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SECTION B : CONSTRUCTION SPECIFICATION

1.0 GENERAL

Work shall be carried out in strict accordance with the Standard Technical Specification outlined in this section.

2.0 MATERIALS

2.1 Standards

All materials used shall conform with Part A of this Standard Technical Specification.

The material or product is required to conform to an Australian or New Zealand Standard and also be licenced to that Standard. Where there is no standard, the specification of the material or product must be provided in detail for acceptance.

2.2 Pipes

Pipes shall be of the type and class shown on the Drawings.

2.3 Concrete

All materials, manufacture and concreting procedures shall conform with NZS 3109:1997 - Concrete Construction.

All concrete shall have a minimum crushing strength of 20.0 MPa at 28 days unless otherwise specified or detailed.

2.4 Roding Materials

Roding materials, chips, sealers etc shall comply with Clause 1 of Part 3 of this Volume.

3.0 STORAGE OF PIPES, MATERIAL AND PLANT

Materials shall be stored in such a manner that will ensure the preservation of the quality and fitness for the work. They shall be so located and disposed that prompt and proper inspection thereof may be made.

4.0 STREET OPENINGS

For any work located in a designated road reserve, a street opening permit will be required.

All excavations in road reserves shall comply with the requirements of Clause 13 of Part 3 of this Volume.

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For specific road opening requirements in participating districts refer to Volume 5 Part 4.

5.0 EXISTING UTILITY SERVICES

Before commencing any excavation, all service utility providers will be contacted and any approvals necessary for excavating in the region of their services will be obtained. Any special restraints imposed by the utility provider in regards to working in the vicinity of their service must be adhered to. Refer Part 1 of this Volume.

6.0 EXCAVATION

6.1 General

Pipelaying shall be carried out in open cut except where permission has been obtained from Council for alternative methods.

6.2 Trench Outlines

The purpose of trench outlines is to avoid overbreak or lifting of sealed surfaces or stabilised sub-base material where trenches are located in sealed pavement. Outlines are to be cut using an abrasive type cutting wheel or other approved means.

6.3 Trench Protection

All working methods adopted shall be subject to the conditions of the "Health & Safety in Employment Act 1992" and any amendments and regulations in force. Where required by the Act, the Occupational Safety & Health Inspector of the Department of Labour shall be notified and any work required by the Inspector undertaken.

All work shall be undertaken in such a manner that the safety of all existing buildings, structures, services and property is not compromised. Particular attention shall be paid to the maintenance of access for pedestrian and vehicular traffic. Where these provisions would be jeopardised by battering the trench to a "safe slope", in compliance with the regulations, then timbering or other approved shoring system shall be used.

All timber used in trenching shall be removed before backfilling.

6.4 Subsoil Water

Water in the excavation shall be controlled so that the level of any such water shall be kept below the level of the underside of the bedding and/or concrete work until the work has been accepted and backfilling completed.

Groundwater seepages through the trench sides shall be prevented to aid both the stability of the excavation and the achievement of suitable backfill densities.

The drainage of the ground shall not be permanently altered so as to create further or future ground instability. No material or fines shall be removed from the groundwater during the dewatering process.

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Under no circumstances shall water from any source be permitted to drain into any existing wastewater sewer. No nuisance shall be allowed to be caused by the discharging of the groundwater.

6.5 Trench Excavation

All excavation shall be carried out to the grades and levels shown on the drawings. The width of the trench shall be no greater than is essential to permit all operations necessary for the jointing of pipes, placing of concrete, compaction of backfill and inspection to be carried out efficiently. The width of the trench measured at the elevation of the top of the pipe shall not exceed the minimum for H2 bedding as defined in AS/NZS 3725:2007.

Excavation for manholes shall be of sufficient size to leave adequate space for construction. The length of trench or area of opening to be made shall be kept to a minimum which recognizes the reasonable requirements of pedestrians and wheeled traffic.

Excavated materials shall not be stockpiled in such a location, to such heights or in any such way as to cause any damage to or instability of the trench or any blocking of roads, footpaths or accessways.

