GISBORNE

first to see the light

ENGINEERING CODE OF PRACTICE

Section 1
Introduction

This Code of Practice provides guidelines for the engineering standards which Council considers are acceptable solutions for Subdivision and Land Use projects in the Gisborne District. These standards can be applied during the investigation, design and construction of any development.

The Code of Practice is subdivided into six technical sections. These are:

Section 2	Geotechnical Engineering
Section 3	Stormwater
Section 4	Sanitary Sewer
Section 5	Water Supply
Section 6	Road and Traffic Engineering
Section 7	Contracts, Quality Assurance Inspection, and As-Built Record and Reporting

The technical sections are separately paginated to make them easier to use, either together or individually. The front of each section contains a detailed Table of Contents. References to published documents and standards are provided in all the Sections.

Section 1: An Introduction to the Engineering Code of Practice

Section 1: An Introduction to this Code of Practice

1.1 Introduction and Objectives

This Code of Practice is a document which the Gisborne District Council hopes will :

- Assist Developers to assess their obligations, responsibilities and liabilities on engineering issues before embarking on a subdivision or land development project, or building project in the Gisborne District. This document shall only apply to infrastructure to be connected to Council assets, assets that Council will take ownership of, and Council's own assets.

- Assist Developers to determine the engineering design standards and performance targets that must be achieved in order to meet the conditions set by Council for the development of new facilities in the Gisborne District, as required by a Resource Consent.

- Help Council to maintain a consistent, fair and flexible approach to the appraisal of developments.

- Encourage innovation in development projects so that Gisborne District benefits from the entrepreneurial skills of its people.

Council intends that the Engineering Code of Practice will be:

- applicable to all land and infrastructure development within the District, including:

  1. Subdivision Consents - By providing a set of Engineering Standards to enable compliance with the rules for subdivision activities in the District Plan, and to identify standards which developers may be required to comply with as a condition of a subdivision consent.

  2. Land Use Consents - By providing a set of Engineering Standards to enable compliance with the rules for developments and permitted land use activities in the District Plan, and to identify standards which developers may be required to comply with as a condition of a land use consent.

3. Building Consents - By providing a set of conditions for the supply of services in accordance with the requirement of the Building Act as part of the Project Information Memoranda and the building consent process.

- an end-product based document that requires developers to document each phase of the proposed development and to certify, through appropriately qualified professionals, any work that is put to Council for acceptance, either as a public or private asset, in accordance with the requirements of the District Plan or the Building Act or a resource consent.

- a living document which will be revised as technology changes.

1.2 Structure of this Code of Practice

This Code of Practice is presented in two parts;

- Part 1 - provides an introduction to the Code, and describes the relationship between the Code, the District Plan and the Building Act.

- Part 2 - provides the Engineering Standards. This part is presented in seven technical sections.

1.3 Relationship Between this Code and the District Plan

The purpose of the District Plan is to assist the Gisborne District Council to carry out its statutory functions in accordance with the Resource Management Act. The Council has the responsibility for the integrated management of the effects of subdivision and land development activities, and the control of those effects on the environment.

In the Gisborne District Plan, there is a clear separation between the Objectives, Policies and Methods for addressing the effects of subdivision and development activities (these being contained within the District Plan) and the Engineering Standards used when setting conditions for consent (these being contained in the Engineering Code of Practice).

This Code of Practice is not a part of the District Plan. The Code describes engineering standards which Council believes provide acceptable solutions, but not necessarily the only solutions, for the engineering works associated with subdivision and land development. Council will impose conditions on Resource Consents, using the Code of Practice as a reference document for acceptable solutions.
These conditions will be enforceable through the resource consent and building consent process. If a developer wishes to use engineering solutions or standards

other than those described in the Code, these will need to be fully justified by an appropriately qualified professional, as part of the process establishing compliance with the conditions of a resource consent.

1.4 Relationship between this Code and the Building Act

The Building Act came into effect on 1 July 1992. It established a new system of building control, and includes a new Building Code which is more flexible and significantly different from the previous bylaw system. All elements of building are brought into the scope of this Act. The Building Consent is the focus for all technical building matters.

This Code of Practice provides the builder and building owner with information on the Engineering Standards that Council will use when setting conditions for building consent, on topics such as:

- land stability
- vehicle access
- road development
- services such as water supply, stormwater and sewage
- and Council's requirements regarding the connection of services in a subdivision or land development to existing Council services.

This Engineering Code of Practice does not provide specific technical information relating to building works, such as plumbing, drainage, structural design, electrical standards or painting and decorating.

1.5 How this Code Helps When Applying for a Resource Consent, or Land Use Consent

The standards provided in the Engineering Code of Practice can be used several times during a development. During the preparation of a Consent Application to Council, and during Engineering Design and Construction, the Code will help developers to understand and the meet Resource Consent Conditions. Because the scale of subdivisions and land development can vary from, for example, a simple subdivision of two units, to a subdivision with many house units, services and roads, the amount of detail submitted with an application will also vary.

We suggest that you contact the Council to find out what the relevant requirements are for resource consent and building consent applications.

Section 2: Geotechnical Engineering

Contents

The Contents of this Section are as follows:

Section 2: Geotechnical Engineering

2.1 Introduction

This section of the Code of Practice provides guidelines for the geotechnical issues associated with a Subdivision or Land Development. Geotechnical issues may include the following:

- the earthworks associated with the excavation and filling of land
- the construction of stable slopes
- the suitability of both natural and made ground for the foundation of roads, buildings, services and other works.
- the control of erosion during and after earthworks

Because of the wide range of soil types, physical conditions, erosion potential and environmental factors experienced in the Gisborne District, it is not possible to set precise requirements which will be applicable in all cases. The criteria set out in this section are therefore intended as indicative standards only. It is expected that if a Subdivision or Land Development involves earthworks, that the advice of an appropriately qualified professional will be obtained.

