CHAPTER 4

STORMWATER

CHAPTER 4 STORMWATER

PART 1 DESIGN

4.1.1 INTRODUCTION

This part sets out the basic design principles for stormwater reticulation. While some construction information is included for completeness, detailed information on construction standards can be found in Part 2 of this chapter.

4.1.2 GENERAL

The stormwater system shall provide for the collection, control and safe discharge of all stormwater within the land being developed together with drainage from the entire catchment upstream of the proposed system. The design of the stormwater system must also take into account the effects of the proposed subdivision or development on downstream systems including both reticulation and pumping.

For on-site disposal, specific design and disposal details are required to ensure that satisfactory collection and disposal is possible.

Where a subdivision or development results in an increased rate of runoff due to the increase in sealed surfaces or other reasons, the Engineer may require the Developer to provide on-site storage to restrict the discharge to the pre-development flow, until the peak storm flow has passed. Any storage system which is installed as part of a development must have in place a maintenance regime that will ensure it will continue to operate correctly in the long term.

4.1.3 STANDARDS

The stormwater disposal system shall comply with the requirements of the following standards:

NZS/AS 2033 : 1980 - “Installation of Polyethylene Pipe Systems”
NZS/AS 3725 : 1989 - “Loads on Buried Concrete Pipes”
AS/NZS 2566.1 : 1998 - “Buried Flexible Pipelines – Structural Design’
AS/NZS 2566. 2 : 2002 - “Buried Flexible Pipelines Part 2 – Installation”

4.1.4 PROTECTION FROM FLOODING

Compliance with the performance standards shall be achieved by evaluating the potential flooding risk and providing the necessary surface water control measures to satisfy the requirements.

4.1.4.1 Risk Assessment

Flood risk assessment shall take account of the characteristics of the total catchment. A search shall also be undertaken to find any relevant historical information on flooding. This could

include reviewing records held by relevant bodies, discussions with the local residents or appropriate field tests.

4.1.4.2 Evaluation

Evaluation shall address the following:

- The proximity and nature of any river, stream or water-course, and associated flood plains
- The capacity of culverts or water-courses downstream of the site and the likelihood of upstream ponding resulting from under capacity, or from blockage by debris or slips
- The upstream culvert and water-course conditions, and the location of the secondary flow path for flood waters in the event of blockage or under capacity.

4.1.4.3 Runoff

Calculations based on reasonable judgement taking account of the overall site conditions, details of the drainage system, and the probable impediments to free flow, (both upstream and downstream) shall determine the expected runoff 'Q', and show that the design flood levels at the site satisfy these Performance Standards.

4.1.4.4 Covenants

Council may consider that land and structures are unlikely to be subject to material damage, or are adequately protected from inundation if subject to drainage easements or restrictive covenants, (building line and level) covering possible inundated and 'at risk' areas. The drafting and registration of all covenant and easement documents shall be carried out by the Council's solicitors, and the cost of such will be borne by the Developer.

Developments on any such properties may, however, be subject to Sections 71-74 of the Building Act 2004.

4.1.4.5 Secondary Flow Paths

Secondary flow paths shall be identified and where appropriate, catered for by specific design, taking account of:

- The capacity of the downstream surface water system, and the risk of blockage at its intake
- The necessity for a secondary intake structure and the relative flow distribution between primary and secondary intakes for the likely degree of blockage

4.1.5 RESOURCE CONSENTS

Where the discharge of stormwater to surface water, or to land where the discharge enters surface water, is a permitted activity under the Environment Bay of Plenty Regional Water and Land Plan, the discharged water shall comply with the requirements of that plan.

Where the discharge of stormwater into the marine coastal environment is a permitted activity under the Environment Bay of Plenty Regional Coastal Environmental Plan, or is in an area included in a Comprehensive Stormwater Consent, the discharged water shall comply with the requirements of that plan or consent.

Resource Consents for stormwater discharge are not required for developments providing that discharged water meets the requirements as set out above.

Developers undertaking development works within the Whakatane District shall provide evidence that the Environment Bay of Plenty discharge conditions will be met.

For discharges which do not comply with the above conditions, Resource Consents will be required from Environment Bay of Plenty, and a copy of that Consent shall accompany the engineering drawings for approval.

The works shall be designed, constructed and maintained in such a manner so as not to cause erosion or flooding or to adversely affect any land or property owned or occupied by another person. Also refer to clause 2.3.5 of Chapter 2 – Construction Management Plan.

Council may impose such controls as it sees necessary to minimise the effects on the water and soil environment caused by the development.

4.1.6 CATCHMENT MANAGEMENT

Council has or is developing Catchment Management Plans for stormwater discharges from urban areas. These plans incorporate numerical catchment models. Where a proposed subdivision will discharge stormwater to an existing reticulated system, the Developer shall submit details to Council for approval. All discharges to a catchment shall comply with the provisions of the relevant Catchment Management Plan. Where the additional quantities involved, combined with the existing flows exceed the capacity of the existing system, Council may require the Developer to fund part or all of the cost of upgrading the existing system, in accordance with the Council financial contributions policy. Other stormwater discharges that cannot be reasonably include under an existing stormwater Catchment Management Plan will need separate Catchment Management Plans, computer models and Resource Consents. The Developer shall be responsible for obtaining these. Council will provide templates of existing Catchment Management Plans and will advise on the appropriate format for the catchment model.

Where further subdivision, upstream of the one under consideration is provided for in any district or regional plan, the Council will require stormwater pipelines to be constructed to the upper limits of the subdivision.

4.1.7 PERFORMANCE STANDARDS

In accordance with Section 106 of the Resource Management Act 1991 and Sections 71-74 of the Building Act 2004, Council shall not grant subdivision or building consents if land or buildings are subject to inundation or other hazards, unless satisfactory means of avoidance, remedy or mitigation are carried out.

Low lying areas prone to inundation by a 1% AEP storm must be identified and restricted from being built upon.

The following requirements must be met:

- The subdivider shall provide a stormwater disposal system that is adequate to safeguard people from injury or illness and to protect property from damage caused by surface water
- A primary system capable of disposal of surface water resulting from a 10% AEP storm shall be constructed
- A secondary flow system capable of carrying surface water resulting from a 1% AEP storm shall be constructed to ensure that such surface water shall not enter buildings
- Secondary flow paths shall be shown on the design plans
- All stormwater secondary flow paths shall be protected by an easement. The easement shall cover the full width of extent of the secondary flow path and shall be not less than 1.5m wide. The easement shall have the effect of preventing alteration to the ground surface and shall prohibit location of structures that may impede flow of water across the land. The easement shall be in favour of the Council and shall be duly granted, reserved and shown on the survey plan
- The Developer shall provide a stormwater reticulation system for the collection and disposal of stormwater runoff from all impermeable surfaces
- Surface flows on carriageways are to be controlled in order to enable safe and comfortable vehicle and pedestrian access across and along road reserves
- The primary disposal system for all residential developments shall be in accordance with clause 4.1.10
- All stormwater reticulation and disposal systems are to be constructed to convey surface water to an appropriate outfall using gravity flow where possible, and in a manner which avoids the likelihood of blockages, leakage, penetration by roots, or the entry of groundwater where pipes or lined channels are used, and avoids the likelihood of damage from superimposed loads or normal ground movements
- Where due to the topography of the land being developed, there is no overland secondary flow path available, the Engineer may require the installation of a pumped disposal system to provide for the 1% AEP storm event
- Accessible inspection chambers shall be provided at all changes of grade, direction and pipe size
- Self-cleansing velocities shall be maintained within reticulation systems
- The reticulation and disposal system shall be designed and constructed for a function design life of 50 years
- Damage to the environment both during and after the development construction phase shall be minimised or avoided
- A stormwater system shall be provided which can be economically maintained.
- Where a detention structure is required in accordance with Clause 4.1.2, it shall be designed to retain the runoff resulting from a 10% AEP storm, with a ten minute duration.

4.1.8 FLOOR LEVELS

A Minimum Floor Level Plan has been prepared by Council indicating minimum floor heights for buildings in various parts of the Whakatane District. The minimum applicable floor level required for a proposed development may be obtained by application to the Council.

All developments shall comply with the minimum levels stated, but notwithstanding the above, they may be subject to additional requirements as deemed necessary by the Council.
Coastal properties vulnerable to wave action may require specific design to protect them from inundation.

Building floor levels must have 500mm freeboard above the 1% AEP flood levels, must satisfy the provisions of the New Zealand Building Code, or must be in accordance with the minimum levels as defined on the Council Minimum Floor Level Plan.

Where approved by the Engineer the floor level of non-habitable and minor buildings may have the freeboard reduced to 200mm above the 1% AEP flood level.

4.1.9 STORMWATER DISPOSAL

The volume of residential roof stormwater to be disposed of shall be calculated as the run-off resulting from a 10% AEP storm, with a duration of ten minutes, using the rainfall intensity obtained as set out in Clause 4.1.11.1 and a run-off coefficient C of 0.9.

For all new “Greenfields’ developments, all lots shall have a piped stormwater disposal system discharging to an approved stormwater soakage area or watercourse. For “infill” developments within existing urban areas, the disposal of all roof stormwater shall be to an existing piped reticulation system if this is accessible, or shall comply with the conditions set out in Clause 4.1.10 below.

All stormwater discharges to open water courses into Ohiwa Harbour or on to Ohope Beach shall be subject to specific treatment and design, in accordance with Environment Bay of Plenty Guideline No. 2001/03 – “Erosion and Sediment Control guidelines for Land Disturbing Activities”. All discharges will be required to have a detention time before discharge to the waterway.

For runoff from residential lots or road reserves where discharge to a watercourse is not possible, soakage pits or swales may be permitted as a primary method of stormwater disposal, subject to satisfactory geotechnical analysis and the Council’s approval. All such soakage areas and swales shall be within dedicated drainage reserves located outside the normal road reserve. Such drainage reserves may form part of a coastal reserve or recreational reserve, subject to compliance with the affected reserves management plan and subject to the land owner’s approval.

4.1.10 STORMWATER DISPOSAL – INFILL DEVELOPMENTS

Note: *While in most cases the Developer will not be carrying out building on the new allotments, the responsibility will lie with the Developer to determine which system the site falls*

into (as outlined in Clauses 4.1.10.1 to 4.1.10.4), and provide a report to the Engineer for approval.

All residential roof stormwater shall be disposed of in the following manner:

4.1.10.1 Allotments with Free Draining Soils

(Percolation rates greater than 1000 mm per hour)

Properties with good free draining soils shall have porous soakage pits within the boundaries of the lot, to dispose of all roof stormwater, equating to the total run-off volume as calculated in accordance with Clause 4.1.9.

Discharge to the Council stormwater reticulation system will not be permitted.

A plan has been prepared indicating where ground soakage conditions which can be expected to comply with the requirements of this clause are generally found in the Whakatane urban area (See Appendix 4.2). Developers shall confirm that these site conditions are applicable to the proposed development.