6.6 Extra Excavation

Where, in the opinion of the Engineer, the ground below the specified bedding level is not suitable, it shall be excavated to a depth directed by the Engineer and backfilled with the crushed metal mix specified in Clause 9.1 of this Specification, or approved free draining granular material as specified by the Engineer and compacted in layers not exceeding 300mm using mechanical tampers or vibrating plate compactors as is appropriate to the material type being compacted.

Any excavation made deeper than the minimum required for bedding shall be backfilled and compacted to the required level at the Contractor's own cost.

6.7 Excavated Material Unsuitable for Backfill

Where, in the opinion of the Engineer, the excavated material is not suitable for use in backfilling, this material shall be carted away and disposed of and shall be replaced with suitable bulk backfill material compacted in layers by mechanical tampers or vibrating plate compactors as is appropriate to the material type.

6.8 Excavated Wet Material

Where, in the opinion of the Engineer, excavated material is too wet for immediate re-use as backfill, but will be suitable if allowed to dry, such material shall be stockpiled at any site that may be agreed and, when ready, replaced in the trench as backfill in accordance with Clause 10.3 or 10.4 (if the excavation is in a carriageway area) of this Specification.

7.0 DISPOSAL OF EXCAVATED MATERIAL

All excavated material which is not required for backfilling, or which has been deemed unsuitable for backfilling under Clause 10.3 of this Specification, shall be removed from site

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and disposed of at the Contractor's own expense and the rates tendered in the Schedule of Prices shall be deemed to have allowed for this.

The Contractor's site or sites used for disposal of 'surplus' excavated material shall be subject to the approval of Council and the Engineer before any material is deposited there. The material shall be spread and the disposal sites left in a tidy condition.

It shall be the Contractor's responsibility to arrange all necessary consents.

8.0 LICENSED DRAINLAYERS

All wastewater drainage work shall be under the direct control of persons holding a current drain layer's license, or wastewater service persons holding the qualification of National Certificate in Water Reticulation (water or wastewater strand).

All stormwater drainage work shall be under the direct control of persons holding a current drain layer's licence, or wastewater service persons holding the qualification of National Certificate in Water Reticulation (water or wastewater strand).

In participating districts all services are to be installed under the supervision of a licensed drain layer or suitable service persons approved by Council (refer Volume 5 Parts 3 & 4).

9.0 BEDDING, PIPELAYING AND JOINTING

9.1 Bedding

Bedding of pipes shall be "Type H2" Bedding or "Type HS2" in carriageways in accordance with AS/NZS 3725:2007 — Concrete Pipes, or AS/NZS 2032:2006 — Installation of PVC Pipe systems, unless specifically modified by the Engineer and the modification is approved by HCC.

No bedding shall be placed or pipes laid before the trench bottom has been inspected and accepted by the Engineer.

An evenly compacted bed of a minimum depth of free draining granular material in accordance with AS/NZS 3725:2007 shall be laid on the bottom across the full width of the trench, to give continuous full support to the barrel of the pipes. In order to ensure no extra loading is placed on the pipe socket bellholes shall be excavated in the trench bottom under the sockets.

Where the bottom of the trench will not provide adequate support for the pipe, the Engineer shall order the use of additional granular bedding material as specified in AS/NZS 3725:2007 — Concrete Pipes, or AS/NZS 2032:2006 — Installation of PVC Pipe systems, for such depths as are necessary.

For pipes 300mm diameter and smaller the surface of the granular bedding material shall be blinded with sand to provide a smooth bedding for the pipe.

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Every pipe shall be examined immediately prior to being laid and the interior and jointing surfaces cleared of all rough projections and debris.

9.2 Pipelaying and Tolerances

9.2.1 General

Pipes made of plastic materials shall be laid with product labelling uppermost in the trench.

The "swift lift" system shall be used for pipes 750mm diameter and over.

9.2.2 Grade Control

Pipes shall be accurately laid to the lines, levels and gradients shown on the Drawings using pipe-laying laser equipment.

