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6. WASTEWATER

6.1 INTRODUCTION

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

6.1.1 Objectives

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

6.1.2 Performance Criteria

The design of a wastewater system shall include the following:

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

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

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

6.1.3 Key References

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

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

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

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

6.2 RETICULATION DESIGN

6.2.1 General

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

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

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

6.2.2 Private Connections

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

6.2.3 Trade Waste

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

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

6.2.4 Reticulation Layout and Alignment

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

6.2.4.1 Wastewater reticulation in roads

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

6.2.4.2 Wastewater reticulation through private property

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

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

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

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

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

6.2.4.3 Easements over drains

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

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

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

6.2.4.4 Crossing other services

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

6.2.4.5 Building over or alongside a common private or public drain

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

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

1) Structures

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

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

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

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

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

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

Table 6-2 Acceptable Techniques for Building over Wastewater Drains

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

Detailed Engineering Drawings of the proposed work are required.

6.3 PIPE DESIGN

6.3.1 Gravity Pipe Material

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

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

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

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

6.3.2 Pressure Sewer (Rising Main) Pipe Material

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

6.3.3 Calculation of Flow

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

6.3.3.1 Residential Flows

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

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

6.3.3.2 Area/Zoning Coefficients

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

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

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

Table 6-4 Wastewater Area/Zoning Coefficients

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

NOTE:

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

6.3.4 Pipe Size

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

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

6.3.5 Grades and Velocities

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

Table 6-5 Minimum Velocity and Grade Requirements

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

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

6.3.6 Pipe Cover

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

Table 6-6 Minimum Cover

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

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

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

6.3.7 Manholes

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

6.3.7.1 Concrete manholes

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

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

6.3.7.2 Thermoplastic manholes

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

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

6.3.8 Roding Point

Roding points shall be used in the following circumstances:

- a) At change of direction or grade. Maximum spacing of 50m. (Note: buried, pre-formed inspection bends may be used in lieu of roding points where the change in direction or grade is closer than 20m from a roding point or manhole)
- b) At the head of a wastewater system.
- c) At the top of steep banks where a standard manhole would be impractical.

For details of Roding Points see SD 610 and 611.

6.3.9 Inspection 'T'

- a) An Inspection 'T' as per SD 612 shall be installed on all private laterals within road reserve. The inspection 'T' shall be positioned 150mm from the road boundary.

6.4 PUMPING STATIONS

6.4.1 Pump Station Design

- a) Pump stations shall comply with NCC requirements and these specific designs are updated on a regular basis. Design will be dependent on a number of factors and should be discussed with the Council at an early stage.
- b) New pumping stations will only be accepted by Council when all other practical options have been ruled out (filling of sites is a normal practical option to gain the required gravity fall so that pump station sites can be avoided).
- c) Design of the pumping station shall enable operation of the station in compliance with industry health and safety requirements having particular regard to safety from falling aspects on site.
- d) Pumping stations shall be of the wet-well type, fitted with approved types of submersible pumps that meet whole of life economies taking in capital cost, power consumption, likely parts and maintenance cost during design life.
- e) Pumping stations shall be located where occasional adverse effects of smell and/or noise will have minimum impact and not within 20m of a residential dwelling. Pump stations shall not be located in low lying areas with potential for surface flooding or Q50 flood inundation.
- f) In all pumping stations the following design specifications apply:
 - 1) Sufficient duty pumping capacity shall be available to handle the design peak flow rate from the catchment area that has been calculated for projected growth extending out to 25-years.
 - 2) A minimum of two pumps on stainless steel guide rails with stainless steel lifting chains shall be installed, with one acting as duty pump and the other on automatic standby. The duty sequence is to be alternate start on variable speed drives in accordance with Nelson City Council control system standards. The standby pump shall be equal in capacity to the duty pump.
 - 3) The wet well shall be of sufficient volume and shape so as to limit the frequency of pump starts, allow cooling of pumps, minimise build up of sludge and to minimise potential odours. The dimensions of the wet-well shall be such that under maximum flow conditions the number of starts for the pumps shall not exceed the pump manufacturer's recommendations.
 - 4) A minimum of four hours on-site emergency storage, not including reticulation storage shall be provided based on the design average dry weather flow volume measured above the overflow to storage, or high level alarm level (measured by Multitrode or ultra sonic level detector). The four-hour

storage facility shall be self draining and normally located in an underground approved structure within the site and covered with grassed topsoil or approved alternative top blending in with surroundings. The storage structure shall have a sealed access lid for inspections.