2.2 Standards and Publications

If the proposed development involves significant earthworks the advice of an appropriately qualified professional is required. Reference can also be made to the following recommended publications:

NZS 4431 : 1989 Code of Practice for Earth Fill for Residential Development

NZS 3604 : 1990 Code of Practice for Light Timber Frame Buildings not requiring specific design (Parts 3 and 4 in particular)

NZS 4229 : 1986 Code of Practice for Concrete Masonry Buildings not requiring specific design (Parts 3 and 4 in particular)

NZS 4402 : 1986 Methods of Testing Soils for Civil Engineering Purpose, Parts 1 and 2

TNZ F/1 1986 Specification for Earthworks Construction

NZS 4404 : 1981 Code of Practice for Urban Land Subdivision

New Zealand Building Code, in particular Section B1

DSIR Information Series No.122, January 1977, Slope Stability in Urban Development

Erosion and Sediment Control Guidelines for Land Disturbance Activities by *Auckland Regional Authority*

2.3 Responsibility of the Developer in relation to Earthworks

Council will require that Developers take full responsibility for any land development or subdivision that may affect the existing landform. To ensure this, and with particular reference to the geotechnical aspects of the project, the following reports will normally be required:

- Preliminary Geotechnical Report - with Resource Consent Application or Building Consent Application.
- Geotechnical Design Report - following Consent
- As Built information, Quality Assurance Report and Certification - submitted for Section 224 approval, or Code Compliance in accordance with Section 7 of this Code of Practice.

These reports are described in more detail below.

2.4 Preliminary Geotechnical Report

After the development of preliminary Scheme Plans, and prior to any detailed planning and design, a Preliminary Geotechnical Report will be required, (except if specifically exempted by Council) in support of a Consent Application, where land development involves any one of the following:

General Earthworks Where Total Earthworks Volume is (cut plus fill) > 50 m^3 in-situ Measure **and**

- Earthworks within identified or known hazard zones **or**
- Earthworks that significantly alter, or could contribute significant sediment or debris, to surface or subsurface drainage patterns

Excavation of a Total Earthworks Cut Where Total Earthworks Volume is > 50 m^3 in-situ Measure **and**

- Excavations greater than 2.5 metres overall vertical extent **or**
- Excavations steeper than 2.5 Horizontal to 1 Vertical (22°) **or**

- Excavations on, or within ten metres of, existing slopes higher than 5 metres overall vertical extent **or**
- Excavations below the ground water table **or**
- Excavations the top of which are within 10 metres of buildings or surcharge loads

Fill of a Total Earthworks Cut Volume > 50 m^3 in-situ Measure **and**

- Buildings on fill or made ground **or**
- Fills on existing ground sloping steeper than 3.5H:1V (16°) **or**
- Fills constructed on, or within a zone extending above an angle of 3 Horizontal to 1 Vertical (18°) from, the toe of a slope or river bank **or**
- Fills within 10 metres of a building or the base of a slope **or**
- Fills with a maximum depth greater than 1.5 metres **or**
- Fills with batter slopes steeper than:

    a) 2H:1V (26°) in sand and gravel
    b) 3H:1V (18°) in silt and clay

Retaining Structures Where

- Retaining walls higher than 1.5 metres overall vertical extent
- Retaining walls with sloping backfill
- Retaining walls with surcharge loading within three metres of top of wall

The Preliminary Geotechnical report is to be prepared by an appropriately qualified professional. It will provide a preliminary evaluation of the site in sufficient detail to determine the likely geotechnical requirements of the proposed subdivision. The report must be submitted with the Consent Application and will include:

(a) the results of any site investigations and material testing,
(b) the assessment of geological hazards,
(c) the geotechnical constraints on land development,
(d) the geotechnical recommendations for site development, for issues such as batter slopes, fill construction, drainage, erosion control etc.
(e) the identification of any requirements for additional investigations or analysis,
(f) the confirmation that a suitable building site is available on each lot,
(g) the confirmation that suitable vehicle access can be provided to each lot, and building site.

(h) Assessment of sediment run-off during the time in which vegetation has been removed from the site.

2.5 Geotechnical Design Report

The Conditions on a Resource Consent or Building Consent may require more detailed geotechnical investigation and analysis where this is identified as being necessary in the Preliminary Geotechnical Report, where the Resource Consent conditions require it, or where new issues arise during detailed design.

A Geotechnical Design report shall detail all investigations and design work carried out, conclusions drawn and recommendations made, and list any requirements for construction. Relevant topics may include assessments of material types and use, foundation bearing capacity, lateral pressures on retaining walls, settlement, slope stability, required subsoil and surface drainage, fill compaction standards for differing soil types, stormwater controls, septic tank effluent disposal (where relevant), batter slopes on fills and cuts, access road drainage controls and erosion protection etc.

2.6 Guidelines for Specifications and Drawings

If the earthworks associated with a subdivision or land development requires a construction specification Council will expect it to be prepared to a standard that ensures that all features of the design are properly understood and carried through to construction. The following information refers to specifications for earthworks. Reference should also be made to Section 7 of this Code of Practice which provides a general overview of construction specifications.

A specification for workmanship and materials must be provided covering earthworks standards, methods of quality control to be achieved during construction and the systems of checking to be used in monitoring the works. Typically this will include :-

- standards for stripping of the existing ground and removal of unsuitable materials
- standards for the placing and for the quality of fill material
- standards for cut slopes and benching if required
- compaction standards (refer NZS 4431, 1989)
- geometric control of finished levels and position, including batter slopes
- standards for earth reinforcement, and/or retaining wall construction, including foundation preparation
- dust control standards

- requirements for revegetation and/or landscaping of batters.
- Quality Assurance "Hold Points" and inspection by the Certifying Engineer (refer NZS 4431, 1989 Section 9) e.g. foundation suitability and testing.
- Sediment control standards (reference can be made to *Erosion and Sediment Control Guidelines for Land Disturbance Activities* by *Auckland Regional Authority)*

Typically the construction and "as built" drawings associated with an earthwork project will include, but not be limited to:

- the extent of cut and fill, batter slopes and heights, road subgrade geometry, and the extent and type of subsoil drainage
- the pre-construction and post construction contours including details of the drainage paths.
- construction detail for retaining walls and/or earth reinforcement.
- details of proposed silt control during construction.
- details of culverts - size and alignment, inlet and outlet details, installation detail.
- Refer also Section 7 of the Code of Practice, and NZS 4431, 1989, Section 10.

Section 3
Stormwater

Contents

The Contents of this Section are as follows:

Section 3: Stormwater

3.1 Introduction

This section provides a set of Engineering standards for the design and construction of stormwater drainage within subdivisions which are to come under Gisborne District Council (GDC) ownership. The intention is to:

- ensure that the stormwater drainage system is designed and constructed so that the subdivision exceeds the surface water performance criteria of the *New Zealand Building Code.*
- provide guidance for effective supervision leading to high construction standards.