The variation between specified invert level and invert level as laid shall not exceed 5mm.

The variation from grade of one pipe to the next shall not exceed 3mm.

Where the variation exceeds the tolerance the Engineer may order the removal and relaying of the pipes affected.

9.2.3 Service Connections

The minimum acceptable grade for 100NB wastewater service connection pipelines is 1:80 (the preferred grade is 1:60).

The maximum depth at the end of the service connection pipe shall be between 0.9 and 1.5 metres with a depth of 1.2 metres preferred. Exceptions to this specification require specific approval of Council (Circumstances include large lots where this maximum depth is inadequate for draining the entire lot area, and when lots slope away from the direction of drainage).

Up until a service connection is utilised (i.e. connected to private drains) it shall be indicated on site as shown in Drawing TS404.

9.3 Jointing

9.3.1 Rubber Ring Joints

Rubber ring joints shall be installed strictly in accordance with the manufacturers instruction. Care should be taken to ensure that the rubber rings are located evenly around the joint with no twists in them. The pipe shall be pushed up firm and tight to the joints.

10.0 BACKFILLING

10.1 General

Backfilling shall keep pace with the excavation and laying of pipes so that not more than 15m of pipes shall be left exposed in open trench where this could represent a danger to road users.

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10.2 Pipe Surround Material

Approved free draining granular material such as detritus free 'run of pit' sand shall be used between the top of the pipe bedding material and to a level 300mm above the crown of the pipe for the full width of the trench. This pipe surround backfill material shall be thoroughly compacted using mechanical tampers or vibrating plate compactors as is appropriate to the material type in layers not exceeding 300mm.

Care shall be taken during compaction operations to prevent displacement of any laid pipes. The degree of compaction shall be such as to produce an insitu density which shall, at a minimum, be equal to 95% of the maximum dry density as determined by the Standard Compaction Test.

10.3 Bulk Backfill Material Outside of Carriageway Areas

Bulk backfill shall be placed in layers and mechanically compacted as for 'pipe surround material'.

Subject to the approval of the Engineer, previously excavated material shall, be used as 'bulk backfill material' above the 'pipe surround material'. Where previously excavated material is found to be unsatisfactory for bulk backfilling purposes, 'pipe surround material' (Clause 10.2 of this Specification) shall be used.

The degree of compaction shall be such as to produce an insitu density which shall not be less than that of the material prior to excavation. To establish the criteria for compliance, scala penetrometer tests shall be carried out along the line of the trench prior to excavation. There shall be not less than 1 test per 50 m of trench length.

Compaction tests (or substituted scala penetrometer tests) shall be carried out for the full depth of the trench to within 300mm of the pipeline (subsequently referred to as the 'test area'). There shall be at least one test area per 50 metres of trench length, or, at least one test area per 50 cubic metres of trench backfill whichever method returns the greater number of test areas.

Compaction test results (or substituted scala penetrometer tests) shall be submitted to Council for approval by appending test results to the QA form Checklist 4.1 Volume 4 Part 4 & 5 of the Development Manual.

For bulk backfill requirements in participating districts refer to Volume 5.

10.4 Bulk Backfill Material in Carriageway Areas

For backfilling and trench reinstatement in carriageways, see Section 13 of Part 3 of this Volume.

Compaction test results (or substituted scala penetrometer tests) shall be submitted to Council for approval by appending test results to the QA form Checklist 4.3, Volume 4, Part 4 & 5 of the Development Manual.

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11.0 MANHOLES

11.1 Types

Manholes shall be constructed in the position and to the details as shown on the Drawings.

Precast concrete manhole components may be used for the works subject to them complying in all respects to details specified hereafter and the details for finished manholes shown on Drawing No. TS400.1-6.

Where precast manhole units are used, the joints of all abutting units shall be sealed against ingress of water by the use of Expandite BM100 'Sealastrip' or an approved equivalent.

11.2 Channels and Benching

A semi-circular channel shall be formed in the concrete floor of the manhole. The benching shall rise vertically from the horizontal diameter of the pipe to the height of the soffit and then be sloped back at a gradient specified on the drawings upwards to the Manhole wall.