- 5) Wet well and valve chamber structures shall be first priority for consideration of emergency storage volume by oversizing to minimize expensive underground structures and control features on site.
- 6) Wet wells shall be provided with ventilation. An approved odour control system such as activated carbon odour control units shall be constructed adjacent to the pump station to mitigate odours. Other odour control devices may be approved on a case-by-case basis to be approved by Council.
- 7) Ground floor levels shall be at least 200mm above finished ground levels in order to exclude surface water entry.
- 8) All pump station site structures shall be designed for a minimum 50-year life complying with the building code.

6.4.2 Access and Services

- a) A 20mm diameter water supply with a standard 15mm brass hose tap must be provided in the immediate vicinity of the pump station. Supply shall be fitted with an approved reduced pressure zone (RPZ) backflow preventer and NCC approved water meter/isolating valve assembly. A water meter is required.
- b) Pumping stations and control buildings shall be sited on a separate lot or a drainage or utility reserve. The lot is to be vested in Council and shall have a sealed access road for maintenance vehicles. The site as a minimum should have screen planting on all common boundaries that will not exceed 2m in height on the South boundary.
- c) A means of lifting pumps and other heavy equipment, or alternatively access to enable mobile plant to perform this task is to be provided on site.
- d) An approved flow meter shall be installed on the outlet line from the pump station and connected to the telemetry system.

6.4.3 Electrical Equipment

An electrical pump control, alarm, and telemetry system is required on site. It shall be assembled and installed in accordance with Council's standard specification, as follows:

- a) A stainless steel control cabinet is required to house electrical equipment. Cabinets are to be fitted with a lock keyed to Council's security system.

- b) All electrical switch gear is to be located a minimum of 300mm above ground level. All electrical equipment is to be assembled and installed in accordance with these standards or the manufacturer's specifications.
- c) All equipment including metering must comply with the requirements of the Network Utility operator and supplier (power).
- d) Suitable alarm and system control interrogation and transmitting facilities shall be provided to enable the pumping stations to be connected to Council's telemetry system.
- e) Cable ducting from the pump station to the control cabinet must be sealed to protect against corrosive gasses travelling to the electrical switchboard.
- f) All electrical and pump station control gear including telemetry shall be housed within a weather proof, lockable, walk-in building to Council approval.
- g) Phase failure protection relays shall be provided for all pump motors unless that protection is incorporated into the electronic control for Soft Start or Variable Speed Drive units.
- h) Automatic control of the pump operation, together with a manual override facility is to be provided.
- i) A standard three-phase industrial power connection shall be supplied such that a portable generator can be connected when power failure occurs.
- j) Suitable lighting shall be provided for the pump station, cabinets and valve chambers with protective materials suited to the corrosive environment.
- k) Details on pump/motor components and electrical control equipment shall be incorporated into an Operation and Maintenance Instruction Manual enclosed in a hard copy A4 bound folder. Four copies shall be provided.
- l) The Manual shall include as-built plans of the pump station including electrical wiring and operational schematic diagrams. Four copies of the Manual shall be supplied to Council on handover of the completed pump station and associated works.

6.4.4 Private Pumping Stations

- a) Individual, private pump systems are permitted provided they meet the requirements of section 3.4.4 and the design and construction meets the requirements of the NZ Building Code (a Building Consent will be required) and the connection to the Council system is via an inspection chamber (This may require odour control) and a gravity pipe connection (Pressurised pipelines must be located entirely on private property).

