

**CHAPTER 6 -
UTILITY SERVICES
SEWERAGE RETICULATION AND
DISPOSAL FACILITIES**

6.1 EXTRACTS FROM THE DISTRICT PLAN

Refer Appendix 16 Subdivision and Development Standards – Utility Services: Sewerage Reticulation and Disposal Facilities

6.2 GENERAL REQUIREMENTS

All sanitary drainage systems shall be capable of serving the entire natural catchment upstream of the system. The flow from the upper section of catchment shall generally be calculated assuming complete urbanisation of the area or other such specific uses as the Engineer may require.

Provision may be required to be allowed for the flow from a pumping station outside the natural catchment, the details being supplied by the Engineer. A contribution towards the additional cost of the gravity system will be considered by Council where allowance for a Pumping Station flow is required.

6.3 FLOW REQUIREMENTS

Flow requirements shall be calculated from the District Plan zoning for the subdivision for the greatest flow possible from the catchment in question, and shall be to the Engineer's approval. Specific calculations are to be carried out using the following data.

6.3.1 DOMESTIC FLOW

Average sewage flow = 220 litres per head per day

Number of persons per house = Three point one (3.1)

Number of houses per hectare (gross) = 15

Peak Flow factor = Four (4) times daily average sewerage flow

Minimum velocity = 0.7 metres per second

Note: Velocities shall be calculated with due allowance for the proportional depth of the flow in the sewer.

6.3.2 INDUSTRIAL FLOW

Specific design will be required within each Industrial Subdivision. However, to assess the future upstream flow, the following will be used:

Average sewage flow = 40 litres per second per 100ha. Peak flow factor and velocities: As above.

6.3.3 PIPE SIZES

In no case shall a sanitary sewer main be less than 150mm internal diameter.

6.4 GRADIENTS

Pipe gradients shall be determined using the graphs included in the Standard Drawings. Specific approval from the Engineer is required and should be obtained prior to the submission of detailed design of the maximum of minimum gradients shown in Table 6.1 are exceeded.

The minimum co-efficient of roughness used in flow calculations shall be, $k = 1.5\text{mm}$.

Table 6.1: Minimum Pipe Gradient for Different Pipe Diameters

Pipe Diameter (mm)	Minimum Gradient (%)
100	1.67
150	0.75
200	0.50
225	0.43
300	0.30

These gradients shall be subject to Clause 6.3 above and are for full pipes.

Where the velocity and gradient limits cannot possibly be complied with, the Engineer may require certain additional works to ensure satisfactory operation of the system.

6.5 PIPES AND FITTINGS – MATERIAL

All pipes and pipe fittings shall comply with the relevant New Zealand, British or Australian Standard.

All fittings shall be of the type specifically designed for use with the pipe in which they are inserted. No fabricated fittings, adaptors, end seals, etc, shall be used without permission from the Engineer.

Unless specified by the Engineer, solvent cement jointed pipes shall not be used for the construction.

The following pipes may be used on sanitary drainage works:

Vitrified Clay Pipes and Fittings: shall comply generally with AS 1741:1991 or BSEN295-1:1991. This included BAND SEALING COUPLINGS, previously to BS 65:1988. Polypropylene Inspection Chambers, previously to RS 65:1981. Polypropylene sleeve incorporating elastomeric sealing rings to BS 2494:1986.

G.R.P Fabrication: Glass-Fibre Reinforced plastic materials shall comply in general with AWWA C950 for buried fibreglass pipes.

uPVC Gravity Pipes: shall comply with NZS 7649:1988

uPVC Pressure Pipes: shall comply with NZS 7648:1987

Concrete Lined Spiral Welded Steel Pipes: shall comply with NZS 4442:1988 Flanges shall be to BS 4" 1989, BSI 0 Table D.

Welded Steel Pipes and Fittings: Welded steel pipes and fittings shall comply with the requirements of NZS 4442:1988.

Bends and Junctions and Specials: shall be of a proprietary manufacture complying in all respects with the requirements of the relevant New Standard unless specified or approved in writing by the Engineer.

Manhole Frames and Covers: These shall be of the Rotorua District Council's "Standard Heavy" pattern. Refer Standard Detail Drawing.

Cast Iron Fittings: Cast iron fittings shall have a minimum Class C rating unless otherwise specified and purchased from an approved supplier.