The flow channel shall be formed so that it presents an evenly curved flow path through the manhole. The cross section of the flow channel shall be uniform.

In wastewater pipelines the channel shall be lined with ceramic half pipes, or alternative channel forms listed in Section A. Ceramic half pipes shall be saw cut to form mitred joints around bends if necessary.

Benching shall be floated to a dense, smooth hard surface using 3:1 sand cement mortar and a steel float. Side branches shall be similarly formed with a smooth bend into the main channel.

The benching shall have step recesses as shown on drawing TS400.1-6.

A U3 standard of finish as specified in NZS 3114:1987 shall be achieved.

The construction tolerance for drop through the manhole shall be:

- no less than the Manhole Drop as shown on drawings, or
- no more than 5 mm more than the Manhole Drop as shown on drawings.

11.3 Flexible Joints

All pipe lines shall have a flexible joint adjacent to the manhole on all incoming and outgoing pipes as shown on Drawing No. TS400.1-6. The base of the manhole shall extend up to these flexible joints. The upper part of the pipe inside the manhole shall be cut back to the wall, the reinforcement cut out and the ends plastered with a cement mortar to a neat finish. Manholes not located at changes of line or gradient or at junctions with existing or proposed pipeline may, be moved sufficiently to utilise existing pipe joints.

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11.4 Drop Connections

Drop connections at manholes shall be designed as external connections in a manner similar to the illustrations in Drawing TS400.1-6. Internal drops shall only be used where manhole diameters are 1200 mm or greater.

11.5 Manhole Steps

11.5.1 *Manhole Step Location*

Manhole steps shall be provided at 300mm centres vertically (refer Drawing TS400). The top step shall not be more than 300mm below the top of the top slab, and the lowest step shall be not more than 375mm above the bench, or such lower level if detailed on other than standard manholes.

11.5.2 *Bolt-Through Type Manhole Steps*

The steps shall be bolted through the walls using properly formed and recessed bolt holes. The step shall have a washer welded to it on the appropriate angle to seat flush against the inside of the manhole chamber.

Prior to tightening, BM100 shall be placed around the stainless steel shank both inside and outside the manhole riser. After the steps have been tightened in place the outside recess which houses the nut shall be sealed with Expocrete "UA" or acceptable equivalent in accordance with the manufacturers directions. Plastering of the recess will not be accepted.

The sealant is to be applied at least 48 hours before the manhole risers are required for construction.

11.6 Manhole Tops

Manhole tops shall be constructed as detailed on Drawing No. TS400.1-6. The manhole frames and covers shall be to Drawing No. TS407. The frame shall be set over the openings and adjusted to the correct height and slope using adjustment rings and mortar so as to conform with the surrounding surface — refer TS406. They shall be held in place with a bold fillet of concrete, the top of which shall be 40mm below the top edge of the frame.

12.0 SITE MORTAR JOINTING OF PIPES INTO MANHOLES OR PIPELINES OR CATCHPITS

Where it is necessary to form site mortared joints between drainage components, the following methods apply:-

- a) All screeded concrete surfaces to accept mortar shall be thoroughly scrubbed clean.
- b) All contact surfaces to accept mortar showing signs of contamination with oil, grease or any other non-water soluble agent shall be cleaned with "Expandite Mystic Acid" or an acceptable equivalent, applied and neutralised in accordance with the manufacturers directions.
- c) All mortar used for the 'on-site' jointing of drainage components shall be Expocrete "UA" or an approved equivalent. The surface priming, mixing of components, application and cure period to be in accordance with the manufacturer's directions.

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13.0 FIELD CONCRETE BANDAGE

A field concrete bandage shall be applied to all field joints as required. Bandages shall be 485 mm wide by 150 mm thick 20 MPa concrete reinforced with a strip of HRC M338 mesh 385 mm wide cut to the outside of two parallel bars. The reinforcing shall have a cover of 50 mm in all directions. Lap splices of the mesh shall not be less than 150 mm.