6.4.5 Wastewater Pressure Rising Mains

- a) Wastewater rising mains shall meet the requirements for the construction of water mains. All pressure sewers shall be subject to specific design for cyclic dynamic stresses (fatigue), in selection of pipe pressure class. (Refer to Plastic Industry Pipe Association POP 101 and POP 010A and POP 010B). Refer also to materials selection in section 6.3.1.
- b) The location of all pumping or pressure mains shall be marked with an approved foil or wire banded tape, buried in the trench (see section 6.5.6.1).

6.4.6 Commissioning

- a) On completion of any pump station, and prior to handover to Council, a full commissioning test shall be carried out on all components of the pump station. This commissioning shall be in the presence of a representative of Council and of Council's operations and maintenance contractor.

6.5 CONSTRUCTION AND INSTALLATION

6.5.1 Excavation Works

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

6.5.1.1 Trench width

- a) The Minimum trench width shall be 200mm wider than the external diameter of the collar of the pipe being laid.
- b) The trench shall be of sufficient width to permit with freedom the installation of all trench support and to allow the laying and jointing of pipes and placing of bedding and pipe surround materials.

6.5.1.2 Base of excavation

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

6.5.1.3 Trench support

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

6.5.1.4 Dewatering

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

6.5.2 Bedding of Pipes and Pipe Protection

6.5.2.1 Metal bedding

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

- a) Metal Bedding shall be in accordance with SD 617 and 523. (For concrete pipes, "Type H2" bedding in accordance with AS/NZS 3725:2007 shall be used.)
- b) The bedding material shall be:
 - 1) In a sand environment - Sand
 - 2) For PVC and flexible pipes - AP20 as per SD 401, or as per AS/NZS 2566.2:2002, Appendix G

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

6.5.2.2 Pipe embedment

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

6.5.2.3 Installation of geotextiles

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

6.5.2.4 Concrete surround for concrete pipes

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

- 2) In areas other than those covered above, where the cover over the barrel of the pipe is or will be less than 300mm, irrespective of the type or class of pipe.

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

6.5.2.5 Concrete protection slab for PVC pipes

- a) Where cover over PVC pipes is less than the minimum stated in Table 6-6, including temporarily under construction traffic, a concrete protection slab shall be constructed in accordance with SD 618.

6.5.2.6 Water-stops and trench groundwater

- a) Where permeable bedding such as 'bedding chip' 'drainage metal' or 'sand' is used, water-stops and trench drainage shall be constructed to prevent unwanted movement of groundwater along the trench and pipe bedding. Also see 6.5.2.3.
- b) Water-stops shall be constructed to the requirements of SD 615. Trench Drainage shall be constructed to the requirements of SD 614.
- c) Manholes can be considered to be water-stops provided they are constructed appropriately.
- d) Where water stops are required, they should be provided at the following intervals:

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

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

- e) Where necessary and practicable trench drainage as per SD 614 will be required to prevent groundwater infiltration at manhole connections. Note: This will not be necessary where prefabricate plastic manhole such as the Smart Pit™ are used (see sections 6.3.7.2 and 6.5.5.2).

6.5.3 Pipe Installation

- a) To help with future identification the end caps and inside of the end of all new wastewater laterals must be painted with red acrylic paint and marked with a 75mm x 25mm ground treated marker stake suitably identified and partly painted red. (Note: stormwater laterals are to be marked green.)

- b) A laser shall be used by the Contractor for fixing line and grade, for setting the pipes to line and level, and for jointing on all major pipelaying work where possible.
- c) The maximum deviation in level of pipe invert when laid shall be 5mm from design level.
- d) The maximum horizontal deviation from a straight line shall be 10mm.
- e) Pipes shall not be laid on bricks, blocks and wedges or other temporary or permanent supports except when concrete surround is to be placed.
- f) Joints shall be flexible and watertight.
- g) Pipes shall be kept clear of dirt or debris, and any pipes that contain such matter shall be required to be cleaned out. Internal pipe walls shall be kept clean and free of all dirt, rubbish and water. Spigots, sockets, rubber rings, etc, shall be thoroughly cleaned before jointing.