Ductile Iron Pipes and Fittings: Ductile iron pressure pipes and fittings shall comply with AS 2280:1986 and unless otherwise stated have a minimum Class K9 rating. Ductile iron non-pressure pipes and fittings shall comply with BS 4772:1980. Unless otherwise stated all pipes and fittings shall be coated with bituminous paint. Rubber rings for joints shall comply with AS 1646:1984.

Rubber Rings for Pipe Joints: (excluding ductile iron pipes) shall comply in every respect with BS 2494:1976 and amendments. Rings of any size delivered to the site shall have been moulded at the same factory. Only an approved water soluble lubricant shall be used for jointing pipes. Mineral based grease shall not be used.

H.D.P.E Pipes: All materials supplied shall be in accordance with NZS 7604:1981 and be purchased from an approved supplier.

6.6 VALVES AND FITTINGS

Valves and fittings shall be installed and fixed in accordance with accepted practice and the manufacturer's recommendations. The position of all valves, fittings and bends shall be marked by the Subdivider by an approved method adjacent to the fitting at the time of backfilling. No fittings are to be backfilled until approved by the Engineer. All connections to uPVC shall be by purpose made tees and under no circumstances will the use of tapping bands or the like be permitted. Unbalanced thrust in the vertical plane resulting from sharp changes of grade, sufficient to warrant special bends, shall also be provided against. Upward thrust shall be countered by special anchors to the Engineer's approval. Downward thrust shall be countered by thrust blocks at least 200mm thick on the firm bottom of the trench with a minimum ground bearing area of 400 x 400mm.

6.7 FLANGE JOINTS

The faces of flanges shall be perfectly clean before jointing and the joints shall be made with approved rings of insertion rubber not less than 1.5mm thick. The nuts shall be carefully tightened in opposite pairs until the joint ring is only just sufficiently compressed between the flanges to ensure water tightness at test pressure.

6.8 CONCRETE

All concrete shall be in accordance with NZS 3101:1982 and the New Zealand Building Code. All concrete shall have a minimum crushing strength of 20 Mpa at 28 days except where specified differently.

6.9 PIPE LAYING AND JOINTING

6.9.1 GENERAL

No pipe laying shall be commenced until the foundation in the trench has been inspected and passed by the Engineer.

Only competent workmen shall be employed on pipe laying. The Engineer reserves the right to require that workmen who in his opinion are not suitably qualified to be taken off pipe laying.

The handling, laying and jointing of pipes shall be in accordance with the relevant New Zealand Standards and to the respective manufacturer's recommendations.

All pipes and fittings are to be thoroughly inspected for soundness and if found defective shall be removed from site.

Suitable slings or other tackle shall be provided to lower the pipes into the trench. All pipes shall be inspected prior to laying and defective pipes marked and removed from the site.

The spigot ends of the pipes and inside of couplings shall be thoroughly cleaned and all lumps, blisters and coatings shall be removed. Rubber rings shall be free from dust, dirt and grease. Joints shall be made in accordance with the manufacturer's instructions and to the satisfaction of the Engineer.

Pipes shall be laid on straight grades or in smooth curves provided that the manufacturer's recommended maximum deflection angle is not exceeded. Where greater curvature is required, special bends shall be used. Such special bends shall be separated by at least one full pipe length. Laying of uPVC pipe shall comply with NZS 7643:1979 and NZS 4451:1986. The deflection of rubber-ring jointed uPVC pipe shall not exceed 300mm per 6 metre length (ie 3 degrees per joint). Approval must be received from the Engineer prior to any gravity line being laid in a curved fashion.

Pressure pipes with flexible joints may be laid around horizontal or vertical curves where the deflection angle at each joint does not exceed that specified; for any sharper angles, fabricated bends shall not be used.

Where it is necessary to cut pipes, they shall be cut true, square and free of blemishes by means of an approved cutter or hacksaw. Where pipes have to be turned down after cutting this shall be done with an approved turning tool.

During the course of the work, every endeavour shall be made to exclude foreign matter from the pipe work. To this end, all temporary openings such as pipe ends, fittings, etc shall be effectively covered with approved blank caps and flanged throughout the work and all pipes shall be inspected and cleaned as pipe-laying proceeds. At the completion of the work all pipe work is to be sealed with the pipe manufacturer's blank end caps where directed by the Engineer.

During the course of the work, the Subdivider shall take all necessary precautions to exclude stormwater from the pipeline trench and backfill and shall leave the trench in such a form as to minimise future erosion of the works.