14.0 CULVERT INLET AND OUTLET STRUCTURES

Culvert inlet and outlets shall be constructed as shown in Drawing TS409B. Alternative proprietary structures are permissible subject to site specific approval by Council.

15.0 PAVEMENT SURFACE CONDITIONS

Pavement surface cleaning and tidy up shall progress as rapidly as the work does. Upon completion of construction activity, the site shall be left in an acceptable tidy condition.

Where vehicular or pedestrian numbers are high or where weather conditions may result in a reduced level of safety, special precautions shall be taken to reduce the potential hazard levels, such as use of temporary surface seals.

No spillage of excavated or construction materials on any road, footpath or verge shall be permitted. Where "clean- up" work is not completed in 48 hours or is not satisfactory, the Engineer may arrange "clean-up" work to be undertaken and all costs incurred will be recovered from the offending party.

16.0 SOAK HOLES

Stormwater soakage holes shall be sized and constructed as shown in the NZ Building Code — Document E1 "Surface Water" published by Building Industry Authority.

17.0 STORMWATER PIPES TO KERB AND CHANNEL

Note: Connection directly to Kerb and Channel is only permitted in limited circumstances — Refer Volume 2, Part 4.21.

A nominal 100mm diameter PVC pipe shall be used for stormwater connections to the kerb and channel. Acceptable products are set out in Section A. The pipe shall be connected to an adaptor as shown on Drawing TS322. This connection, and the one at the boundary shall be watertight to a head of 10 metres.

If a pipe to kerb & channel is the allowable but it is not possible to gravitate to the kerb, then a bubble up pit is acceptable. See Drawing TS408 for construction details.

A maximum of 3 kerb & channel connections side by side in the kerb is acceptable, although multiple kerb & channel connections from a single lot are not permitted.

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18.0 TESTING

18.1 RCRRJ Pipes 600mm Diameter and Above

Leakage occurring in the pipelines during construction shall be immediately rectified.

Before a Certificate of Practical Completion is issued, Council will carry out an audit of the pipelines to ensure there is no leakage into the line and any leakage caused by faulty materials or workmanship shall be immediately repaired.

A further inspection will be made before final approval of the work is given at the end of the maintenance period.

18.2 RRJ Pipes Below 600mm Diameter

Each section of wastewater sewer constructed as part of the works shall pass one of the three leakage tests set down in the BIA Verification Method E1/VM1 Section 8.0 (as quoted below):

Drain Leakage Tests

The materials and workmanship used in surface water drains shall pass one of the following tests:

- a) *Water test (preferred for plastic pipe materials. Not recommended for concrete pipe due to water absorption into the pipe wall.)*
- b) *Low pressure air test (preferred for concrete pipes)*
- c) *High pressure air test (considered too hazardous for general use)*

All test require the pipeline to be sealed with suitably restrained plugs at both ends and at branch connections. Because porous pipes such as those of ceramic or concrete materials absorb water and can transmit air through their walls, they would have the void filled by soaking prior to testing.

Water Test

- a) *Fill the pipe with water, ensuring all air is expelled.*
- b) *If pipe materials absorb water, leave for 24 hours.*
- c) *Top up water to test head level. The minimum head shall be 1.5m above the top of the pipe or ground water level whichever is the higher. The maximum head at the lower end of the pipeline should not exceed 6.0m.*
- d) *Leave for 30 minutes then measure water loss.*
- e) *The pipeline is acceptable if water loss does not exceed 2 ml per hour, per mm of internal diameter, per m of pipeline length.*

Comment:

Care should be taken when conducting water testing of pipes on steep gradients, to ensure that excessive hydraulic pressures are not applied.