6.5.4 Installation by Trenchless Technology

- a) Gravity pipes and pressure rising main pipes may be installed by trenchless methods, including:
 - 1) Horizontal Directional Drilling (HDD),
 - 2) Pipe bursting,
 - 3) Auger boring/guided boring,
 - 4) Slip lining,
 - 5) Pilot bore microtunnelling,
 - 6) In-line replacement/pipe eating/pipe reaming with HDD rig.
- b) Pipes may include fusion welded PE, or rubber ring joint PVC with restraint joints specifically designed for trenchless installation.
- c) Gouging or notching of the pipe shall not exceed 10% of the pipe wall thickness for pressure pipe and 20% of the pipe wall thickness for gravity pipe. Pipe shall not be bent to a radius less than 35 times the pipe OD for PE pipes or 600 times the pipe OD for PVC pipes.
- d) The trenchless installation methodology selected must be compatible with, and capable of achieving the required pipeline gradient.
- e) The specified allowable load on the pipe shall not be exceeded during pulling.

- f) Where gouging or notching exceeds the above limits or if buckling of the pipe occurs, that length of pipe shall be removed and a new section welded in at the nearest join.
- g) The Contractor shall overtop the pipe by one lineal metre for each length of pulled pipe that is the greater of one manhole length or 200m. The excess pipe length shall be supplied to the DPA for a visual inspection.

6.5.4.1 Pipe installation by pipebursting

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

6.5.4.2 Pipe installation by slip lining

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

6.5.4.3 Pipe installation by directional drilling

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

6.5.5 Manhole Installation

The following standards apply to the installation of manholes:

6.5.5.1 Concrete manholes

- a) Manholes shall be constructed in accordance with SD 602 - 609.
- b) All concrete manholes shall be made water tight by effective sealing of manhole section joints with mastic sealant and around pipe entries, where applicable, using epoxy mortar inside and out.
- c) The connection of PVC pipes to concrete structures, such as manholes and sumps, shall be with a purpose made PVC starter and finisher with a 'gritted' external surface.
- d) The connection of PE pipes to concrete structures shall be in accordance with SD 607.
- e) All PVC pipes entering or leaving a manhole shall have one flexible joint within 200mm of the manhole and a second flexible joint within 1200mm of the manhole.
- f) The channel through the manhole shall be formed from in-situ concrete properly formed to grade and radius sweeps. The channel shall be finished with a smooth, regular half circle invert with falls as specified in SD 602. Benching shall be steel float finished to give a regular smooth surface.

6.5.5.2 Thermoplastic manholes

- a) Installation shall be to the suppliers requirements subject to the following conditions:
 - 1) The ground is firm and stable.
 - 2) The pipe size is small (i.e. pipes up to and including diameter NB 225mm).
 - 3) A manhole from thermoplastics shall consist of a factory manufactured benched base, a vertical riser(s), a suitable transition, as necessary, from the base to the riser (e.g. an adaptor), a cover slab, a throat, as necessary, from the cover slab to the lid at ground level, a frame and a cover. The components must be easy to assemble on site to form a watertight construction.
 - 4) Manholes from thermoplastics shall have a safety factor of at least 2 against flotation after backfilling (e.g. weight of backfill over horizontal ring fins and cover slab).
 - 5) All components of the manhole shall be designed by the manufacturer for the expected site loading including vehicle loads of 51kN (0.85HN) where in trafficable areas. A manufacturer's certificate shall be provided to this effect.

- 6) Depth to the invert of the outlet from the lid shall not exceed 3.0m.

6.5.6 Pumping/Pressure Main Tracer Tape

The location of all pumping mains and gravity pressure mains (swallows) shall be marked with a foil tape buried in the trench.