4.1.10.2 Allotments with Moderate Draining Soils

(Percolation rates 100 mm to 1000 mm per hour)

Properties with moderate draining soils shall have porous soak pits with a capacity designed in accordance with Clause 4.1.9. In addition, in urban areas, the soak pits shall be provided with a 100mm diameter high level overflow pipe to a Council stormwater reticulation system, or where this is not possible, be connected to the street kerb with an approved kerb connection. Where a gravity discharge to the stormwater reticulation system is not feasible, it will be necessary to install a pumped discharge. In rural areas the overflow shall be to a natural watercourse or to “soakage” as defined in the NZ Building Code.

4.1.10.3 Allotments with Poor Draining Soil

(Percolation rates less than 100mm per hour, **OR** sloping sites, steeper than 15%; **OR** sites of known or possible instability).

Properties with these conditions shall be provided with on-site storage capacity equivalent to the volume calculated in accordance with Clause 4.1.9. In urban areas the storage container shall have a 25mm diameter outlet at the base and a 100mm diameter sealed piped overflow system connected to the Council stormwater reticulation, or where this is not possible, it shall be connected to the street kerb with an approved kerb connection. Where a gravity discharge to the stormwater reticulation system is not feasible, it will be necessary to install a pumped discharge. In rural areas the overflow shall be to a natural watercourse or to “soakage” as defined in the NZ Building Code.

All systems in this category will be subject to the final approval of the Engineer.

4.1.10.4 Non-Complying Allotments

Those properties which, due to their topography and poor draining soils, cannot comply with the stormwater requirements set out above shall be subject to specific design and approval from the Engineer.

***Note**: For all systems it will be the Developers responsibility to assess the potential for instability and or other drainage problems caused by the proposed stormwater system and if necessary seek professional geotechnical advice on which system is appropriate for the site.*

4.1.10.5 Soak Pits

Where the collected surface water is to be discharged to a soak pit, the suitability of the natural ground to receive the water shall be determined.

This evaluation may involve field testing of ground soakage and discussion or direction from suitably qualified soils or geotechnical engineers.

Field testing of soakage may be carried out as follows:

- Bore test holes of 100mm to 150mm diameter to the depth of the proposed soakhole and record the ground profile as excavation proceeds
- Fill the hole with water and maintain full for at least four hours (unless the soakage is so great that the hole completely drains in a short time)
- Fill the hole with water to within 750mm of ground level, and record the drop in water level against time until the hole is almost empty, or over four hours, whichever is the shortest
- Plot the drop in water level against time on a graph, and the soakage rate in mm/hr is determined from the minimum slope of the curve. If there is a marked decrease in soakage rate as the hole becomes nearly empty, the lower rates may be discarded and the value closer to the average can be adopted.

Standard precast soakrings shall be installed for all ground soakage systems.

The size and capacity of soak rings is shown in Table 4.1 below

Table 4.1 - Standard Precast Soak Rings

Size: Inside Diam. x Depth (mm)	Volume (m^3)
570 ID x 760 deep	0.194
765 ID x 457 deep	0.210
1070 ID x 305 deep	0.274

4.1.11 CALCULATION OF SURFACE WATER RUNOFF

Runoff may be determined by using any recognised method that achieves reasonable results. Appendix 4.1 shows details of the “Rational Method”.

4.1.11.1 Rainfall Intensity

The rainfall intensity shall be that for a storm having a duration equal to the time of concentration and a probability of occurrence as appropriate.

Note: For the Whakatane and Ohope urban areas the rainfall intensities in Table 4.2 below shall be used to calculate the runoff. For other areas, rainfall figures shall be determined from the High Intensity Rainfall Design System (HIRDS).

If reliable current data is not available from HIRDS, a rainfall intensity of 115mm per hour as required by the Building Act shall be used.

The HIRDS information system is available from the National Institute of Water and Atmospheric Research Ltd (NIWA).

Table 4.2- Rainfall Intensities – Whakatane and Ohope Urban Areas - Millimetres

Return Period (years)	Duration (Time in minutes/hours)							
	10 Min	20 Min	30 Min	1 Hour	2 Hour	6 Hour	12 Hour	24 Hour
2	11	14	21	31	41	69	88	109
5	12	19	27	38	50	84	107	147
10	16	23	32	45	58	95	122	177
20	18	26	37	51	64	108	137	206
50	20	30	44	59	73	123	156	244
100	23	32	47	63	81	134	170	272

4.1.12 HYDRAULIC DESIGN OF PIPELINES

4.1.12.1 Minimum Sizes of Drains

The hydraulic capacity of stormwater pipes shall be sufficient to convey the design flow as determined by the procedure in Clause 4.1.11 above. The capacity and velocity of flow shall be determined by using a design method which achieves reasonable and practical results. Alternatively a computerised design tool may be used subject to the approval of the Engineer.

To avoid blockages, public surface water drains shall have an internal diameter of no less than:

- 200mm diam. for main pipes
- 225mm diam. for cesspit leads less than 15m long
- 300mm diam. for cesspit leads greater than 15m long
- 375mm diam. for cesspit leads for double sumps
- 100mm diam. for residential property connections
- 150mm diam for Industrial/Commercial property connections

In general, the internal diameter of a drain shall not decrease in size in the direction of flow, but may be approved by the Engineer where it is justified by a large increase in the pipe gradient.

4.1.12.2 Minimum and Maximum Velocity

A drain flowing full shall have a minimum velocity of 0.7m/second.

No limitation on maximum velocity is practical, however pipes must be laid within the limitations set by their manufacturers.

4.1.12.3 Energy Loss through Manholes

Hydraulic design shall make the appropriate allowance for energy losses at manholes. These losses are generally associated with a change in direction of the flow, or an increase in pipe size. As an access chamber is normally required at such changes, an additional fall can be provided through the access chamber to allow for the losses.

This fall H_L is in addition to the fall produced by the gradient of the pipeline, and can be calculated by:

$$H_L = \frac{Kv^2}{2g}$$

where

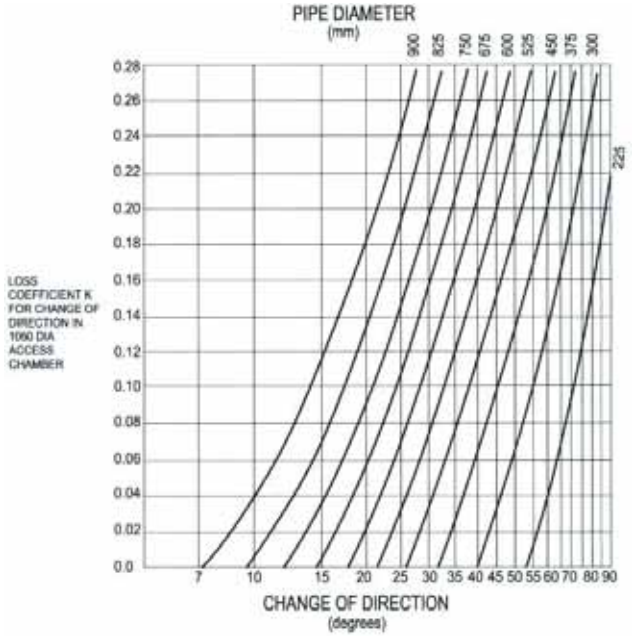
K	=	loss co-efficient for change in direction and can be determined from Figure 4.3.
V	=	velocity in the pipeline

Where there is an increase in pipe size at the access chamber, the hydraulic design shall ensure gravity flow with no surcharging for a 10% AEP storm event.

Note: *This is normally achieved by maintaining the same soffit level for both drains at the access chamber.*

In cases where a reduction in drain size is justified, an additional head loss of $0.5v_e^2/2g$ is to be allowed for. (v_e = exit velocity).

Figure 4.3 - Energy Loss Coefficient



4.1.12.4 Energy Dissipation Structures

Where the hydraulic analysis demonstrates that a significant turbulence or energy dissipation will occur, control structures shall be provided for energy dissipation to prevent damage to the drainage system, its outfall and the surrounding environment.

4.1.12.5 Inlet and Outlet Structures

Approved structures shall be constructed at the inlets and outlets of pipelines. Acceptable types of concrete structures are available from most drainage equipment manufacturers.

Provision must be made for energy dissipation unless it is demonstrated that outlet velocities and soil conditions are such as to make this unnecessary. The design shall ensure non-scouring velocities at the point of discharge.

4.1.13 OPEN WATER COURSES

4.1.13.1 Piping

In general, all open water-courses are to be piped. Council may approve unlined drains or concrete lined channels where the natural topography lends itself to this, or where the flow exceeds the capacity of a 1200mm diameter pipe.

4.1.13.2 Watercourse Improvements

Where the use of an open water-course is permitted under Clause 4.1.13.1, the extent of improvement work shall be agreed with the Engineer in order to achieve a satisfactory compromise between the retention of the natural topography and vegetation, and the maintenance, hydraulic and safety considerations, including the downstream effects of the work.

4.1.13.3 Watercourse Easements

Open water-courses where permitted shall generally be located in a drainage reserve or easement vested in Council to enable maintenance to be carried out. The cross-section and erosion protection for the open water-course shall be specifically designed and to the approval of the Engineer.

4.1.14 DRAINAGE LOCATIONS

4.1.14.1 Pipelines

Stormwater drainage pipelines shall generally be aligned parallel with the street network. However their alignment may deviate from the standard parallel alignment provided there is no interference with other services and the pipes are located in the road reserve. Alternatively, stormwater drainage pipelines may be located in areas which will not reduce the building area available on the lot.

4.1.14.2 Manholes

Manhole structures shall be located at least 1.0 metre clear of all boundary lines.

4.1.14.3 Easements

Where a stormwater drain or structure is laid within private property, it shall be protected by an easement in favour of Council and be of sufficient width to allow practical access for maintenance.

Where the diameter of the stormwater pipe is 300mm or less, the easement shall be at least 3.0m wide and the pipe shall be located in the centre. Where the diameter of the stormwater pipe is greater than 300mm, or the depth of the pipe is greater than 2.5m, the easement width may be required to be greater than 3.0m. The actual width will depend on the location of the pipe, and shall allow for a 12 tonne excavator and a truck to gain access for maintenance or replacement of the pipe.

4.1.15 PIPES

Pipes acceptable for use in stormwater and wastewater drainage work in Whakatane District are shown in Clause 4.2.3 of this Chapter.

4.1.16 JOINTS

All joints in drains shall be watertight and prevent the infiltration of groundwater and the intrusion of tree roots. Pipes shall be rubber ring jointed or flanged unless specifically required to be flush jointed or solvent cemented by the Engineer.

Where a drain consists of concrete, or other rigid material, a flexible joint shall be installed within 750mm of the outside wall of any manhole, but outside the line of the base and on each pipeline which connects to the manhole.

Note: *This allows for differential settlement between the manhole and the pipeline while minimising damage to the pipeline.*

4.1.17 PIPE DESIGN AND LAYING

Pipes shall be installed in accordance with the requirements of AS/NZS 3725 : 2007 - "Design for Installation of Buried Concrete Pipes".