3.2 Performance Criteria

3.2.1 Capacity and Layout

APPENDIX/URBAN STORMWATER CRITERIA ← LEVELS OF SERVICE →			
Item	Level 1	Level 2	Level 3
Gully Trap Above flood level	"100yr" + 100mm freebboard	"50yr" + 50mm freeboard	"20yr" + 50mm freeboard
Above ground level	GL + 150mm	GL + 100mm	GL + 50mm
Existing Houses Freeboard above flood level:	"100yr" + 100mm freeboard	"50yr" + 50mm freeboard	"20yr" + 50mm freeboard
Properties Maximum frequency of flooding: lawns/gardens/sheds etc (exclude minor ponding)	1 in 5yr	1 in 2yr	1 in 1yr
Street Flooding Maximum frequency of street flooding (over extensive lengths; up to 200mm deep in gutters)	1 in 2yr	1 in 2yr	1 in 1yr
Streets As Flowpaths Product of (velocity x depth) not to exceed 0.4 m²/seconf in the following flood events	1 in 100yr	1 in 50yr	1 in 20yr

Notes: 1. The above criteria are the minimum to be achieved for each level of service
2. The above table does not apply to new subdivision

The stormwater system shall:

a) Provide protection from floods of up to a 1% probability of exceedance (100 year return period) using a system of primary and secondary flow paths, appropriate to the intended land use.

b) Provide protection from floods of up to a 10% probability of exceedance (10 year return period) using a system of primary flow paths appropriate to the intended land use. This protection will include preventing the ingress of stormwater into the reticulated sewerage system in all but the 1% event.

c) Provide rural lots with an area suitable for effluent disposal that is free from inundation in a storm of up to 10% probability of exceedance (10 year return period storm) and will not cause a health hazard during any inundation.

d) Adequately service the catchment and accommodate the design flows, for both the level of development at the time of design and that which can reasonably be expected to exist once the catchment is fully developed as allowed for under the District Plan.

e) Adequately service each lot, road area or land area discharging to a point of entry, and conveying such surface water to an approved outlet.

f) Wherever practical convey the flow by gravity.

g) Be compatible with the existing drainage network without causing any adverse effects on the existing system, or on upstream and downstream properties.

h) Not place undue restrictions on the location of any future building or development nor cause any undue risk to public health and safety.

i) Be designed and constructed to facilitate ongoing maintenance, minimize risk of blockage, leakage, penetration by roots, entry of groundwater (where pipes or lined channels are used), outlet scour or land instability, and provide efficient and safe inlet and discharge.

j) Enhance the amenity value of any open channels and flood banks with protection from scouring, erosion or siltation.

k) Comply with all applicable Resource Consents and avoid, remedy or mitigate adverse effects on the environment.

l) Utilise mechanical, electrical, alarm and telemetry equipment which is compatible with existing equipment used by GDC.

m) Ensure that mechanical and electrical equipment is either designed for submergence, or located above the 100 year design flood level. (1% probability of exceedance)

n) Minimise whole of life costs, by utilising best practice in design, construction and operation.

3.2.2 Structural Integrity

The stormwater system shall:

a) Be constructed from approved materials suitable for that use, with a minimum design life of 80 years, and with a proven record of performance.

b) Not suffer damage from any anticipated superimposed load or normal ground movement, and ensure safety during operation of the system.

c) Minimize root penetration of piped systems and erosion, piping or collapse of batter slopes of open channels.

3.3 Design Guidelines

The following topics are included in the discussion of design guidelines:

3.3.1 The Stormwater System

3.3.2 Catchments

3.3.3 Stormwater Runoff

3.3.4 System Design

3.3.5 Pipeline Design

3.3.6 Open Watercourses

3.3.7 Inlet and Outlet Structures

3.3.1 The Stormwater System

Stormwater drainage encompasses the total system protecting land, buildings and infrastructure against flooding. The primary drainage system consists of pipes and open channels, while overland flow paths and controlled flood paths form the secondary system and provide additional protection.

3.3.2 Catchments

All stormwater systems shall provide for the collection and controlled disposal of stormwater from within the land being developed, together with any runoff from upstream catchments including roads and driveways etc. In designing downstream facilities the upstream catchment should be considered as being fully developed to the extent permitted in the current District Plan under both present and deferred zonings.

For large developments or where constraints exist in the downstream stormwater system, the developer is required to ensure that the development does not exceed the capacity of the downstream stormwater system. To satisfy this requirement the design of stormwater attenuation may be required within the development catchment area. Specific attenuation methods and design criteria shall be submitted to Council for approval.

3.3.3 Stormwater Runoff

Stormwater runoff from a catchment or watershed, above a particular element of the system being designed, should be calculated using a sophisticated hydrological modelling package. For catchments up to 100 ha in size, where surface water results from rainfall on this catchment only, stormwater runoff may be calculated using the Rational Method as detailed in the NZ Building Code Document E1- Surface Water Verification Method 1. Alternative methods will be accepted subject to certification by an appropriately qualified professional, and approval by Council.

Data for Rainfall intensities and duration for probabilities of exceedance can be obtained from Council, who will use the *HIRDS*, High Intensity Rainfall Design System. Developers will be asked to provide Council with location coordinates for this system

3.3.4 System Design

When preparing a system design, the designer must:

(i) Use the best hydrological information available on local conditions.

(ii) Be a person who on the basis of experience or qualification is competent to apply them.

(iii) Take into account any possible secondary flow.

The primary stormwater system shall be comprised of pipes, except where Council approves an open watercourse (refer Section 3.3.6).

The primary stormwater system of pipes and/or open watercourses shall have sufficient capacity to convey a 10 year rain storm without surcharging onto roads i.e., not within 400mm of kerb tops. If a detailed accurate runoff calculation method is applied, a hydraulic grade line 250mm below kerb level may be acceptable to the Council.

For rainfall in excess of a 10 year storm up to a 100 year rainstorm, the secondary stormwater system shall have sufficient capacity to discharge runoff and protect buildings and household gully traps from inundation.

3.3.5 Pipeline Design

Pipes shall be sized according to Colebrook White's formula or any other approved method, such as Manning's formula (Culverts). Supporting calculations shall be submitted to Council for approval.