Low Pressure Air Test

- a) *Introduce air to the pipeline till a pressure of 300mm of water is reached. (This shall be measured by a manometer such as a 'U' tube, connected to the system).*
- b) *Wait until the air temperature is uniform (indicated by the pressure remaining steady).*
- c) *Disconnect the air supply.*
- d) *Measure pressure drop after 5 minutes.*
- e) *The pipeline is acceptable if the pressure drop does not exceed 50mm.*

Comment:

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1. The low pressure air test is highly susceptible to temperature fluctuations during the test period. A 1°C change during the 5 minute test period will cause a pressure change of 30mm water gauge or 60% of the permitted change.
2. Failure to soak ceramic and concrete pipes can cause highly variable results.

High Pressure Air Test

- a) Pressure pipelines to 25 kPa.
- b) Wait at least 2 minutes to ensure temperature stabilisation.
- c) Disconnect air supply.
- d) Measure the time taken (minutes) for the pressure to drop to 17 kPa.
- e) The pipeline is acceptable if the time does not exceed that given for the appropriate pipe size in Table 5 following.

<i>Table 5: Time for pressure drop versus internal pipe diameter</i>	
<i>Internal pipe diameter (mm)</i>	<i>Time for permissible pressure drop (minutes)</i>
90	3
100	3
150	4
225	6

18.3 Infiltration Test for Pipelines

The pipeline shall be observed for infiltration over a 24 hour period. For wastewater pipelines where infiltration is observed, the source shall be investigated (CCTV inspection) and any leak detected shall be repaired.

Where infiltration is observed into stormwater pipelines the following test shall apply.

A vee notch weir shall be installed at the downstream manhole and the water level behind the weir given sufficient time to reach equilibrium level. The flow will then be measured and this flow shall not exceed 1.25 litres per 10mm diameter per 100m pipeline tested per hour. Should the infiltration rate exceed this figure, the installer shall discover the cause and rectify it after which a further test shall be applied.

18.4 Infiltration Test for Manholes

Low Pressure Air Test

- a) Introduce air to the manhole till a pressure of 300mm of water is reached. (This shall be measured by a manometer such as a 'U' tube, connected to the system).
- b) Wait until the air temperature is uniform (indicated by the pressure remaining steady).
- c) Disconnect the air supply.
- d) Measure pressure drop after 5 minutes.
- e) The manhole is acceptable if the pressure drop does not exceed 50mm.

Comment:

1. The low pressure air test is highly susceptible to temperature fluctuations during the test period. A 1°C change during the 5 minute test period will cause a pressure change of 30mm water gauge or 60% of the permitted change.
2. Failure to soak ceramic and concrete pipes can cause highly variable results.

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19.0 CLEANING PIPELINES

Before acceptance of the works all pipelines shall be thoroughly cleaned of silt and any other debris.

20.0 REINSTATEMENT

All surfaces shall be reinstated as nearly as possible to their original condition and sealing shall be carried out wherever an original sealed surface has been removed or damaged.

All drains, fences and other structures shall be put back in their original place. In the case of damage, replacement shall be made using similar new items.

The Contractor shall be solely responsible for all damages that may result from their operations, and shall satisfy the Engineer that they have made proper reinstatement. Should no satisfactory efforts be made by the Contractor within a reasonable period of time, the Engineer may seek another Contractor to carry out the reinstatement to the full requirements of the Engineer. All costs resulting from the work will be deducted from any monies due, or which may become due, to the Contractor.

21.0 AS BUILT RECORDS

An accurate "as built" record shall be maintained as work progresses in accordance with Volume 1 Part 2 of this Development Manual and Section C of this Specification.

For as built requirements in participating districts refer to Volume 5.

22.0 WORK ON IN-SERVICE STORM & WASTEWATER SEWERS & MANHOLES

Where connections are required to an operating storm or wastewater sewer, the following requirements shall apply:

- i) Before any person enters any operating manhole or pipeline, the safety plan incorporating Confined Space Entry aspects shall be accepted by Council.
- ii) Before making any connection, the new line to be brought into use shall be properly cleaned out and approved by Council as complying with all specifications.
- iii) As soon as possible after the connection has been made and flow has been diverted the benching shall be finished off to its new form.
- iv) No concrete or any other debris shall be permitted to enter the sewer at any stage during connection or diversion.