The class of pipe to be adopted shall be in accordance with AS/NZS 3725 Supplement 1 : 2007 "Design for Installation of Buried Concrete Pipes Commentary".

Bedding of pipes shall be "Type H2 "bedding in accordance with AS/NZS 3725: 2007, or in accordance with NZS 7643 : 1979, unless specifically approved by the Engineer.

4.1.18 TRENCH SLOPE

Where the slope of the trench is 1 in 8 or greater, anti-scour blocks shall be provided. These anti-scour blocks shall be:

- Constructed from 150mm thick concrete up to pipe diameters of 300mm and 230mm thick concrete for diameters greater than 300mm
- Keyed into solid ground to the sides and floor of the trench by 150mm
- Extended to 300mm above the drain, or to ground level where the drain cover is less than 300mm, and spaced at:
  (i) 7.5m centres for trench slopes between 1 in 8 and 1 in 5, or
  (ii) 5.0m centres for trench slopes greater than 1 in 5.

Note*: The anti-scour blocks partition off the trench and prevent ground or surface water running along the trench and causing scouring.*

4.1.19 MINIMUM COVER

4.1.19.1. General

All pipelines shall be specifically designed to support the likely loadings in relation to the minimum cover to be provided in accordance with the terms of AS/NZS 3725. Generally, the minimum cover for all types of pipes under all conditions shall be 600mm except as otherwise specified in Section 4.1.19.2 below.

4.1.19.2 Private Property

The minimum cover over pipelines in private properties shall be 500mm. Where this cover cannot be provided, specific design and approval will be required by Council.

4.1.20 MANHOLES

4.1.20.1 General

Manholes shall normally be provided at each change of direction or gradient, at each branching line, and at a spacing of not more than 100m. Manholes may either cast in-situ or of precast concrete in accordance with Clause 4.2.14 of this Section.

4.1.20.2 Standard Manholes

Manholes shall be circular with a minimum internal diameter of 1050mm and may be used in situations where the largest inlet pipe does not exceed 600mm in diameter. In a situation where there are multiple entries into a manhole, or it has an inlet pipe of 600mm diameter or greater, a larger diameter manhole may be required.

Outlet pipes from manholes should always be of not less a diameter than the largest size pipe leading into the manhole. The Engineer may however give dispensation from this requirement in certain cases.

In environments where the Engineer considers that detritus is likely to find its way into stormwater systems, silt traps and/or special purpose screens may be required to be installed at intervals within the systems.

4.1.20.3 Deep Manholes

Where manholes are more than 5.0m deep, they shall be specifically designed and shall incorporate intermediate landing platforms or grilles in order to prevent a free fall of more than 3.0m.

4.1.20.4 Shallow Manholes

Where the depth to invert of a manhole is less than 1.0m, and it is serving no more than four houses, a shallow manhole may be constructed with a minimum diameter of 600mm, or a minimum width in the case of a rectangular shallow manhole of 450mm. In all cases, shallow manholes shall be of sufficient diameter to allow full benching and reasonable access to the pipes.

4.1.20.5 Manholes on Large Pipes

Manholes on stormwater pipelines more than 600mm diameter, and on smaller pipelines where the use of standard manholes is not suitable, shall be specifically designed, and will require the Engineer's approval. The minimum diameter of the manhole shall be equal to the largest pipe size plus 450mm.

4.1.20.6 Manhole Covers

Manhole covers shall be constructed and fitted in accordance with Clause 4.2.14.5 of this Chapter.

4.1.20.7 Junctions

Cesspit leads not more than 300mm in diameter and not more than 20m in length may be saddled on to pipes 600mm in diameter and larger, without a manhole being required.

Branch lines should normally be connected to a manhole. However branch lines 300mm diameter and smaller may be saddled on to pipelines 600mm diameter or larger, provided a manhole is supplied on the branching line within 40m of the main line. Proprietary 'Wye' connections shall be used where possible.

4.1.20.8 Step Irons

All manholes exceeding one metre in depth, shall be provided with approved step irons, steps or ladders in order to give reasonable access.

Step irons shall be in accordance with Clause 4.2.14.9 of this Chapter.

Where the smallest pipe entering a manhole is 600mm or greater, recessed steps shall be provided in the haunching within the manhole such that a person standing in the invert of the manhole may easily reach the lowest rung of the manhole steps or ladder.

4.1.20.9 Drop Connections

Drop connections on stormwater manholes may be avoided by allowing pipes up to and including 300mm diameter to have an open "cascade" inside the manhole, provided the steps are clear of any cascade. Otherwise a short ramped section must be provided on the connecting line.

4.1.21 ALLOTMENT CONNECTIONS

Connections shall be capable of taking the full design flow from the area to be serviced by the connection as calculated in Clause 4.1.2. Connections for commercial and industrial lots shall not be less than 150mm diameter.

4.1.22 RAMPED RISERS

Ramped risers shall be designed in accordance with good drain laying practice. A typical example is shown in Drawing SS 01.

4.1.23 CONNECTIONS TO DEEP PIPELINES

Where an existing or proposed stormwater pipeline is more than 5m deep to the top of the pipe, connections to the lots served, shall be provided from a shallower branch pipeline connected to the deep stormwater line at a manhole.

This method may also be used where ground conditions preclude direct connection to pipelines less than 5m deep.

4.1.24 CESSPITS

Details of cesspits are shown on Standard Drawings SW 01 and SW 02. Design requirements for cesspits are included in Clause 3.1.9 of Chapter 3, “Roading.”

PART 2 CONSTRUCTION

4.2.1 GENERAL

All work shall be carried out in strict accordance with the methods and standards outlined in this section.

4.2.2 MATERIALS

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

4.2.3 PIPES

Pipes shall be of the type and class shown on the drawings and shall conform to the following specifications:

a) **Stormwater Pipes.**

AS/NZS 4058 : 2007 – "Precast Concrete Pipes (Pressure and Non Pressure)"
AS/NZS 1254 : 2002 – "PVC Pipes and Fittings for Stormwater and Surface Water Applications" Class SN8

b) **Wastewater Pipes.**

AS/NZS 1254 : 2002 – "PVC Pipes and Fittings for Stormwater and Surface Water Applications"
AS/NZS 1260 : 2000 – "PVC-U Pipes and Fittings for Drain, Waste and Vent Applications". Class SN16.
AS/NZS 4130 : 2003 -.Polyethylene (PE) Pipes for Pressure Applications

4.2.4 JOINTS

Jointing methods shall conform to the following specification:

- Heat welded or flange joints for HDPE pipes - NZS/AS 2033 : 1980

4.2.5 CONCRETE

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

All concrete shall have a minimum crushing strength of 20MPa at 28 days unless otherwise specified or detailed.

4.2.6 ROADING MATERIALS

Roading materials, chips etc shall comply with the requirements set out in Part 4 of Chapter 3 of this Manual.

4.2.7 STORAGE

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

4.2.8 STREET OPENING

All excavations in road reserves shall comply with the requirements of Clause 3.4.12 of Chapter 3 of this Manual and will require a street opening permit in accordance with Clause 3.4.12.1.

4.2.9 EXISTING UTILITY SERVICES

Before commencing any excavation, all utility service providers shall be contacted and any approvals necessary for excavation in the region of their services shall be obtained. Any special restraints imposed by the utility provider in regards to working in the vicinity of their services must be strictly adhered to by the developer. All information supplied by the Council should be checked on-site for correctness as far as possible, prior to commencing excavation.

4.2.10 EXCAVATION

4.2.10.1 General

All working methods adopted shall be subject to the conditions of the “Health and Safety in Employment Act 1992” and any amendments and regulations in force. Where required by the Act, the Occupational Safety and Health Inspector of the Department of labour shall be notified and any work required by the Inspector shall be carried out.

4.2.10.2 Standards

The construction of all underground pipelines must conform to the requirements of AS/NZS 2566.2 : 1998 - “Buried Flexible Pipelines : Part 2 - Installation” and NZS 7643 : 1979 - “Code of Practice for the Installation of Unplasticised PVC Pipe Systems” and the requirements of these standards, which will take precedence

4.2.10.3 Trench Protection

All work shall be undertaken in such a manner that the safety of all existing buildings, structures and property is not compromised. Particular attention shall be paid to the maintenance of access for pedestrian and vehicular traffic. Where required to carry out the work in a safe manner in compliance with the regulations, timbering or other suitable trench shoring methods shall be used.

All timber used in trench shoring shall be removed before backfilling.

4.2.10.4 Subsoil 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 by well pointing.

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 subsoil 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.

4.2.10.5 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 needed 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 – “Design for Installation of Buried Concrete Pipes.

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 at anytime shall be kept to a minimum which recognises the reasonable requirements of pedestrians and wheeled traffic.

4.2.10.6 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 as directed by the Engineer and backfilled with free draining granular material approved by the Engineer, and compacted in layers not exceeding 300mm by mechanical means.

4.2.11 PIPE LAYING

4.2.11.1 General

All drain laying work shall be under the direct control of persons holding a current drain layers licence as provided in the Plumbers, Gasfitters and Drainlayers Act 1976

No bedding shall be placed before the bottom of the trench has been inspected and approved by the Engineer.

4.2.11.2 Bedding

An evenly compacted bed of free draining granular material (graded chip or pea metal all passing 9.5mm sieve and all retained on 4.75mm sieve) in accordance with NZS/AS 3725 shall be laid on the bottom across the full width of the trench, to give continuous full support to the barrel of the pipes.

Bedding shall be laid over the full width of the trench to a minimum depth of 100mm and compacted by rolling and/or vibration to 90% of maximum dry density as ascertained by the New Zealand Standard Compaction Test. The Contractor shall carry out a plateau test on the first section of bedding, by counting the number of passes required by the compactor to achieve the desired compaction as determined by a nuclear densometer test. This number shall then be the minimum required by the compactor in the remaining sections. Care shall be taken to avoid over compaction causing fine grained materials underneath to pump. The cost of all testing, both laboratory and on site, shall be borne by the Developer.

Care shall be taken to ensure that no cavities are left under the pipe barrel and that the bedding is not disturbed when trench timbering or construction shields (if required) are removed. Socket holes shall be formed to allow the pipe barrel to rest firmly on the bedding over its entire length.

Where the bottom of the trench will not provide adequate support for the pipe, the Engineer may order the use of additional granular bedding material as specified in NZS/AS 3725, or NZS 7643 : 1979, for such depths as are necessary.

Where the ground slope is steeper than ten percent or where in the opinion of the Engineer ground conditions merit the need, sufficient cement shall be added to the granular bedding material to provide a weak concrete with a strength of not less than 7 MPa.

4.2.11.3 Laying

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

Pipes shall be laid accurately to the lines, levels and gradients shown on the drawings.

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

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

Rubber ring joints shall be installed strictly in accordance with the manufacturer's instructions. Care shall be taken to ensure that the rubber rings are located evenly around the joint without any twists in them. The pipes shall be laid with the female ends uphill, and shall be pushed up tight to the joints.