6.9.2 CONSTRUCTION

The construction of all underground sewers must conform to the requirements of NZS 4452:1986 'Code of Practice for the Construction of Underground Pipe Sewers and Drains' and the requirements of these Standards, the latter to take precedence over NZS 4452:1986.

All pipes shall be tested and conform to the High Pressure Air Test.

6.9.3 BEDDING

Where unstable or unsuitable material (eg rock) is encountered in the bottom of the trench prior to pipelaying the material shall be undercut either until suitable material is reached or until the Engineer considers a suitable foundation can be achieved and lay pumice, metal or concrete as the Engineer directs.

Normal bedding shall be Type C as detailed in NZS 4452:1986 except where the gradient is steeper than ten percent (10%) in which case concrete bedding shall be used and in accordance with the Standard Drawings. Where pipes are subject to special loading, eg traffic embankments etc or other particular circumstances, the proposed method of bedding is to be approved by the Engineer prior to construction. Care shall be taken to ensure that the pipe is supported continuously along the barrel and not on the socket; a chase shall be excavated in the bedding to accommodate any socket or fitting. The bedding material used shall be selected granular non-cohesive material approved by the Engineer, with moisture content appropriate to the degree of compaction specified. The maximum particle size shall generally not exceed 10mm. The presence of an occasional particle between 20mm and 40mm is acceptable provided that the total quantity of such particles is less than five percent of the whole. If particles over 40mm are present, the material shall be rejected. The excavated material, if free from rock and well broken up by the trencher, may provided a suitable bedding material.

Where in excavation, boulders or more than 100mm dimension are encountered, the excavation shall be carried out at least 75mm below the normal depth and made up with suitable bearing materials.

6.9.4 PIPELAYING

Laying pipes by Lasers will be preferred but it will be necessary to check the accuracy above ground of any such equipment. Invert levels of all manholes shall be checked to ensure that work is proceeding according to design grades and alignment.

Pipes shall be laid commencing from the downstream end with the collars pointing upstream. Any variation must have approval of the Engineer.

6.9.5 CONCRETE SURROUND

Where encasement or bedding is required, 17.5 Mpa concrete shall be used and the work shall be in accordance with the standard drawings. The Engineer will specify when a concrete surround is required. uPVC pipe shall not be encased or bedded with concrete unless specifically directed by the Engineer.

6.9.6 FLEXIBILITY OF ENCASED PIPES

Where pipes are bedded, capped or surrounded in ordinary grade concrete, provision shall be made for breaking the concrete at each pipe joint to preserve the flexibility. This can be done by inserting a piece of 'soft board' into the wet concrete at the time of pouring.

6.9.7 THRUST BLOCKS

Cast in situ thrust blocks shall be provided at all bends and tees to the sizes shown in the Standard Drawings. All thrust blocks shall be poured against trimmed natural ground. The concrete is to be separated from the uPVC, HDPE or ABS by a material such as malthoid,

approved by the Engineer. This material shall prevent any bond forming between the pipe and the concrete. Concrete shall not encase more than 135 degrees of the pipe diameter.

6.9.8 COVER

Cover to pipes shall preferably be not less than 750mm in roads or 600mm in driveways, berms, gardens or footpaths. Exceptions will be allowed where absolutely necessary. The width of the excavation shall be the minimum required to permit reasonable access for laying, jointing and installing fittings and shall comply with NZS 7643 for uPVC pipes or otherwise in accordance with the pipe manufacturer's recommendation. The bottom of trenches are to be trimmed where necessary and the depth may have to be varied through local undulations to provide reasonably uniform grades, but in no case shall the cover be less than that stipulated above except with the express permission or instruction of the Engineer. Additional depth of excavation may necessary through "over-vertical" or summit curves to ensure that the minimum specified cover is maintained throughout.

6.9.9 PIPES THROUGH WALLS

Where the pipes pass through walls, the joints shall be watertight. Extreme care shall be taken that the pipe is free of all dirt and grease. All pipes through walls shall conform to the appropriate Standard.

All uPVC sewer pipe shall be connected to concrete structures via a proprietary uPVC manhole connector supplied by the pipe manufacturer.

6.9.10 PIPELAYING BELOW WATER

Should water appear in excavations, it shall be kept down below the level of the joints and bedding by the appropriate means of either a side channel and pumping or well jointing.

All wells or sumps shall be sunk and pumps fixed so as not to interfere with the work of bedding, laying and jointing of the pipe.

Should the Subdivider fail to take adequate steps to keep the sub-soil water down, or should the Engineer consider the methods adopted by the Subdivider are endangering or damaging the bedding or pipe, the Engineer shall advise the Subdivider and may require pipes and bedding to be relaid when methods acceptable to the Engineer are in place.