Appropriate allowance shall be made for head losses at changes of direction in manholes, as per the *New Zealand Building Code, Approved Document E1 – Surface Water, Verification Method 1.*

The following overall coefficients, Council believes, allow for aging, joints and other fittings:

- Colebrook-White (ks) = 0.6
- Manning (n) = 0.012

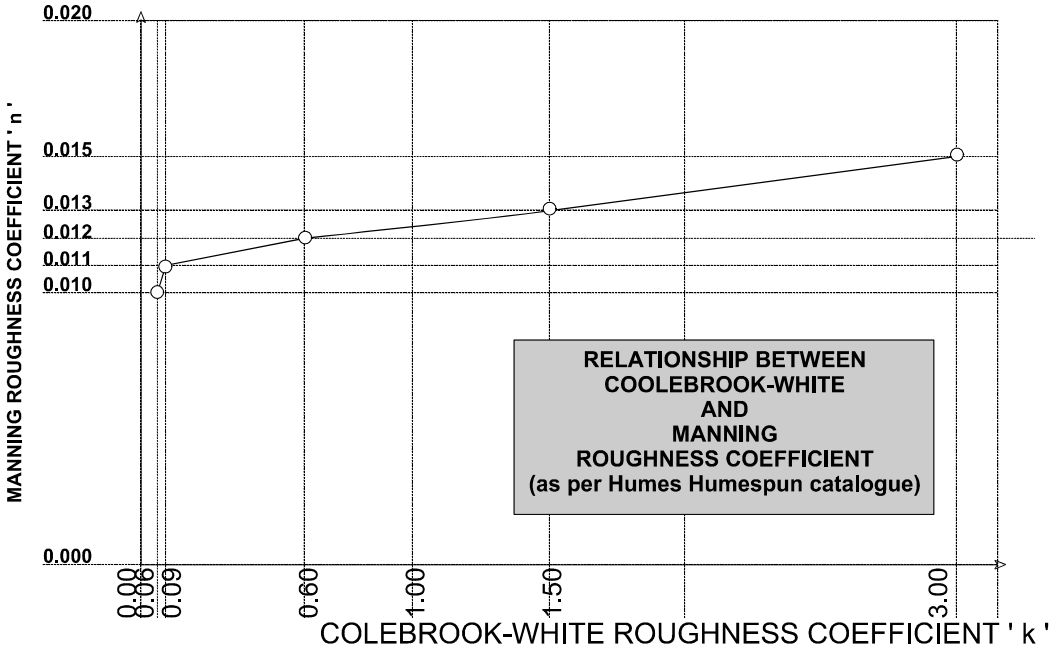
Where possible the minimum flow velocity for pipes flowing just full shall be 0.6 m/s, where there are sumps in the system, otherwise 0.9 m/s.

No stormwater pipe, except for a connection to a lot shall be less than 200mm internal diameter.

All stormwater pipes shall be laid in accordance with the manufacturers recommendations.

Pipeline plans shall show long-sections, identifying other crossing services (except water supply laterals) and other drains with pipe diameters and invert levels. Pipewall strength shall be sufficient to withstand soil pressure, surface and traffic loads, and any other loads to be anticipated. These factors shall be taken into account during design, and appropriately documented in the information supplied to Council.

Figure 2



3.3.6 Open Watercourses

Open watercourses are discouraged as permanent features in urban areas. Consultation with Council's Drainage Engineer is required if alternative disposal methods are not available.

Existing watercourses within a development or subdivision shall be protected by a drainage easement. The easement shall include clear land sufficient to allow access for maintenance purposes with the minimum berm requirements as shown in the Drawings.

The extent of any stream or open watercourse improvement work shall be agreed with the Council . Factors for consideration are:

- the retention of natural topography and vegetation
- hydraulics
- maintenance requirements

Where open watercourses are retained through a new development, channel upgrading and/or land raising may be required.

The design of open channels and secondary flow paths, e.g. parks, roads, paths and drainage reserves, shall ensure that flow velocities will not cause erosion or scour. Where potential for scour or erosion exists preventative measures such as silt and debris traps, bank and bed protection, shall be included in the design. All overland flow paths shall be identified in the combined District Plan, and protected from conflicting uses and restrictions or obstruction by way of easements or encumbrance on the title.

3.3.7 Inlet and Outlet Structures

Permanent structures shall be constructed at the inlets and outlets of pipelines. Provision shall be made for energy dissipation unless it is demonstrated that outlet velocities and in-situ bed and bank materials are such as to make this unnecessary. The design shall ensure non-scouring velocities at the point of discharge. Inlet structures shall be designed to develop sufficient head to overcome entry losses.

3.3.8 Manholes

- ***General***

  Manholes shall be provided on all pipelines, at each change of direction and/or gradient, at changes of pipe size, at the junctions of all pipelines greater than 100mm in diameter, at the termination of mains, and at a spacing of not more than 100m. Typical manhole details are shown on the Drawings.

- ***Standard Manholes***

  Standard manholes are to be circular with an internal diameter of 1050mm and shall be used on pipelines deeper than 600mm, from ground to pipe invert.

  Precast manholes shall consist of 1050mm internal diameter spun concrete pipe to *NZS 3107* Class S with holes cast in the side for step irons. The manhole shall be constructed of pre-cast concrete manhole risers, pre-cast concrete bases, pre-cast concrete lids and cast iron frames and covers, as shown on the Drawings.

  Manholes shall be constructed from the longest available risers relative to the depth of the manhole, in order to reduce the number of joints. This will normally mean that no joints will be permitted in the risers for manholes less than 2.4m deep.

  Where joints are unavoidable and in addition to the manufacturer's standard joint details, all joints must be wrapped externally with a waterproof "Densopol 60HT tape" for external joint seal or similar for additional infiltration protection.

- ***Shallow Manholes***

  Shallow manholes of 600mm maximum depth may be constructed using 600mm diameter reinforced concrete pipe (½ sump barrels) to *NZS 3107*, subject to specific approved from Council. Lids and fittings must be compatible with the reduced diameter.

- ***Manholes on Large Pipelines***

  Manholes on large pipelines where the use of a standard manhole is not suitable shall be specifically designed to the approval of GDC. Manholes on straight sections of pipelines of 1.2m diameter and larger may be constructed using pre-formed tees, subject to approval by Council.