4.2.12 BACKFILLING

4.2.12.1 General

Where the Engineer requires, unsuitable excavated material shall be replaced by approved material. No backfilling shall be done until the laying, jointing and haunching of the pipeline has been approved for backfilling by the Engineer. All material for backfilling shall be approved 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.

4.2.11.2 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 (5%) 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 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 80% of the optimum density before placing excavated or imported materials over the pipe.

4.2.12.3 Initial Backfilling

The initial backfilling will be carried out over the haunching to a maximum height of 150mm above the top of the pipe, using 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 pipe, ie whether under road reserves or in lawns, gardens, etc.

4.2.12.4 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. Mechanical compaction shall be used until the pipe is covered by the pipe manufacturer's recommended depth of material.

4.2.12.5 Compaction Requirements

In all cases, compaction shall be carried out in accordance with Standard Drawing R 31.

4.2.13 TRENCH REINSTATEMENT

For trench reinstatement in roadways see Clause 3.4.12 of Chapter 3 of this manual.

4.2.14 MANHOLES

4.2.14.1 Cast In-Situ Bases

Cast in-situ bases for manholes shall be a minimum 150mm thickness, constructed from 20MPa concrete and shall extend at least 150mm radially outside the outer dimension of the manhole section.

The base concrete shall be brought up to the top or over the connecting 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 connecting pipe and manhole riser shall be maintained to ensure no direct load is on the connecting pipe. The base concrete is to extend 150mm up the outside of the riser section.

4.2.14.2 Precast Bases

Shall comply with Standard Drawing SS 05 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 pipes shall be neatly cut out using a concrete saw. Pipes shall be cast into the wall using an approved epoxy mortar to provide a firm water tight joint. Refer to clause 4.1.16 for pipes through walls.

4.2.14.3 Risers

Precast manholes components shall consist of centrifugally spun concrete pipes to Class X standard, and shall comply in all respects to the details specified hereafter and the details shown on Standard Drawing SS 05.

Precast concrete riser sections shall be manufactured to the requirements of NZS 3107 : 1978 - “Specification for 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. Risers shall have holes case in the side for step irons.

The method of joining the precast sections shall be strictly in accordance with the recommendations of the manufacturer. This shall be a proprietary jointing compound or adhesive, such as Ëxpandite BM100 ”Sëalastrip” or an approved equivalent.

Cast in-situ manholes shall be constructed using ordinary grade concrete (20 MPa) vibrated to give maximum density and watertight construction.

4.2.14.4 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 of 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 Standard Drawing SW 03. 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.

4.2.14.5 Manhole Lids and Covers

Standard precast reinforced flat lids of a minimum 150mm thickness shall be used. The opening shall be located as shown on Standard Drawing SS 05.

For manholes of 1050mm diameter, lids shall be reinforced with D12 bars at not more than 150mm centres in two directions. For manholes of greater diameter, the lids shall be specifically designed to the approval of the Engineer.

Covers shall be heavy duty cast iron covers in accordance with the details shown on Standard Drawing SS 06.

The use of lid rings to raise the covers to the correct level shall be limited to a maximum height of 200mm

4.2.14.6. Finishes to Manholes

The internal walls of the manholes 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.

4.2.14.7 Backfilling around Manholes

Backfilling around manholes in road reserves and private driveways shall be carried out with selected fill or other approved material.

This material shall be compacted in layers not exceeding 150mm, but in lawns, gardens, etc, the layers may be no greater than 500mm.

4.2.14.8 Flexible Connections

Where pipes pass through the walls of manholes, the joints shall be watertight. Extreme care

shall be taken that the pipe is free of all dirt and grease. All pipes through manhole walls shall conform to Standard Drawing SS 05.

All uPVC sewer pipes shall be connected to concrete structures via a proprietary uPVC manhole connector supplied by the pipe manufacturer. In addition, the main shall be connected to the manhole connector using a rubber ring flexible collar.

4.2.14.9 Step Irons

Where manhole depths exceed one metre, step rungs shall be provided to conform with Standard Drawing SS 07. The step irons shall be of the “dropper” or “safety” type constructed from 20mm diameter mild steel, hot dipped galvanised, with a coating of not less than 400 grams per square metre.

4.2.14.10 Connection Markers

After installation, all stormwater and sewer connections shall be marked by a 50mm x 50mm timber stake (H3 treated or better) extending to 300mm above ground level.
The top of the stake shall be painted blue. This marker post shall be placed alongside a timber marker installed at the time of pipe laying and extending from the connection to 150mm below finished ground level. The lower end of the marker post shall be adjacent to, and not touching the connection. Connections shall be accurately indicated on the "As Built" plans.

All connections, whether to reticulation lines or to manholes, shall be sealed either by a factory sealed stopper or a plug fixed with a rubber ring and held with stainless steel wire.

4.2.15 SOAK PITS

Porous soak rings for the discharge of stormwater shall be installed with a suitable filter cloth entirely surrounding the outside of the rings to prevent silt and fine material clogging the walls of the ring. After installation of the rings and the filter material the soak pit shall be surrounded with a minimum of 200mm of clean no-fines drainage metal before the pit is backfilled.

4.2.15 TESTING

4.2.15.1 General

All stormwater and wastewater pipelines shall be visually inspected for joints and bedding at the "as laid" condition. No joints may be covered until the pipe line has been approved by the Engineer. Open trench testing may be used for the interim acceptance of a pipe line, but shall not be used as a basis for final acceptance.

The tests shall be carried out in the presence of the Engineer upon receipt of 24 hours notice from the subdivider.

4.2.15.2 Infiltration Test

If the groundwater level is above the buried pipe line, a test of infiltration will be carried out in accordance with Clause 402.15.2 of NZS 4404 : 1981.-."Code of Practice for Urban Land Subdivision", ie, the total infiltration in any portion of a wastewater pipeline shall not exceed a rate of 600ml per 25mm of pipe diameter per 1000m of pipe in five minutes.

The source of any observed infiltration shall be investigated and every defect made good.
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 shall then be measured and this flow shall not exceed 1.25 litres per 10mm diameter per 100m pipeline tested per hour. Should the infiltration exceed this figure, the installer shall find the cause and rectify it, after which a further test shall be carried out.

4.2.15.3 Lamping/Inspection

All pipelines 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 tests carried out after all backfilling has been completed.

4.2.15.4 Leakage Testing

For RCRRJ pipes 450mm diameter and above, the inspections as set out in Clause 4.2.15.1 to 4.2.15.3 above shall be carried out and during construction and any leakage occurring shall be immediately rectified.

For all RRJ pipes below 450mm diameter, each section of constructed as part of the works shall pass one of the three leakage tests set down in the Building Industry Authority Verification Method E1, VM1 section 8.0 (as quoted below)

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

4.2.15.5 Water Test

a) Fill the pipe with water, ensuring that all air is expelled
b) If pipe material absorbs water, leave for 24 hours
c) Top up water to test head levels. The minimum head should 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 30minutes then measure water loss.
e) The pipeline is acceptable if water loss does not exceed 2ml per hour per mm of internal diameter, per metre of pipeline length.

Note. *Care should be taken when conducting water testing of pipes on steep grades to ensure that excessive hydraulic pressures are not applied to the pipe.*

4.2.15.6 Low Pressure Air Test

a) Introduce air into the pipeline until a pressure of 300mm of water is reached. (This may 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 air supply.
d) Measure pressure drop after 5 minutes.
e) The pipeline is acceptable if the pressure drop does not exceed 50mm.

Note. *The low pressure air test is highly susceptible to temperature fluctuations during the test period. A 1ºC change during the 5 minute test period will cause a pressure change of 30mm water gauge or 60% of the permitted change.*

4.2.15.7 High Pressure Air Test

a) Pressurise the pipeline to 25kpa.
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 17kpa.
e) The pipeline is acceptable if the time does not exceed that given for the appropriate pipe size in Table 4.4 below.

Table 4.4 - Time for Pressure Drop Versus Internal Pipe Diameter

Internal Pipe Diameter (mm)	Time for Permissible Pressure Drop (Minutes)
90	3
100	3
150	4
225	6

4.2.15.8 Testing of Rising Mains

All rising/pumping mains shall be tested in accordance with the procedure below.

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 subjected to a pressure test after laying, jointing and covering 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 the test pressures indicated below.
The test pressure shall be measured at the lowest point of the line under test and for steel pipe lines, 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 NB which shall be tested in accordance with Procedure A. Test pressures shall be as Table 4.5 below:

Table 4.5 - Test Pressures for Pressure Lines

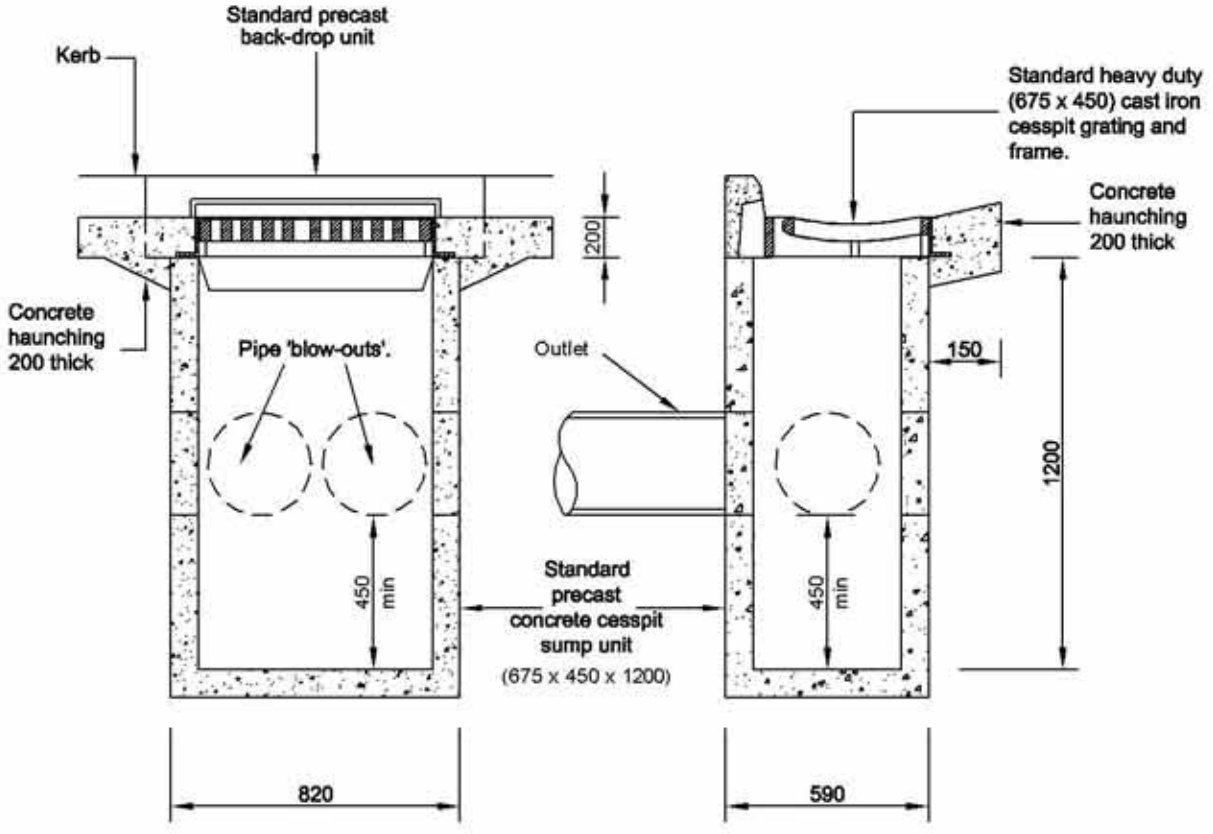
Class of Pipe	Test Pressure	
	Meter Head	kPa
Class B uPVC	90	900
Class C uPVC	135	1350
Class D uPVC	180	1800

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 pre-tested 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.