All care shall be taken to ensure that no completed lines are subject to floating. Any pipelines which float are to be relaid. The cost of relaying shall be borne by the Subdivider.

Where the bedding material is soft, wet or spongy and in the opinion of the Engineer, is not satisfactory for the laying of pipes, the Subdivider shall supply approved free draining material (eg basecourse) to stabilise the bedding.

In the event of infiltration being detected after laying pipes through subsoil water areas, the Subdivider shall locate and repair the defects causing the infiltration.

6.9.11 BACKFILLING

6.9.11.1 General

Where the Engineer so requires, unsuitably excavated material shall be replaced by quarry strippings or other approved material. No backfilling shall be done until the laying, jointing and haunching of the pipeline has been approved for backfilling by the Engineer. Backfilling shall be carried out as soon as possible after the pipeline has been approved for backfilling. Material shall be carefully placed and not dropped and shall be well compacted in layers by approved mechanical means.

6.9.11.2 Haunching

The maximum particle size shall generally not exceed 10mm. The presence of an occasional particle between 20mm and 40mm is acceptable provided that the total quantity of such particles is less than five percent of the whole. If particles over 40mm are present, the material shall be rejected. Re-excavated material, if free from rock and well broken up by the trencher, may provide a suitable bedding material.

Haunching of the surround to half barrel height shall be carried out after the pipe has been laid on the bedding and inspected and approved by the Engineer. The bedding material, except when otherwise directed, shall be used for the haunching which shall be well compacted by hand tamping in layers not exceeding 150mm. Material at the sides of the pipes shall be compacted to 90% of the optimum density before placing excavated or imported materials over the pipe.

6.9.11.3 Initial Backfilling

The initial backfilling will be carried out over the haunching to a maximum height of 150mm above the top of the pipe with selected fill approved by the Engineer and this shall be compacted in layers not exceeding 150mm. The initial backfilling and haunching shall be by the same method regardless of the location of the sewer, ie whether under road reserves or in lawns, gardens etc.

6.9.11.4 Final Backfilling

Final backfilling shall be carried out above the initial backfilling with excavated or other approved material. Layers shall not exceed 150mm in road reserve or private driveways nor exceed 500mm in lawns, gardens, etc and shall be compacted mechanically. No mechanical compaction shall be used until the pipe is covered by the pipe manufacturer's recommended depth of material.

6.9.11.5 Compaction Requirements

In all cases compaction will be carried out in accordance with Sewerage Reticulation and Disposal Facilities Drawing, SS-01.

NOTE No backfilling shall be compacted to a lesser standard than the undisturbed ground immediately adjacent to the trench of structure.

6.9.11.6 Backfilling in Carriageways

Where pipes are laid across existing or proposed roadways the backfilling must be in accordance with the following:

- (a) A minimum of 150mm above the pipe is to be selected compacted material to act as a cushion.
- (b) The remainder of the trench to within 125mm of the surface shall be backfilled with suitable compacted material placed in layers not exceeding 150mm as specified above.

All trenches within existing formed carriageways shall be reinstated as per the requirements of the Rotorua District Council Street Opening Specifications booklet. In particular the finished reinstatement level must match the existing level.

1. Hotmix must be joint sealed to hotmix with an approved sealer.
2. Hotmix must overlap chipseal by 100mm.
3. First coat chipseal to butt to edge of existing seal. Second coat chipseal must overlap existing chipseal by 100mm.

6.10 CONNECTIONS

6.10.1 GENERAL

All connections, whether into reticulation lines or into manholes shall be sealed by a factory manufactured stopper fixed with a rubber ring. Connections shall conform to the details in the Standard Drawings.

A chamber can only be used at the end of a lateral just inside the boundary on private property if the depth from the invert on the outlet pipe to the ground level will not exceed one metre. It can be used at the end of a public drain if the depth of the invert on the outlet pipe will not exceed one metre from the ground surface, or to the satisfaction of the Engineer.

The existing sewer main and inspection chamber or manhole shall be protected by a memorandum of easement in favour of the Rotorua District Council.

6.10.2 BRANCH CONNECTIONS

Where lengths of 100mm diameter branch connections are included in the works, these shall be constructed of Vitrified Clay or uPVC pipes. All specification clauses relating to trenching, excavation, pipe laying, backfilling etc shall apply to the construction of these lines.