- ***Deep Manholes***

  Manholes deeper than 5 metres shall be subject to specific design and separate approval for Council, in particular to meet specific access conditions.

- ***Hydraulic Flow in Manholes***

  Losses in a manhole shall be compensated for by a drop in the invert across the manhole equivalent to 20mm plus 5mm per 10° of change in direction of flow, or as determined from a specific calculation. For a pipeline greater than 1m in diameter the drop shall be determined by specific design. Reference for assistance with these calculations can be made to the *Australian Rainfall and Runoff Manual: 1987,* and *Hydraulic Design Manual of Concrete Pipe Association of Australia (available from Humes).*

- ***Benching***

  The pipe invert and benching through manholes shall be as detailed in the Drawings. Edges shall be rounded and the benching given a form and finish which facilitates smooth flow, non-entrapment of debris, and easy access with cleaning rods.

- ***Steps and Ladders***

  Manholes other than shallow manholes shall be provided with approved hot dipped galvanised steel step irons. Step irons shall be of the "dropper" or "safety" type such that a foot will not slide off and shall be spaced at 300mm centres. For detailing see the Drawings.

- ***Manhole Lids and Covers***

  Manhole lids and covers shall be as detailed on the Drawings. Aluminum covers are not permitted. The lids and covers shall be precast 200mm thick extra heavy duty within the roadway of arterial roads (HN-HO-72 loading) and 150mm thick heavy duty within the roadway of residential and subdivision roads (0.85 HN-HO-72 loading). Light duty lids and covers can be used in footpaths and berms.

- ***Manholes in Soft Ground***

  Where a manhole is to be constructed in soft ground (<2 blows per 50mm on the Scala Penetrometer) the foundation needs to be specifically designed and approved by Council. Typically a softer foundation will be undercut and backfilled with suitable hardfill to provide an adequate foundation. On very soft ground the use of geotextile and geogrid should also be considered. Alternatively, subject to specific approval, the manhole shall be constructed on a reinforced concrete pad at least twice the plan area of the manhole.

- ***Pipe Connections to Manholes***

  The typical pipe connection to manholes is detailed in the Drawings. For intrusions through the manhole using PVC pipe, the surface of the pipe must be roughened in accordance with the manufacturers recommendations (e.g. sanded connections) so that the pipe adheres to the mortar used.

- ***Manhole Requirements for Pipe Inter-Connections***

  Branch lines 300mm diameter and smaller may be saddled directly onto pipelines 900mm diameter or larger, providing a manhole or other surface opening is supplied on the branching line within 50m of the main line.

Where a smaller diameter pipe is connected into a larger pipe the soffit to soffit of the two pipes shall be set at equal height, with the first joint within 450mm, to assist with rendering and sealing the joint, as shown on the Drawings.

3.3.9 Connections

Each residential stormwater connection shall be capable of providing drainage from the whole building area of a lot (including all surface water from the yard), at grades and cover complying with the *New Zealand Building Code*. However, under special conditions, and subject to certification by the designer and approval by Council of an adequate soakage system, the requirement to include the yard surface water in the capacity of the connection may be waived. The certification from the designer shall include adequate proof that the soil and ground water on the lot can provide sufficient soakage. A suitable solution for catchment areas not exceeding 0.25 ha is provided in the *NZ Building Code Approved Document E1- Surface Water Acceptable Solution 1.* (Note: the limitations detailed in 1.0.1 of this Acceptable Solution)

A connection laid to a residential lot shall end at least 500mm inside the boundary. The connection shall preferably discharge into the road channel but may be connected to a manhole, pipeline or road sump subject to approval. Pipes larger than 100mm diameter shall discharge direct to a pipe, or enter the kerb via a back entry sump. See also notes under 3.3.8 for inter-connections.

Where a connection is deeper than 1.8m below ground level, a ramped riser shall be constructed to bring the connection to within 1.2m of ground level.

The connection provided for each residential lot shall be capable of taking the spigot end of a 100mm nominal internal diameter PVC pipe.

Connections for commercial and industrial lots shall be designed to accommodate the design flow from the area served by the connection and meet the requirements of *NZ Building Code E1- Surface Water.* Connections larger than 100mm diameter shall be made directly to a main pipeline or road sump. The end shall be sealed either by a factory sealed stopper or a plug fixed with a rubber ring and held with stainless steel wire.

3.3.10 Sumps

Sumps shall be located at intervals as per hydraulic calculation and not greater than 100m in road carriageways and at street intersection radius tangent points to ensure the total design flow can enter the stormwater system without surcharging. The intake capacity of a road sump with grating, back entry, and acceptable ponding, is per the following sump entry capacities table. The sump design preferred by Council is shown on the Drawings.

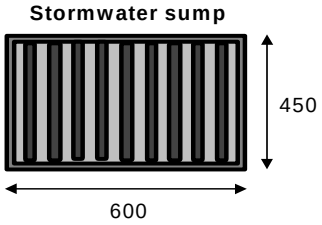
Comment: ***The sump capacity will depend on perimeter length of the grate and average .allowed depth of ponding above sump grate. Acceptable ponding will be determined with GDC level of service requirements or in accordance with GDC stormwater manual.***