CHAPTER 4

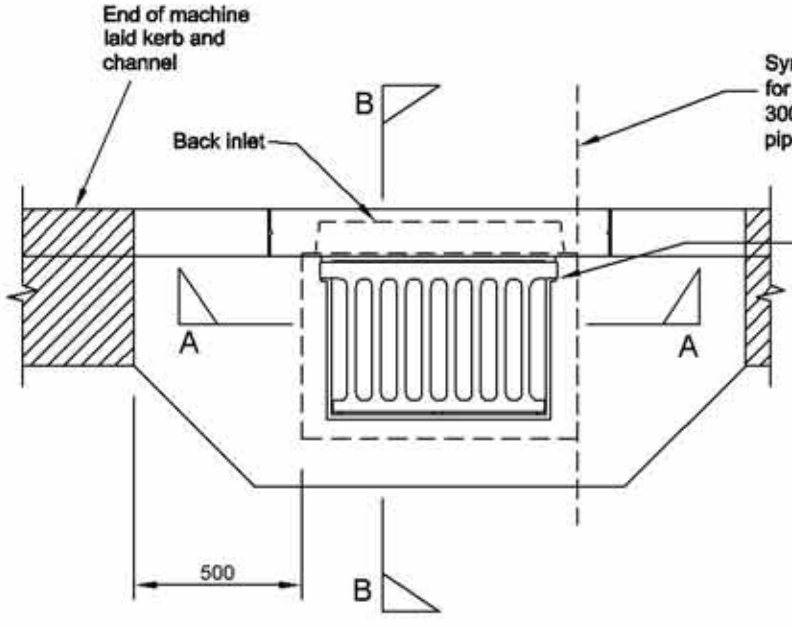
STORMWATER

STANDARD DRAWINGS



SECTION A-A

SECTION B-B



PLAN

NOTES:

1. All concrete to be Ordinary Grade 20 MPa at 28 days.
2. All pipes to be finished flush with inside of cesspit and plaster finished.
3. All cut concrete pipes to have exposed reinforcing plastered over.