6.5.6.1 Tape

- a) The tape shall be red, 50mm wide, and printed with "CAUTION PRESSURE SEWER MAIN BURIED BELOW" or similar message. All printing shall be encased to avoid in rub-off.
- b) The tape shall be either a woven reinforced acid and alkali resistant polythene plastic with a solid aluminium foil core which shall be visible from both sides. "Thor Tec™" tape is an accepted product. Alternatively the tape shall be a sinusoidal stainless steel wire encased in a polythene strip. "Waterwave" and "Wavelay" are acceptable products.

6.5.6.2 Installation

- a) The tape shall be buried above the centre line of the pipe within 300mm to 400mm from the finished surface. Refer SD 702.
- b) All joints in the tape (e.g. roll ends, accidental breaks and at tees) shall be made electrically conductive with purpose made splice clips installed to the specific manufacturer's instructions. Tying together of the tape ends is not acceptable as the polythene coating will prevent electrical conductivity.
- c) The tape shall be brought up inside the surface box risers at all manholes and air valves with a 300mm long tail so that pipe location equipment can be readily connected.

6.5.6.3 Tracer wire

- a) When a pumping main or swallow pipe is installed by a directional drilling technique or bored through the ground for a distance exceeding 20 metres, the pipe shall have a 'Tracer Wire' attached. This wire shall take the form of a continuous 2.5mm 2 multi strand (polythene sleeved) cable, strapped to the pipe wall by means of a minimum of two complete wraps of heavy duty adhesive tape, at a maximum of 3.0m intervals.

6.5.6.4 Tape or Wire Testing

- a) The tracer tape may be tested and checked at Practical Completion by Nelson City Council for continuity using an electric pulse induction system. The new pipeline will be tested between manholes, valves, etc where the tape is brought up inside the surface box risers. Nelson City Council will carry out this test only when all work associated with laying the wastewater main is complete.

6.5.7 Connection to Council Network

- a) Connection to existing wastewater mains shall not be made until all upstream work has been completed and inspected and approved by Council. Specifically, this shall include flushing and testing of all new pipework, manholes, and other wastewater facilities by the contractor and internal (CCTV) and external inspections by Council.
- b) No contractor is permitted to enter a live wastewater system without the approval of the Engineering Manager.

6.6 TESTING

6.6.1 Air or Water Pressure Test (Non pressure pipelines)

All non- pressure pipelines to be vested in Council ownership shall pass one of the following air or water pressure tests.

- a) Air Test – To AS/NZS 2032: 2006, section 7.3.3.
 - 1) Start test pressure of 50kPa, hold for 60 seconds with no make up pressure, the test passes if the test pressure does not fall below 35kPa.
 - 2) For safety reasons, plugs must be well braced into position as the failure of a plug could result in serious injury.
- b) Water Test – To AS/NZS 2032: 2006, section 7.3.2.
 - 1) Fill line to at least 1.0m head above ground level at the high end and not more than 5.0m at the low end. The pressure shall be maintained without leakage for at least 15minutes.
 - 2) All manholes shall be watertight and may require testing at the Council's direction. The test involves plugging and filling the manhole with water (including time allowed for absorption). During the test, the level of water in the manhole shall not drop more than 5 mm in 10 minutes.

6.6.2 Pressure Pipelines

- a) Refer Draft NZS 4404:2010 Appendix B Field Testing of Pressure Pipes.

6.6.3 Pipe Gauging

- a) All gravity pipelines to be vested in Council ownership may be required to be tested for short term vertical deflection using an appropriate proving tool ("rigid prover") and complying with AS/NZS 2566.2: 2002, Table 5.6, Section 6 and Appendix O – "Diametral Deflection Measurement"

6.6.4 Closed-Circuit Television (CCTV) Inspection

- a) All pipelines to be vested in Council ownership shall pass a closed circuit television (CCTV) inspection, carried out at an appropriate time agreed by Council or at the completion of the works.

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