6.10.3 POSITION OF LATERALS TO PROPERTIES

All households shall be provided with an individual connection. The connection shall extend 0.5m into the body of each lot.

6.10.4 CONNECTIONS TO PIPELINES

Connections and junctions to the main shall be accomplished as detailed in the Standard Drawings. The level of the connection will be constructed to terminate at the level appropriate to service the building site.

6.10.5 SADDLING

Saddling of pipes for connections will not be permitted unless with specific approval of the Engineer. Saddles shall only be allowed where manufactured junctions cannot be obtained, and must be of an approved pre-manufactured type installed to the manufacturers specification.

6.10.6 MARKER POSTS

The termination of a house connection shall be marked by a 50mm x 50mm treated timber (treated pine or better) marker post painted red. This post shall extend from the pipe end to at least 300mm above the finished ground level. Posts shall be supplied by the Subdivider at his expense. The posts shall be inserted at the time of installation of connection and not driven into the ground after backfilling has been completed. Connections shall be accurately indicated on 'As-Built' plans.

6.10.7 EASEMENTS

Where a public sewer is laid within private property, it shall be protected by an easement in favour of Council and of sufficient width to allow practical access for maintenance, and shall be not less than 3.0m wide.

6.11 MANHOLES

6.11.1 GENERAL

Manholes shall be provided at every change of direction, at every main junction, at every change of gradient, at distances apart not exceeding 100 metres and at the end of every line except where approved by the Engineer.

Manholes and access points shall not be located in stormwater ponding areas and in overland flow paths. In the event this is unavoidable, the affected manhole/access point shall be specifically designed to preclude the ingress of surface and groundwater. The specific design shall include an approved mechanical sealing arrangement between the cover and the frame.

6.11.2 SHALLOW MANHOLES

Where the depth to invert of the manhole is less than one (1) metre and it is serving less than four houses a shallow type manhole may be constructed with a minimum diameter of 500mm. In all cases, shallow manholes shall be of sufficient dimension to allow full benching.

6.11.3 STANDARD MANHOLES

Where the depth to invert exceeds one (1) metre and where inlet and outlet pipes are 600mm diameter or less, the Standard Manhole is to be constructed. For pipes greater than 600mm diameter, each manhole will have to be individually designed and approved.

Cast-in-situ manholes shall be constructed in accordance with the Standard Drawings. Precast manholes shall consist of 1050mm diameter Class X flush jointed pipes with holes precast into the walls for steps irons. Prior to jointing, the recess at the joint shall be filled with an approved jointing compound such as R.B.200 in order to prevent leakage at the joint. In country where the water table is high or where directed by the Engineer, joints between sections and between manholes and lid shall be effected using approved jointing “clips”.

A flexible joint shall be located either side if the manhole not more than 300mm from the manhole’s outer wall. No precast units shall be permitted to bear directly onto any pipe. An additional flexible joint shall be located not more than 800m from the wall of the manhole, (or in accordance with the Standard Manhole Drawing where the pipe size exceeds 375mm in diameter) where ground conditions indicate a settlement of 25mm or more is likely or when directed by the Engineer. These pipes shall be supported by an extension of the floor concrete to a point just short of the joint. This applies to both mains and laterals.

If the manhole is less than 2 metres deep and not located in the carriageway, then a single flexible joint is acceptable.

In areas where geothermal conditions could cause concrete decay as determined by the Engineer, GRP or HDPE manholes will be required. Prior to installation the contractor shall submit drawings showing the position of the inlets, outlets and overall dimensions, for approval by the Engineer.

6.11.4 STEP IRONS

Where manhole depths exceed one (1) metre, step irons shall be provided to conform with the Standard Drawings. The step irons shall be constructed from 20mm diameter mild steel, hot dipped galvanised with a coating of not less than 400 grams per square metre. All step irons shall have “stepped” irons. In thermal areas where approved by the Engineer, ladders or step irons are not provided.

6.11.5 MANHOLE LIDS AND COVERS

Standard manholes shall conform with the following:

Table 6.2: Standard Manhole Specifications

Location	Type of Cover	Thickness of Lid Slab	Dia. of R/Steel in con. Cover
In all situations	Cast iron heavy M.H cover 500mm dia. clear opening	150mm	12mm dia. at 150mm centres

Castings shall be in accordance with the weights shown on the Standard Drawings. The use of lid rings on the top slab shall be limited to a maximum height of 200mm.