WHAKATANE DISTRICT COUNCIL

PREPARED BY OPUS

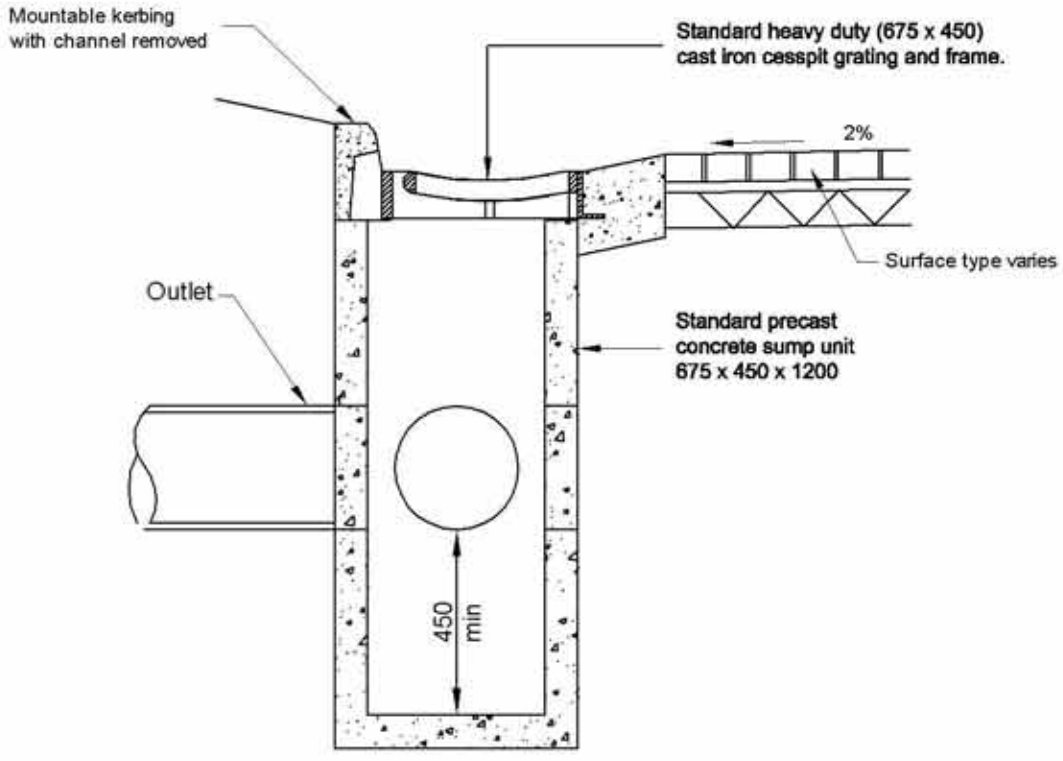
STANDARD DRAWING

NOT TO SCALE

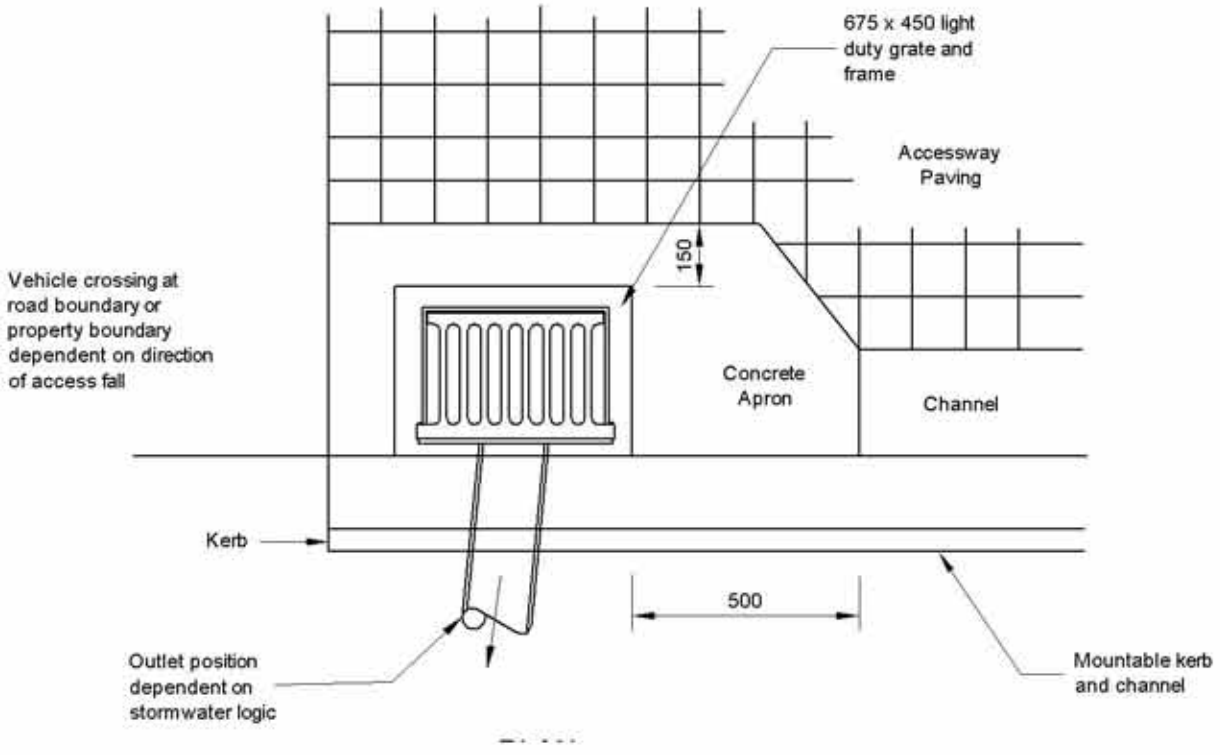
STANDARD CESSPIT

SW 01

ISSUE 7.0
SEPTEMBER 2007



SECTION



WHAKATANE DISTRICT COUNCIL

PREPARED BY OPUS

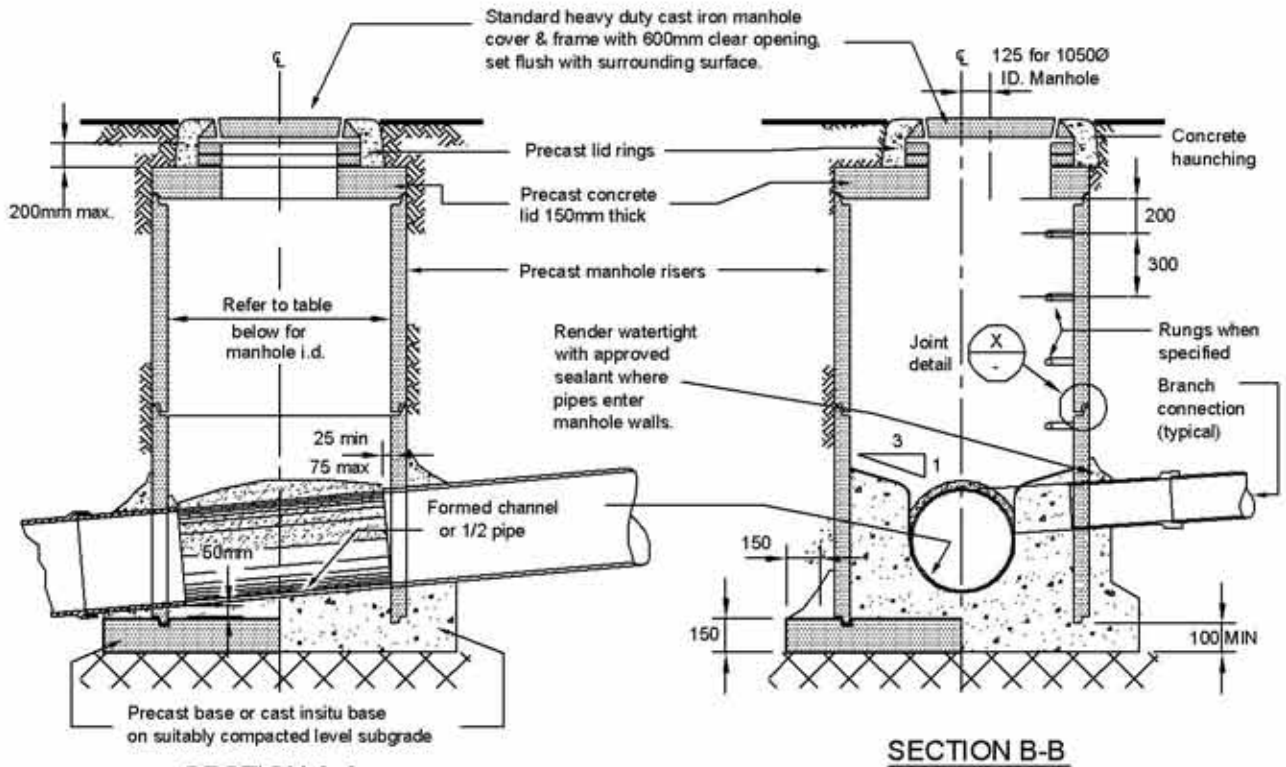
STANDARD DRAWING

NOT TO SCALE

PRIVATE ACCESS CESSPIT

SW 02

ISSUE 7.0
SEPTEMBER 2007

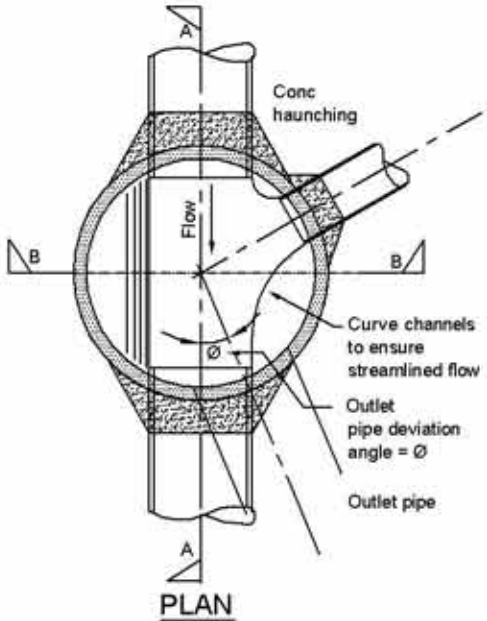


SECTION A-A

SECTION B-B

	MINIMUM MANHOLE INSIDE DIAMETER*			
OUTLET PIPE DIA. (mm)	PIPELINE DEVIATION ANGLE (Ø)			
	0°-15°	16°-45°	46°-75°	76°-90°
UP to 300	1050	1050	1050	1050
375 to 575	1050	1050	1050	1050
600 to 750	1200	1200	1500	1500
825 to 900	1500	1500	1800	1800

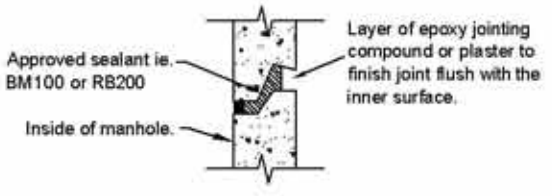
* To be used as guide only.
* Larger diameters may be required where more than one inlet pipe is to be constructed.



PLAN

NOTES:

1. All insitu concrete other than site concrete shall have a minimum compressive strength of 20 M Pa @ 28 days.
2. All manhole precast units (shaded) are standard manufactured concrete units from a certified precast supplier.
3. Allowance to be made for the provision of basecourse to depth between manhole lid and cast iron cover where manhole is located within carriageway.
4. All cut concrete pipes to have exposed reinforcement, plastered over.
5. Manhole sizes are subject to specific design where pipes are larger than 900mm diameter.
6. All figured dimensions are in millimetres.



X JOINT DETAIL

WHAKATANE DISTRICT COUNCIL

PREPARED BY OPUS

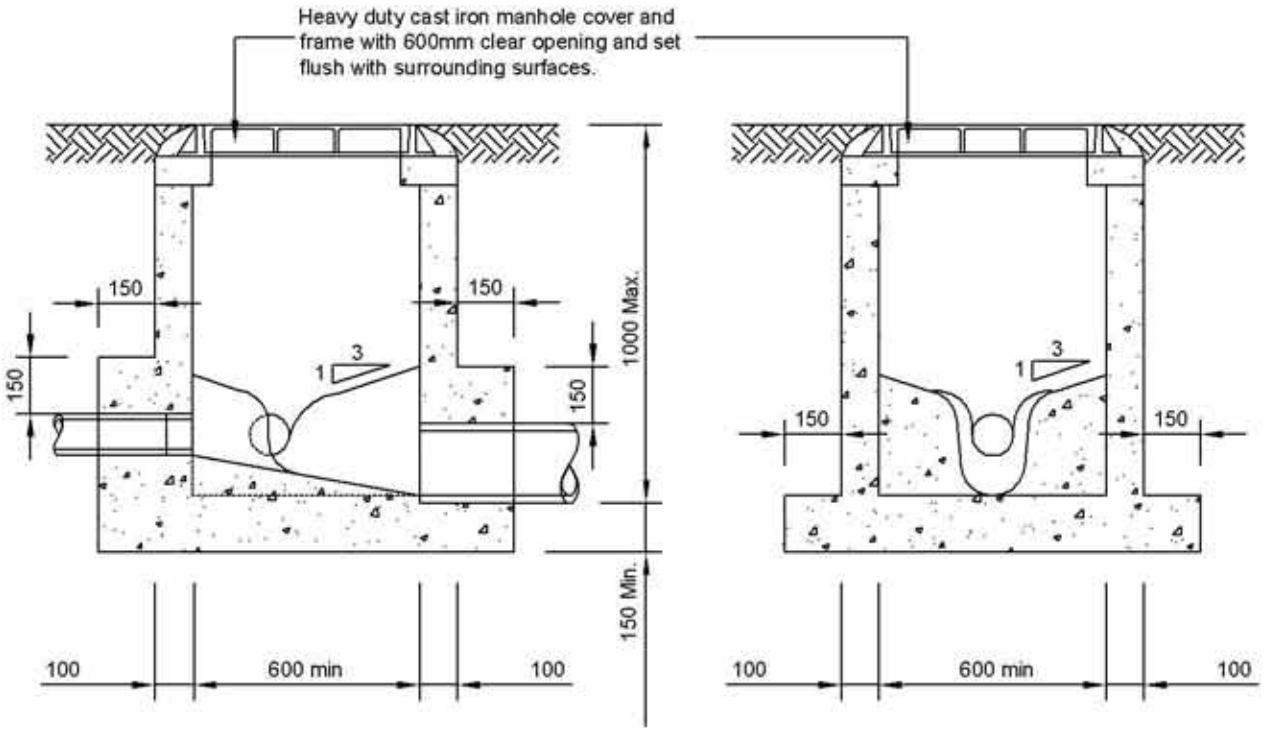
STANDARD DRAWING

NOT TO SCALE

STANDARD MANHOLE CONSTRUCTION DETAILS

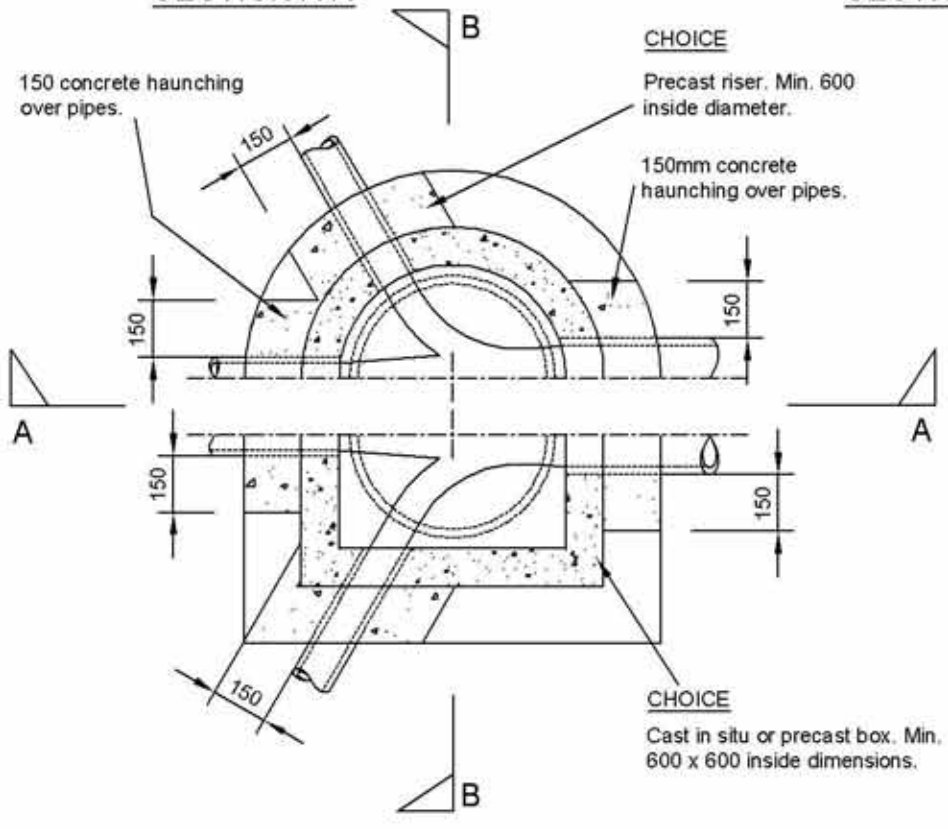
SW 03

ISSUE 7.0
SEPTEMBER 2007



SECTION A-A

SECTION B-B



PLAN

NOTES

1. Install flexible joints in accordance with standad drawing SS05.
2. All concrete to have a minimum compressive strength of 20 MPa at 28 days.
3. Chambers must be large enough to allow full bending of prodding rods and full benching.
4. All cut pipes to have exposed reinforcement plastered over.

