawings and Schedule of Asset Information

A set of drawings and a schedule of asset information shall be submitted as per Section 1.7 of this Standard. These shall clearly and accurately show the as-built locations and details of all reserves infrastructure provided as part of the work, including any modifications made to existing systems.

The As Built drawings may be checked on site for accuracy on completion of the subdivision or development. A certificate of completion for the works will not be issued until acceptable As-Built drawings have been produced.

The drawings shall identify assets that have been removed or decommissioned.

7.7.2 Operation and Maintenance Manuals

Full details of any equipment, including complete O & M Manuals in PDF format, plus 3 hard copies, The O&M Manuals shall include:

- As-built drawings,
- Equipment List, with make, model and serial numbers,
- Equipment supplier details,
- Maintenance schedules,
- Conservation plans.

7.8 DEFECTS LIABILITY

A Performance Bond will be required for the works in terms of Section 1.13 of this Standard.

8. POWER, TELECOMMUNICATIONS AND GAS

8.1 GENERAL REQUIREMENTS

This Section covers the requirements for the provision of Power, telecommunications and gas.

The developer shall arrange with the appropriate network utility operators for the supply of electricity, street lighting, telecommunications and gas reticulation as appropriate.

- Reticulated electricity and telecommunications shall be provided to the boundary of each new lot, including that of the balance allotment as specified in the District Plan.
- Where it can be demonstrated that the intended land usage does not warrant a power or telecommunications supply, (e.g. Forestry, run off blocks), or where it is uneconomic to provide such services to the boundary, then the Council or controlling utility service operators may approve the use of a `no power' or `no telecommunications' encumbrance registered on the new title.
- It is the incoming owner's responsibility (not withstanding prior arrangements) to meet the costs of any internal power and telecommunication reticulation and/or any network upgrade that may be necessary to supply loads above and beyond that designed for.
- Easements - Where applicable, electrical and telecommunication easements will need to be registered over new and existing plant to ensure the security of supply.

8.2 DESIGN DRAWINGS

Design drawings complying with the requirements of Section 1.5 and 1.6 shall be provided for approval.

8.3 ELECTRICITY

In urban areas, and where practicable in other areas the supply of electric power shall be made by means of an underground ducted system installed at the time of road construction. Sites for power transformers and switching stations shall be provided for as and where required.

Power cables, lines and plant constructed on public land, or on private property and secured by an easement in gross; need to be signed over to a recognised network operator to meet the requirements of the Electricity Act 1992.

8.4 TELECOMMUNICATIONS

Telecommunications reticulation in urban areas shall be an underground system installed at the time of roading construction. Sites for necessary services and equipment shall be provided for as and where required at no cost to the Council.

8.5 SERVICE LOCATION

Preferred service locations in berms are as shown on SHEET 11.

8.6 AS-BUILT PLANS

A set of drawings and a schedule of asset information shall be submitted as per Section 1.7 of this Standard. The drawings shall clearly and accurately show the locations of all power, telecommunication and gas reticulation.