SUMP ENTRY CAPACITIES

$$Q = 1.66\ P\ d^{1.5}$$

P (m)- perimeter length of the grate excluding section against the kerb

d (m) - average depth of ponding



d	$d^{1.5}$		Q_1	Q_2	Q_3	Q_4	Q_5	Q_6	Q_7	Q_8
		P=	0.45	0.60	0.90	1.05	1.20	1.50	1.65	2.10
		l=	*0.45*	*0.60*	*2 x 0.45*	*0.45 + 0.60*	*2 x 0.60*	*2 x 0.45 + 0.60*	*2 x 0.60 + 0.45*	*2 x 0.6 + 2 x 0.45*
m	-		l/s	l/s	l/s	l/s	l/s	l/s	l/s	l/s
0.01	0.001000		**0.7**	**1.0**	**1.5**	**1.7**	**2.0**	**2.5**	**2.7**	**3.5**
0.02	0.002828		**2.1**	**2.8**	**4.2**	**4.9**	**5.6**	**7.0**	**7.7**	**9.9**
0.03	0.005196		**3.9**	**5.2**	**7.8**	**9.1**	**10.4**	**12.9**	**14.2**	**18.1**
0.04	0.008000		**6.0**	**8.0**	**12.0**	**13.9**	**15.9**	**19.9**	**21.9**	**27.9**
0.05	0.011180		**8.4**	**11.1**	**16.7**	**19.5**	**22.3**	**27.8**	**30.6**	**39.0**
0.06	0.014697		**11.0**	**14.6**	**22.0**	**25.6**	**29.3**	**36.6**	**40.3**	**51.2**
0.07	0.018520		**13.8**	**18.4**	**27.7**	**32.3**	**36.9**	**46.1**	**50.7**	**64.6**
0.08	0.022627		**16.9**	**22.5**	**33.8**	**39.4**	**45.1**	**56.3**	**62.0**	**78.9**
0.09	0.027000		**20.2**	**26.9**	**40.3**	**47.1**	**53.8**	**67.2**	**74.0**	**94.1**
0.10	0.031623		**23.6**	**31.5**	**47.2**	**55.1**	**63.0**	**78.7**	**86.6**	**110.2**
0.11	0.036483		**27.3**	**36.3**	**54.5**	**63.6**	**72.7**	**90.8**	**99.9**	**127.2**
0.12	0.041569		**31.1**	**41.4**	**62.1**	**72.5**	**82.8**	**103.5**	**113.9**	**144.9**
0.13	0.046872		**35.0**	**46.7**	**70.0**	**81.7**	**93.4**	**116.7**	**128.4**	**163.4**
0.14	0.052383		**39.1**	**52.2**	**78.3**	**91.3**	**104.3**	**130.4**	**143.5**	**182.6**
0.15	0.058095		**43.4**	**57.9**	**86.8**	**101.3**	**115.7**	**144.7**	**159.1**	**202.5**
0.16	0.064000		**47.8**	**63.7**	**95.6**	**111.6**	**127.5**	**159.4**	**175.3**	**223.1**
0.17	0.070093		**52.4**	**69.8**	**104.7**	**122.2**	**139.6**	**174.5**	**192.0**	**244.3**
0.18	0.076368		**57.0**	**76.1**	**114.1**	**133.1**	**152.1**	**190.2**	**209.2**	**266.2**
0.19	0.082819		**61.9**	**82.5**	**123.7**	**144.4**	**165.0**	**206.2**	**226.8**	**288.7**
0.20	0.089443		**66.8**	**89.1**	**133.6**	**155.9**	**178.2**	**222.7**	**245.0**	**311.8**
0.21	0.096234		**71.9**	**95.8**	**143.8**	**167.7**	**191.7**	**239.6**	**263.6**	**335.5**
0.22	0.103189		**77.1**	**102.8**	**154.2**	**179.9**	**205.6**	**256.9**	**282.6**	**359.7**
0.23	0.110304		**82.4**	**109.9**	**164.8**	**192.3**	**219.7**	**274.7**	**302.1**	**384.5**
0.24	0.117576		**87.8**	**117.1**	**175.7**	**204.9**	**234.2**	**292.8**	**322.0**	**409.9**
0.25	0.125000		**93.4**	**124.5**	**186.8**	**217.9**	**249.0**	**311.3**	**342.4**	**435.8**
0.26	0.132575		**99.0**	**132.0**	**198.1**	**231.1**	**264.1**	**330.1**	**363.1**	**462.2**
0.27	0.140296		**104.8**	**139.7**	**209.6**	**244.5**	**279.5**	**349.3**	**384.3**	**489.1**
0.28	0.148162		**110.7**	**147.6**	**221.4**	**258.2**	**295.1**	**368.9**	**405.8**	**516.5**
0.29	0.156170		**116.7**	**155.5**	**233.3**	**272.2**	**311.1**	**388.9**	**427.7**	**544.4**
0.30	0.164317		**122.7**	**163.7**	**245.5**	**286.4**	**327.3**	**409.1**	**450.1**	**572.8**
0.31	0.172601		**128.9**	**171.9**	**257.9**	**300.8**	**343.8**	**429.8**	**472.8**	**601.7**
0.32	0.181019		**135.2**	**180.3**	**270.4**	**315.5**	**360.6**	**450.7**	**495.8**	**631.0**
0.33	0.189571		**141.6**	**188.8**	**283.2**	**330.4**	**377.6**	**472.0**	**519.2**	**660.8**
0.34	0.198252		**148.1**	**197.5**	**296.2**	**345.6**	**394.9**	**493.6**	**543.0**	**691.1**
0.35	0.207063		**154.7**	**206.2**	**309.4**	**360.9**	**412.5**	**515.6**	**567.1**	**721.8**
0.36	0.216000		**161.4**	**215.1**	**322.7**	**376.5**	**430.3**	**537.8**	**591.6**	**753.0**
0.37	0.225062		**168.1**	**224.2**	**336.2**	**392.3**	**448.3**	**560.4**	**616.4**	**784.6**
0.38	0.234248		**175.0**	**233.3**	**350.0**	**408.3**	**466.6**	**583.3**	**641.6**	**816.6**
0.39	0.243555		**181.9**	**242.6**	**363.9**	**424.5**	**485.2**	**606.5**	**667.1**	**849.0**
0.40	0.252982		**189.0**	**252.0**	**378.0**	**440.9**	**503.9**	**629.9**	**692.9**	**881.9**
0.41	0.262528		**196.1**	**261.5**	**392.2**	**457.6**	**523.0**	**653.7**	**719.1**	**915.2**
0.42	0.272191		**203.3**	**271.1**	**406.7**	**474.4**	**542.2**	**677.8**	**745.5**	**948.9**

Discharge from sumps shall be via pipe leads with a minimum diameter of 200mm, either

- directly into manholes, or

- soffit to soffit into a stormwater main of at least 600mm diameter, provided that the receiving pipe has a manhole within 40m of the sump lead connection. Where the hydraulic gradient of a sump lead is affected by pipe full conditions in the main, specific design calculations to determine size will be required.

Sumps shall have a minimum trap depth of 225mm below the invert of the sump outlet.

Sumps shall be sited so that they do not impede accessways or kerb crossings due to any ponding that may occur in events less than 10% probability of occuring annually.

Design consideration shall also be given to the effect of stormwater flows from and along the road surface, e.g. flow around corners and at intersections.