WHAKATANE DISTRICT COUNCIL

PREPARED BY OPUS

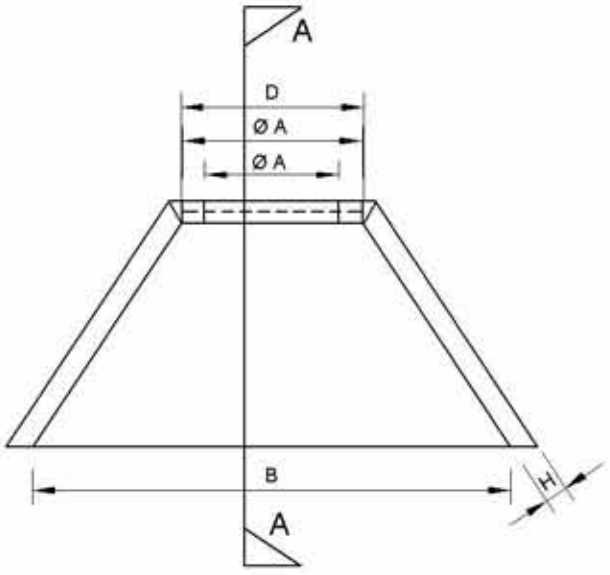
STANDARD DRAWING

NOT TO SCALE

SHALLOW MANHOLE DETAILS CONSTRUCTION DETAILS

SW 04

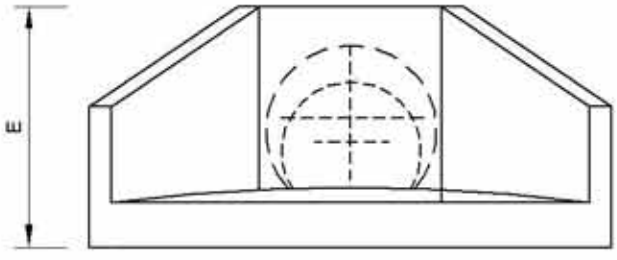
ISSUE 7.0
SEPTEMBER 2007



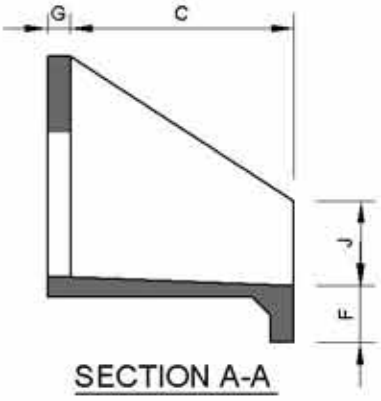
PLAN

NOTES:

1. Concrete strength and reinforcement to be designed by precaster
2. Allow to bed wingwall unit on 300mm min depth of drainage metal.
3. Allow to provide scour protection where outlet velocities and soft soil conditions dictate.
4. Allow to provide to the satisfaction of the Engineer a galvanised screen over the end of the pipe in residential zones to prevent children entering the pipe.
5. For outfalls with floodgates confirm hole position with the Engineer prior to fabrication.



ELEVATION



SECTION A-A

WING WALL DIMENSIONS										
PIPE DIAMETER	APPROX MASS KG	A		B	C	D	E	F	H	J
		O/D.SOFT SPOT	HOLE TO SUIT							
100-300	205	190	390	1000	600	460	520	200	60	160
300-675	755	390	790	2150	745	810	1000	250	90	390
300-600	925	370	700	1950	1100	750	900	280	80	500
600-1050	1800	1225	3000	1000	1270	1675	345	345	100	600
1200-1350	5610	1380	1540	4100	2400	1600	1975	425	125	750
Dimension A is either a soft spot or a hole only						All dimensions are in millimeters				

WHAKATANE DISTRICT COUNCIL

PREPARED BY OPUS

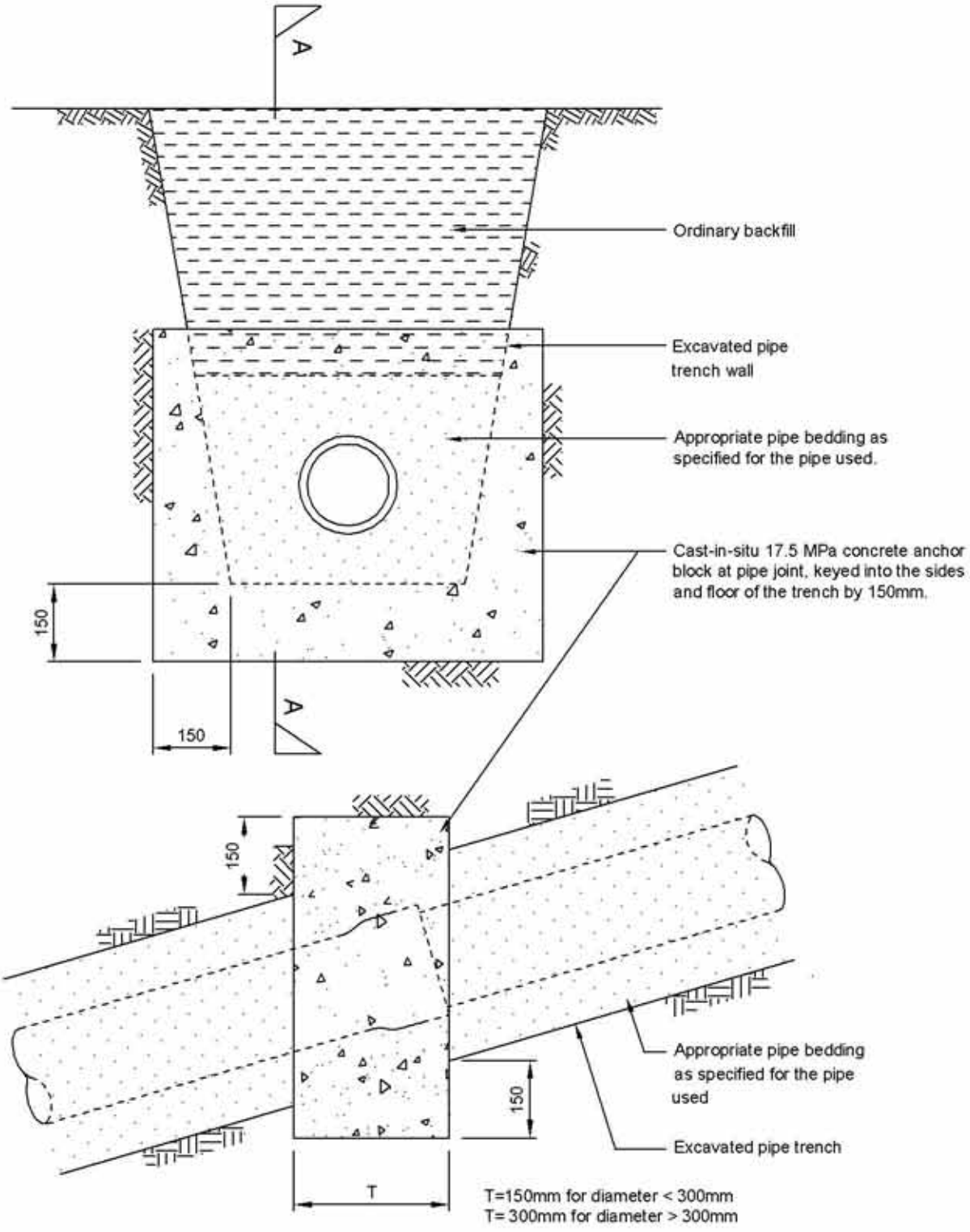
STANDARD DRAWING

NOT TO SCALE

STANDARD OUTLET DETAILS

SW 05

ISSUE 7.0
SEPTEMBER 2007



SECTION A-A

WHAKATANE DISTRICT COUNCIL

PREPARED BY OPUS

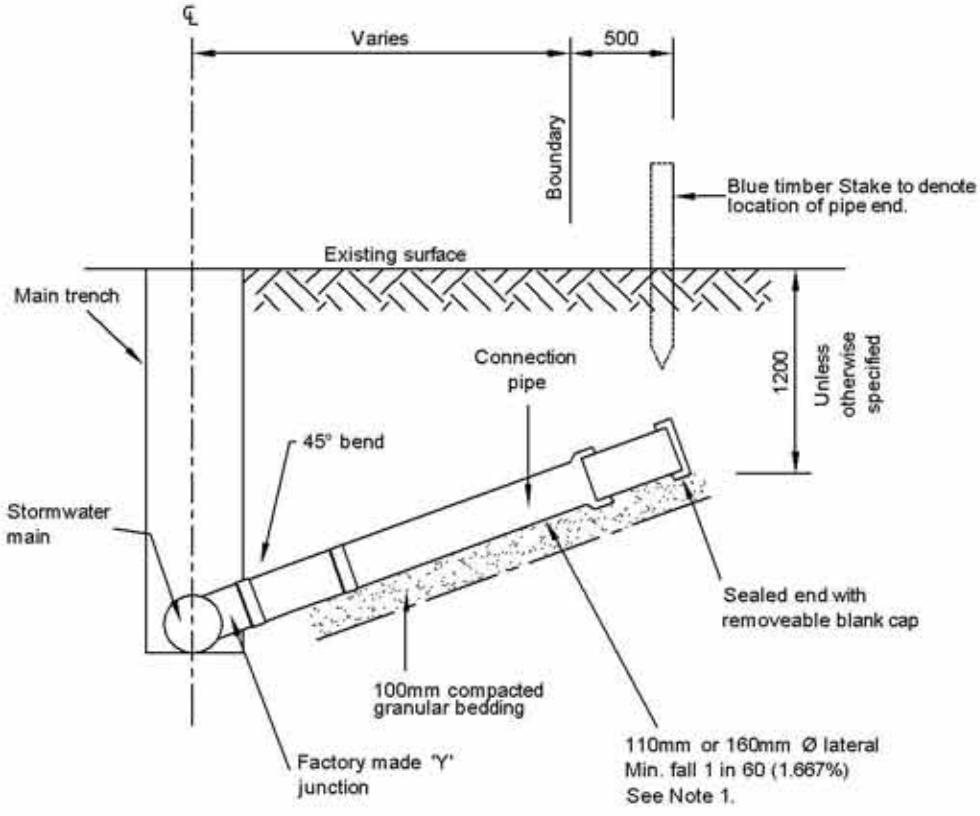
STANDARD DRAWING

NOT TO SCALE

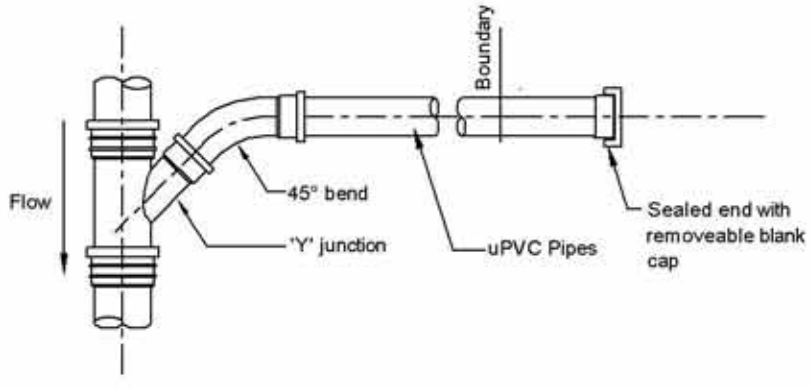
ANTI-SCOUR BLOCK DETAIL

SW 06

ISSUE 7.0
SEPTEMBER 2007



ELEVATION



PLAN

NOTES:

1. Pipe sizes shall match design flows from property served. Minimum size:
   Industrial/Commercial - 160mm Ø
   Residential - 110mm Ø

2. For larger diameter pipes where factory junctions are not available, saddle connections may be subject to the approval of the Engineer. When connecting to concrete pipes, hole openings shall be saw cut into the stormwater main.