6.11.6 DROP JUNCTIONS

Where the fall in a manhole exceeds 500mm, a drop connection is required in accordance with Standard Drawings. Where the fall is less than 500mm but greater than 200mm, falls shall be constructed as ramps for the incoming pipe to the channel invert.

External drops shall be used on 150mm or greater diameter lines unless otherwise directed by the Engineer.

6.11.7 MANHOLES ON UNSUITABLE FOUNDATION MATERIAL

Where a manhole is to be constructed on unsuitable foundation conditions, the area under the manhole shall be undercut down to solid ground or until suitable conditions are reached and backfilled up to the underside of the manhole base with hardfill.

6.11.8 FALL THROUGH MANHOLES

Where there is a change of direction in a manhole, the loss of velocity at change of direction must be compensated for by a drop of 10mm plus 3mm for every 15° of change of direction. This applies for velocities up to 1.2 metres per second.

For higher velocities:

$$\text{Drop} = 10\text{mm} + \frac{(\text{Angle of Deviation} \times V^2)\text{mm}}{7.5}$$

The minimum fall allowable is 15mm.

Where an increase in pipe size occurs, the soffit/s of the inlet/s shall not be lower than the soffit of the outlet. This will also apply to multiple inlets subject always to the requirement for minimum fall through the manhole in respect of each pipe.

6.11.9 BACKFILLING AROUND MANHOLES

Backfilling around manholes in road reserves and private driveways shall be carried out with selected fill or other approved material which shall be compacted in layers not exceeding 150mm and in lawns, gardens, etc not exceeding 500mm.

6.11.10 PRECAST LIDS

Standard precast reinforced flat lids of a minimum of 150mm thickness shall be used. The opening shall be located as shown on the standard drawings.

6.11.11 PRECAST RISER SECTIONS

Precast concrete riser sections shall be manufactured to the requirements of NZS 3107:1978 Precast Concrete Drainage and Pressure Pipes. The standard precast risers shall consist of circular sections with nominal internal diameter of 1050mm and wall thickness shall be in accordance with NZS 3107:1978 Class X pipes unless otherwise specified.

6.11.12 MANHOLE BENCHING

Benching in manholes shall be concrete rendered and trowelled smooth with a steel tool and neat cement. Inverts to manholes shall be made smooth and true to grade with flow channels neatly curved at changes in direction or the pipelines or at junctions. The practice of utilising a half round pipe to form the channel is permitted on manholes without any change of direction only. All channels shall be true to grade, properly shaped and constructed in accordance to the Standard Drawings. All connections to manholes shall enter by way of properly formed channels through the benching. All branch connections shall be curved in the direction of the flow and set to discharge above the invert of the main channel.

6.11.13 CAST-IN-SITU BASES

Cast-in-situ bases for manholes shall be a minimum of 150mm thickness and shall extend at least 150mm radially outside of the outer dimension of the manhole section. The base concrete shall be brought up to or over the connecting sewer pipes before the first riser section is placed. If required, the riser section may be recessed to fit over the connecting sewer pipe. The riser section may be placed before the base concrete has taken initial set and then carefully adjusted to alignment. A minimum 25mm gap between the sewer pipe and manhole riser shall be maintained to ensure no direct load is on the sewer pipe. The base concrete is to extend 150mm up the outside of the riser section.

6.11.14 PRECAST BASES

Shall comply with the Standard Drawings in all respects and shall be carefully placed on the prepared bedding so as to be fully and uniformly supported in true alignment. The openings for incoming or outgoing sewers shall be neatly broken out. Pipes shall be cast into the wall using Epar epoxy or similar compound to provide a firm water tight joint. Refer to clause 6.10.9 for joining uPVC pipe through walls.

6.11.15 FINISHES TO MANHOLES

The internal walls of the manhole shall be made smooth and free from joint gaps to the satisfaction of the Engineer.

All joints that will allow grout to take hold shall be filled and made smooth. In particular, between risers manhole top collar (lid-rings) and frame and manhole top and risers.

In addition, all internal, rough or protruding material left over from the casting process shall be removed by suitable means and made smooth to the satisfaction of the Engineer.

6.12 CLEANING EYES

Cleaning eyes may be constructed after obtaining prior approval in writing from the Engineer. They shall be constructed in accordance with the Standard Drawings.