During road works or construction a suitable means of preventing debris entering sumps must be used. Any gravel or debris entering sumps or the stormwater system shall be removed or flushed from the system prior to acceptance by GDC.

3.3.11 Location of Pipelines

In residential areas stormwater pipelines should be laid within the road reserve. Due account should be given to location of other services, when defining pipeline alignments. Space limitations usually require that drainage pipes (sewer and stormwater) must be laid in the carriageway. If possible, drains shall be laid where access from the surface is possible at all times. Pipelines shall not be laid within 500mm of kerb lines.

Pipelines on private land shall be sited to minimize reduction of the building area available. Pipelines shall be laid at least 1.0m clear of existing buildings. Drainage structures including manholes shall be located clear of boundaries and kerblines.

Stormwater pipelines shall be extended to the upper boundary of a subdivision unless otherwise approved. Easements shall be provided for any public drainage on private property.

3.3.12 Stormwater Pumping

Stormwater pumping will only be approved where gravity disposal is not feasible. Pumping systems shall be specifically designed using a multi pump system to best balance the need for regular pump operation against the relative infrequency of major storm events. Design philosophy and technical details shall be discussed with Council before detailed design is commenced. All electrical equipment shall be designed for a maximum of 15 starts per hour.

All pumps within a station shall be of the same capacity. An additional installed pump shall act as standby. Depending on the consequences of flooding during a pump station power outage, GDC will require that on-site emergency power generation be provided.

Valving of pumps shall be such that maintenance can be undertaken on the standby pump and check valve without interfering with the operation of the duty pump. Pipes of 100mm diameter or larger shall be ABS, API Schedule 40 line pipe, concrete lined steel, ductile iron, or PVC material (of appropriate Class); with all bends and valves adequately protected against movement. Flanged or welded fittings shall be provided throughout, with a proprietary dismantling joint or similar in the system to facilitate dismantling.

Stormwater pump stations shall incorporate control, monitoring, alarm and telemetry communication systems to GDC standards at the time of the design. Any station on private land must have all weather access for light 5 to 7 tonne trucks.

3.3.13 Siphon

Inverted siphons are not acceptable, except with the approval of GDC.

3.3.14 Vicinity of Other Services

Where a stormwater pipe crosses another service pipe a minimum clearance of 150mm shall be maintained between the pipes. Due care must be given to proper compaction of the fill between and around the pipes. A smaller clearance will be accepted if the upper pipe is supported on a pedestal either side of the lower service pipe, as shown in the Drawings.

3.3.15 Miscellaneous Facilities

Components of stormwater drainage systems which have not been specified may be proposed for use in stormwater drainage. Possible examples include stopbanks, dams and spillways. Such items will be subject to the specific approval of GDC.

3.4 Guidelines for Specifications

3.4.1 General

The following clauses relate specifically to construction specifications which apply to stormwater works. Reference should also be made to Section 7 of this Code of Practice which provides a general overview of construction specifications.

Specifications must clearly explain, in combination with the related construction drawings, the scope of works. They shall indicate the circumstances and conditions the contractor may expect to face during the works and requirements the work shall comply with. While standard clauses may be used, the whole specification must be prepared and edited for each specific project.

The following topics are included in the discussion of guidelines for specifications:

3.4.1 General

3.4.2 Standards

3.4.3 Construction

3.4.4 Pipes

3.4.5 Joints

3.4.6 Cover to Pipelines

3.4.7 Pipe Strength, Bedding and Pipe Surrounds

3.4.8 Backfilling and Reinstatement

3.4.9 Testing of Stormwater Drainage System

3.4.10 Connection to GDC System

3.4.2 Standards

The Standards and Codes of Practice which are listed below are referred to in this section. The design, materials and methods of construction shall comply with these standards and codes as applicable. The standards shall incorporate the latest amendments. Standards superseding those listed shall automatically apply.

NZS 3107:1978	*Specification for Precast Concrete Drainage and ressure Pipes*
NZS 3109:1997	*Specification for Concrete Construction*
NZS 3302:1983	*Specification for Ceramic Pipes, Fittings and Joints*
NZS 4405:1986	*Helical lock-seam corrugated steel pipes.*
NZS 4442:1988	*Welded Steel Pipes and Fittings for Water, Sewage and Medium Pressure Gas*
NZS/AS 3725:1989	*Loads on Buried Concrete Pipes*
NZS 4452:1986	*Code of Practice for the Construction of Underground Pipe Sewers and Drains*
NZS 7604:1981	*Specification for High Density Polyethylene Drain and Sewer Pipe and Fittings*
AS/NZS 3500.2.2:1996	*National Plumbing and Drainage Code, Sanitary plumbing and drainage, Acceptable Solutions*
AS/NZS 1260:1996	*PVC pipes and fittings for drain, water and vent applications*
NZS 4402:1986	*Methods of testing soils for civil engineering purposes*

3.4.3 Construction

All elements of a stormwater drainage system must be constructed in accordance with the relevant New Zealand Standards, and with the specific requirements of the design prepared in accordance with this Code of Practice.

3.4.4 Pipes

The following pipe materials may be specified for use in the construction of stormwater drains provided they comply with the latest amendment of the New Zealand Standard cited.

- Reinforced concrete pipes to *NZS 3107:1978* (minimum Class X)
- Ceramic pipes to *NZS 3302:1983*
- Concrete lined steel (CLS) to *NZS 4442:1988*

- -mPVC pipes to *AS/NZS 1260:1996*
- High Density Polyethylene (HDPE) to *NZS 7604:1981*
- Corrugated Steel Pipe (CSP) to *NZS 4405:1986* for culverts greater than 500mm diameter outside urban areas

3.4.5 Joints

Where thermal expansion of the pipe may occur flexible joints capable of accommodating the expected movement for a temperature rise of 25°C shall be used.

3.4.6 Cover to Pipelines

The following Table gives the minimum cover to finished surface level above the crown of pipes in different locations. Any design involving a cover less than the minimum shown, shall demonstrate that compliance is impractical and be supported with full calculations for approval.

Minimum Ground Cover for Stormwater Pipes

Location	Minimum Cover (mm)
Private property	500
Carriageways, driveways, road reserve, and parking areas	750
Berms and paths	600

The designer shall check that in any particular case the surface load does not require more cover for the chosen pipe.

Where topographical conditions do not allow the prescribed cover to be achieved, reinforced or unreinforced concrete protection shall be provided over the pipelines to the approval of GDC.