WHAKATANE DISTRICT COUNCIL

PREPARED BY OPUS

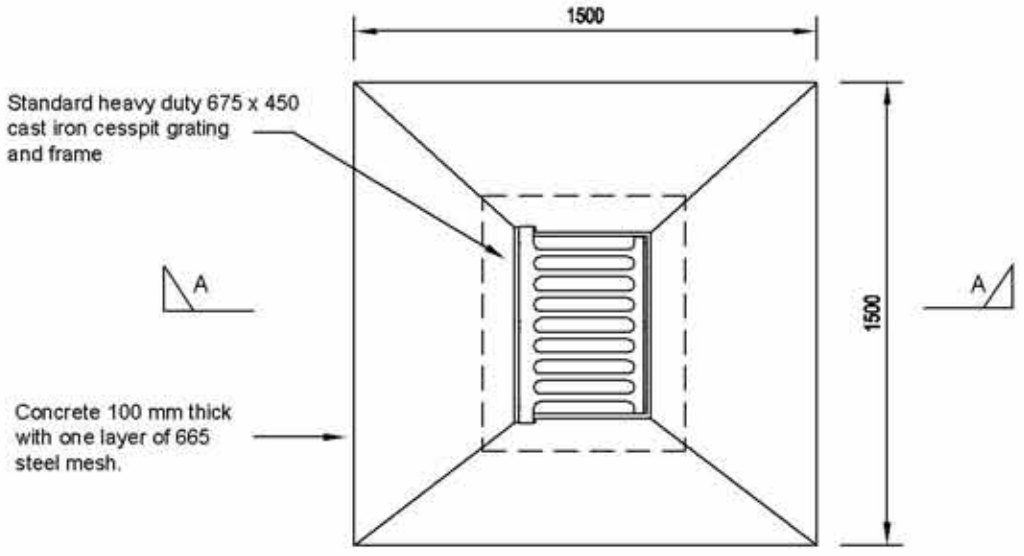
STANDARD DRAWING

NOT TO SCALE

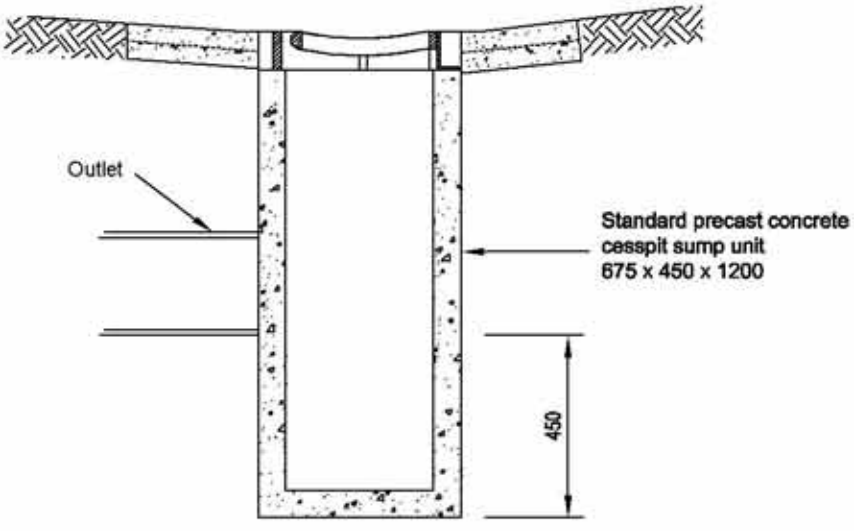
STANDARD STORMWATER CONNECTION

SW 07

ISSUE 7.0
SEPTEMBER 2007



PLAN



SECTION A-A

NOTES:

1. All concrete to be Ordinary Grade 20 MPa at 28 days.
2. All pipes to be finished flush with inside of cesspit and plaster finished.
3. All cut concrete pipes to have exposed reinforcement plastered over.

WHAKATANE DISTRICT COUNCIL

PREPARED BY OPUS

STANDARD DRAWING

NOT TO SCALE

BERM CESSPIT

SW 08

ISSUE 7.0
SEPTEMBER 2007

Appendix 4.1

CALCULATION OF RUNOFF

Runoff may be calculated using the "Rational Method" which is based on the formula:

$$Q = \frac{CIA}{3600}$$

Q = runoff in litres per second (l/s)
C = runoff co-efficient (see Table 4.3)
I = rainfall intensity in millimetres per hour
A = area of catchment above the point being considered in square metres

Runoff Coefficients

The runoff coefficients shown below are to be used for the various land use types and are provided as a guide for the initial calculation of system requirements.

More accurate investigations into the appropriate return periods and runoff coefficients will be necessary for detailed design.

Detailed design should involve calculating a weighted average runoff coefficient by averaging the value for individual parts of the catchment. This may be done for a representative sample area or the whole catchment. The formula for this calculation is shown in Clause 2.1, Verification Method of the "NZ Building Code - Clause E1 Surface Water"

In refining the estimate of run-off coefficient, the coefficients provided in the NZ Building Code E1 table 2 shall be used. The following coefficients are provided as a guide.

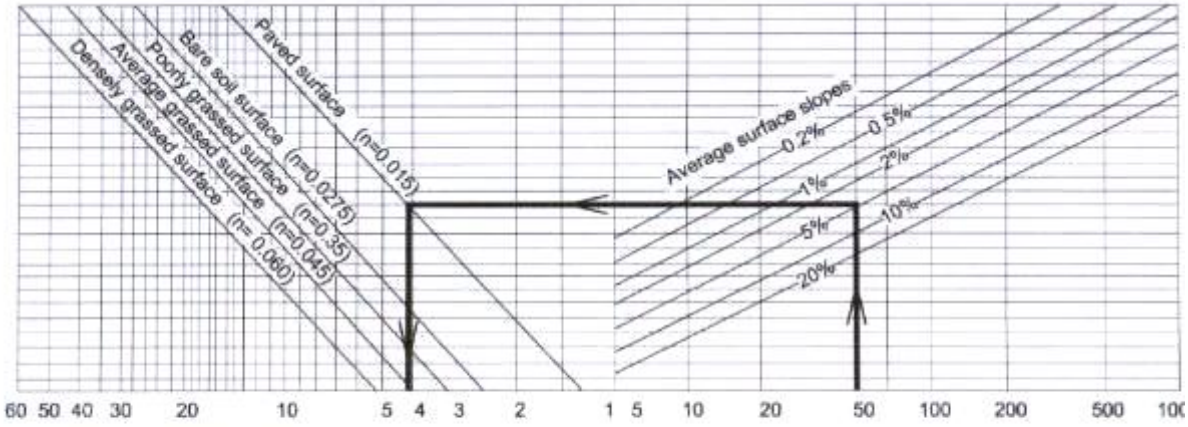
(i)	Roofs	C = 0.95
(ii)	Asphaltic and concrete Areas	C = 0.90
(iii)	Uncultivated ground, lawns and playing fields	C = 0.30
(iv)	Cultivated ground and dairy farmland	C = 0.20

Time of Concentration

The Time of Concentration shall be determined as the "time of entry" plus the "time of flow" from the furthest point of the catchment to the point of discharge. The minimum Time of Concentration to be used is 10 minutes.

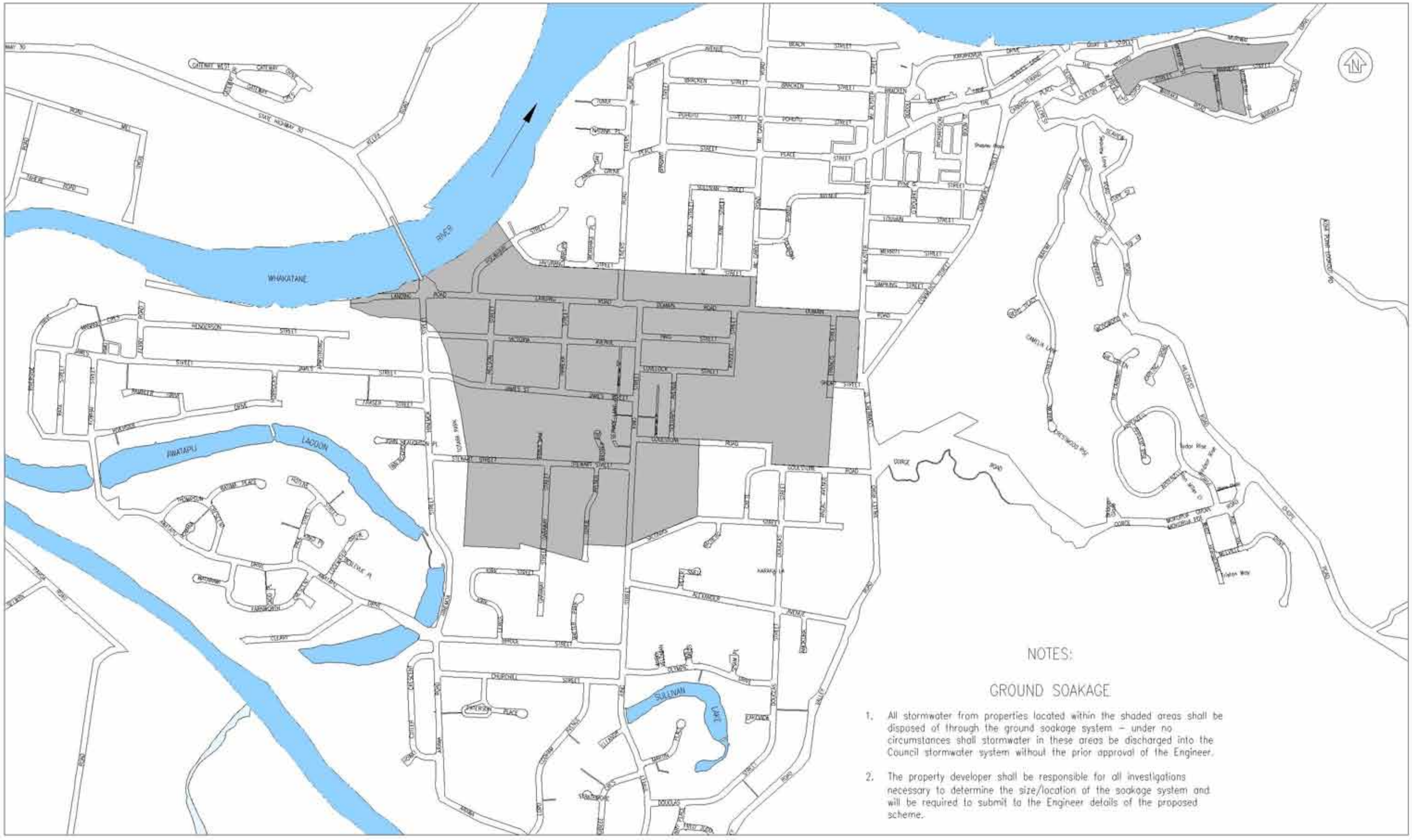
Time of Entry to the system shall be calculated from the Overland Flow graph in Clause 4.1.12.3 below or an equivalent published graph and the formula from which it was derived.

Overland Flow Graph



TIME OF TRAVEL OVER SURFACE - minutes LENGTH OF OVERLAND FLOW - metres

Example: for surface water flowing 50m over a paved surface at a slope of 5%, the time of travel is 4.1 minutes



WHAKATANE DISTRICT COUNCIL

STANDARD DRAWING

NOT TO SCALE

WHAKATANE URBAN AREA GROUND SOAKAGE

APPENDIX 4.2
ISSUE 7.0
SEPTEMBER 200