6.13 TESTING GRAVITY SEWERS AND MANHOLES

6.13.1 TESTING – GENERAL

The subdivider shall supply all equipment required to carry out the tests. All pipes should be pre-tested by the Subdivider before testing in the presence of the Engineer. All sewers shall be visually inspected for joints and bedding at the as laid condition. No joints may be covered until the pipeline has been approved by the Engineer. Open trench testing may be used for the interim acceptance of a pipeline but shall not be used as a basis for final acceptance.

The tests will be carried out in the presence of an Engineer upon receipt of 24 hours notice from the Subdivider. The first test will incur no charge from Council. In the event of this test failing, any further tests on the same line will be charged at cost.

6.13.2 INFILTRATION TEST

If the groundwater level is above the buried pipeline, a test for infiltration will be carried out in accordance with Clause 402.15.2 of NZS 4404:1981, ie: Total Infiltration in any portion of a Sanitary Sewer shall not exceed a rate of 600ml per 25mm of pipe diameter per 1000m of pipe in 5 minutes.

The source of any observed infiltration shall be investigated and any defect discovered repaired.

6.13.3 LAMPING/INSPECTION

All sewers shall be lamped to check trueness of alignment and grade and that they are free from obstructions and joint defects. Final acceptance will be based on the above test carried out after all backfilling has been completed.

6.13.4 HIGH PRESSURE AIR TEST

Note:

This will supercede clause 11.5 of NZA 4452:1986. Code of Practice for the Construction of Underground Pipe Sewers and Drains.

Method

The completed pipeline shall be effectively plugged and air introduced until the required internal pressure is reached. After the air inside the pipe has attained a uniform temperature, as indicated by the pressure becoming steady, the supply of air shall be disconnected and the pressure checked and again measured after the test period of five minutes. Pressure will be measured by means of a suitable gauge marked in graduations of 1kPa.

Test Pressures

The aim is to submit the pipe to an internal pressure equivalent to 2.5m head of water greater than the external pressure. Thus the test pressure will vary according to the surrounding Ground Water Level (G.W.L).

As 1m head of water is equivalent to 10kPa, the initial test pressure shall be 25kPa when pipes are laid above G.W.L. The allowable drop in pressure after five minutes will be 7kPa. For every 0.5m below G.W.L, these pressures will increase by 5kPa. (See table below).

Table 6.3: Test Pressures for Gravity Sewers

Location of Pipe Invert Relative to G.W.L (m)	Initial Test Pressure (kPa)	Minimum allowable Pressure after 5 min (kPa)
Above G.W.L	25	18
0 – 0.40m below	30	23
0.5 – 0.99m below	35	28
1.0 – 1.49m below	40	33
1.5 – 1.99m below	45	38

The inspection procedure will be recorded on the standard form “Record of Sewer Inspection” by the Engineer. One copy shall be handed to the Subdivider or his representative and one copy shall retained by the Engineer inspecting the work.

6.13.5 WATER TEST

The test shall be carried out in accordance with NZS 4452:1986 clause 11.3.

6.13.6 TESTING OF MANHOLES

Manholes may be tested for water tightness by filling for 30 minutes. The allowable loss shall not exceed 1 litre per metre depth. Care must be taken that undue pressure is not put on any of the downstream sewer while this test is taking place.

6.14 PRESSURE LINE TESTING

The subdivider shall be responsible for testing all lines and fittings and for providing all the necessary equipment, water and materials for such testing.

All pipes and fittings shall be subject to a pressure test after laying, jointing and are covered with backfill. The section to be tested shall be capped or flanged off at either end. The blanked off ends and all bends, tees, etc shall be securely strutted or otherwise prevented from movement before applying any pressure.

The subdivider shall provide means of bleeding air from both ends of the pipeline where directed by the Engineer. Pipes shall be slowly filled with water allowing all air to escape and left for 24 hours to allow any take-up. The pressure shall then be slowly raised by means of a pump to test pressures indicated below. The test pressure shall be measured at the lowest point of the line under test and for steel pipelines shall be maintained for a period of 30 minutes during which time the leakage shall not exceed 750ml per 100mm of pipe diameter per kilometre of pipe. Testing of uPVC pipe shall be in accordance with the requirements of Section 9 Procedure B of NZS 7643:1979, except for pipes of diameter less than 100mm. N.B which shall be tested in accordance with Procedure A. Test pressures shall be as tabulated below:

Table 6.4: Test Pressures for Pressure Lines

Class of Pipe	Test Pressure	
	Metre Head	KPA
Class B uPVC	90	900
Class C uPVC	135	1350
Class D uPVC	180	1800

Any faulty pipes, joints or fittings shall be replaced by the Subdivider and the line retested. All pipes are to be tested so that the specified test pressures are achieved but not exceeded in such lengths of pipe as may be approved by the Engineer. All pipes shall be pretested by the subdivider before testing in the presence of the Engineer. Should any section of pipe fail this latter test, the cost of attendance by the Engineer at the subsequent test or tests shall be charged at cost. Test sections shall not be longer than 1000 metres.

6.15 SEWAGE PUMPING STATIONS

6.15.1 GENERAL

Sewage Pumping Stations shall be vested in the Rotorua District Council.

Model Pumping Station drawings are available from Council.

Sewage Pumping Station design shall be subject to the Engineer's specific approval and shall meet the following general requirements:

1. The electrical control cabinet shall be above ground level and shall be to Rotorua District Council design and specification.
2. The pump well shall be underground and have lockable aluminium lids.
3. Pumps shall be "Flygt" 3 phase submersible type design for each to take the full flow and be capable of passing a 75mm diameter solid.
4. There shall be a minimum of two pumps in all pump stations.
5. Valve chambers shall be below ground level, attached but separate from the pump well. Provisions shall be made to bypass the pumps in case of breakdown. Non-return valves shall be ball-valves full-bore opening. Valve chambers shall have lockable aluminium lids.
6. The capacity of wet-well between start and stop levels shall be such as to limit pump starts to no more than ten per hour.
7. Residential Pump Stations shall be designed for a peak flow rate of 1m³ per person per day in the fully developed catchment. Other Pump Station's capacity will be subject to specific design and must be approved by the Engineer.
8. All pumps chambers shall have a single inlet pipe.

6.15.2 DUTY

Pumps shall be controlled so that while one pump is acting as duty pump, the other is on automatic standby. The switchboard configuration shall allow the duty sequence to be interchangeable remotely via the District Council Telemetry System.

6.15.3 EMERGENCY PROVISIONS

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. Emergency storage capacity equal of eight (8) hours at the design average daily 220 l/c/d flow is to be provided.

All stations shall be constructed with a standard plug for the connection of Council's Mobile Generator. All pump stations shall have an approved and controlled overflow system which discharges in such a manner to ensure maximum storage is used prior to discharge.

6.15.4 SITE

The actual site of the pumping station shall be on a separate lot with an accessway (if required) to a formed road. Resource Consent may be required for the construction and installation and where necessary must be obtained by the Developer prior to the commencement of Engineering Works. The site shall be developed to prevent entry of surface runoff into the station.

6.15.5 TELEMETRY MONITORING SYSTEM

The Telemetry system shall be compatible with Council's existing system, include an approved radio link and be subject to approval by the Rotorua District Council.

6.15.6 POWER SUPPLY

The power supply to the station shall be underground.

6.15.7 WATER SUPPLY

A 25mm water supply shall be provided to the immediate vicinity of the Station. The supply shall be fitted with a backflow preventor in accordance with the requirements of the Building Act and the Engineer. The supply shall also be fitted with an approved meter.

6.15.8 ACCESS

Permanently surfaced vehicle access and manoeuvring areas shall be provided to the station.

6.15.9 FENCING

The area around the pumping station shall be fenced to the Engineer's satisfaction Council shall not become responsible for fencing costs.

6.15.10 TYPICAL DESIGN

A typical design of a pumping station is included in the standard drawings.

6.16 TREATMENT PLANTS

6.16.1 GENERAL

In special cases where a Treatment Plant is required, the subdivider must construct a Plant to a design that is satisfactory to the Engineer, the Regional Council and the Medical Office of Health. The design must have the prior approval of the above. Resource Consents may be required and where necessary, must be obtained by the subdivider prior to the commencement of any Engineering works within the subdivision. Any consents shall be obtained by the subdivider.

6.16.2 POWER SUPPLY

The power supply to the Plant must be underground.

6.16.3 WATER SUPPLY

The Treatment Plant is to be provided with a water supply in the immediate vicinity. The supply shall be fitted with a backflow preventer.

6.16.4 ACCESS

Sealed vehicle access and manoeuvring areas must be provided to the Plant.

6.16.5 FENCING

The area around the Plant must be fenced and provided with a suitably locked gate, all to the Engineer's satisfaction.

6.16.6 SITE

The actual site of the Plant shall be on a separate lot with access to a formed road. After the Plant has finished operating it must be removed and the area may revert to any suitable site the subdivider may stipulate. In certain cases, specific conditions will be set by Council resolution at the time of the subdivision consent approval.