3.4.7 Pipe Strength, Bedding and Pipe Surround

Pipe strength, bedding and pipe surround shall be selected for suitability under the design loading conditions, using the appropriate pipe material standard, and the manufacturer's pipe laying publication.

As a general guideline, with good ground conditions, bedding and other trench details shall be as shown Appendix C, NZS 4452:1986, Type B and Type D.

In poor ground conditions, potentially unstable ground, under extreme loadings or if the pipeline gradient is steep (exceeds 1 in 10); pipe strength and bedding shall be specifically designed and certified by an appropriately qualified professional.
Where the pipeline gradient exceeds 1 in 10 anti-scour blocks shall be constructed as shown in the Drawings, at the spacings shown in the following Table.

Spacing of Anti Scour Blocks

Grade	Spacing (m)
Steeper than 1 in 5	5
1 in 5 to 1 in 10	10

- **Concrete and Ceramic**

Backfilling of pipe surround shall be carried out in accordance with the manufacturer's recommendations and in general agreement with NZS 4452:1986 for a Type B pipe bedding. The selected fill (free of organic materials, lumps larger than 75mm, and stones larger than 40mm) shall be placed in 150mm layers and compacted with a hand operated vibrating compactor with a total static weight not exceeding 0.5 tonne, to a density of not less than 95% of Maximum Dry Density as determined by NZS 4402.1:1986, Test 4.1.2. Careful attention to the control of moisture content and material variability is required. Compaction control with a Nuclear Densometer is recommended.

- **All Other Pipes**

Blackfilling of pipe surrounds shall be carried out in accordance with the manufacturer's recommendations and in general agreement with NZS 4452:1986 for Type D pipe bedding using granular material as pipe surround to a minimum of 100mm above the top of the pipe. The granular material shall be selected clean free draining material with the maximum particle size shall generally not exceed 20mm. The presence of an occasional particle between 20mm and 40mm is acceptable provided that the total quantity of such particles is less than 5 percent of the whole. If particles over 40mm are present, the material shall be rejected. It can also include naturally occurring sand which is free of organic or other deleterious material.

Typically bedding material shall be placed in layers not exceeding 150mm and shall be carefully compacted, with particular attention to compacting under the pipe haunches. The material shall not be dropped from a height of greater than 600mm. The fill shall be compacted to a density of not less than 95% of the Maximum Dry Density as determined by *Test 4.1.2 of NZS 4402.1:1986*. Careful attention to the control of moisture content and material variability is required. Compaction control with a Nuclear Densometer is recommended.

- **Trench Width**

The designer must clearly identify on the Construction Drawings the intended trench widths for pipeline installations. If narrow trench technology is proposed, the methods of backfill must be clearly identified and agreed with Gisborne District Council.

3.4.8 Backfilling and Reinstatement

- **Pipeline in Road Reserve**

Within a road reserve, filling above the pipe surround shall be in accordance with Council's *Specification for Service Maintenance Operations and New Service Installations within Road Reserve.*

- **Land Not in Road Reserve**

Pipe trenches above the pipe surround may be backfilled with suitable excavated material (ordinary fill). If the excavated material is unsuitable, as determined by the Certifying Engineering, approved imported material shall be used.

Typically bedding material shall be placed in layers not exceeding 150mm and shall be carefully compacted, with particular attention to compacting under the pipe haunches. The material shall not be dropped from a height of greater than 600mm. The fill shall be compacted to a density of not less than 95% of the Maximum Dry Density as determined by *test 4.1.2 of NZS 4402.1:1986*. Careful attention to the control of moisture content and material variability is required. Compaction control with a Nuclear Densometer is recommended. Mechanical compaction equipment shall not be used within 300 mm of any plastic or ceramic pipe, and with care close to concrete pipes.

3.4.9 Testing of Stormwater Drainage System

The pressure testing of stormwater pipelines will not normally be required. Acceptance will be on the basis of the quality of materials and the general standard of construction. Inspection during construction shall be as set out in 3.5.

3.4.10 Connection to GDC System

Connection of any part of the works into the GDC system shall only be made with prior approval of GDC.

3.5 Quality Assurance, Inspection during Construction, As Built Record and Compliance Reporting

To provide Council with the confidence that the sewerage systems within any subdivision have been constructed to the specified standards, the Contractor/Developer shall ensure that at all times quality assurance records are maintained, and that at the end of construction these records are provided to the GDC along with certification from an appropriately qualified professional that all inspections and testing have met the required standards.

The attached table, and Section 7 of this Code of Practice, lists the quality assurance information, as built records and reporting that GDC considers would be the minimum documentation required for submission to Council for Compliance.

For stormwater works, in all cases inspections on site shall be carried out by a person with a good knowledge of drainage theory and construction practice, who shall have reasonable liaison with the design engineer for works being inspected.

The appropriately qualified professional will be required to certify the accuracy of all inspection records and test results that are submitted to Council for Compliance.

Specific attention must be given to as built plans for pump stations.

Council reserves the right to, and shall be granted access upon 24 hours written notice, to independently inspect the works. Where work or material is found to be unsuitable it shall be removed and replaced to the satisfaction of Council prior to further work being carried out. The cost of the independent inspection shall in this case be charged to the Contractor/Developer.

3.6 General Requirements for Private Developers

3.6.1 Resource Consents

The developer shall be responsible for obtaining any necessary Resource Consents from the Council. Resource Consents may be required for the following work:

- the diversion of natural water during construction
- the permanent diversion of natural water as a result of development
- the discharge of stormwater from industrial or trade premises, or areas used for the storage of hazardous substances

- where the diversion or discharge may cause erosion

- where the discharge may cause the production of such things as films, scums or foams in the receiving water after reasonable mixing

Resource consents for diversions and discharges associated with permanent works shall be for the maximum term possible and in the name of or transferable to Gisborne District Council.

3.6.2 Easements

The developer shall create easements for all private and public drains which cross adjacent private land. In cases where the subdivider gives Council a formal statement declaring the drain as public, the creation of an easement may be omitted. Public drains shall be vested in the Gisborne District Council.

For buried pipes, easement widths shall be the larger of:

(a) a width equal to 1.5 times the depth to invert with the service laid in the centre, or

(b) a minimum of 3 metres with the service laid in the centre.

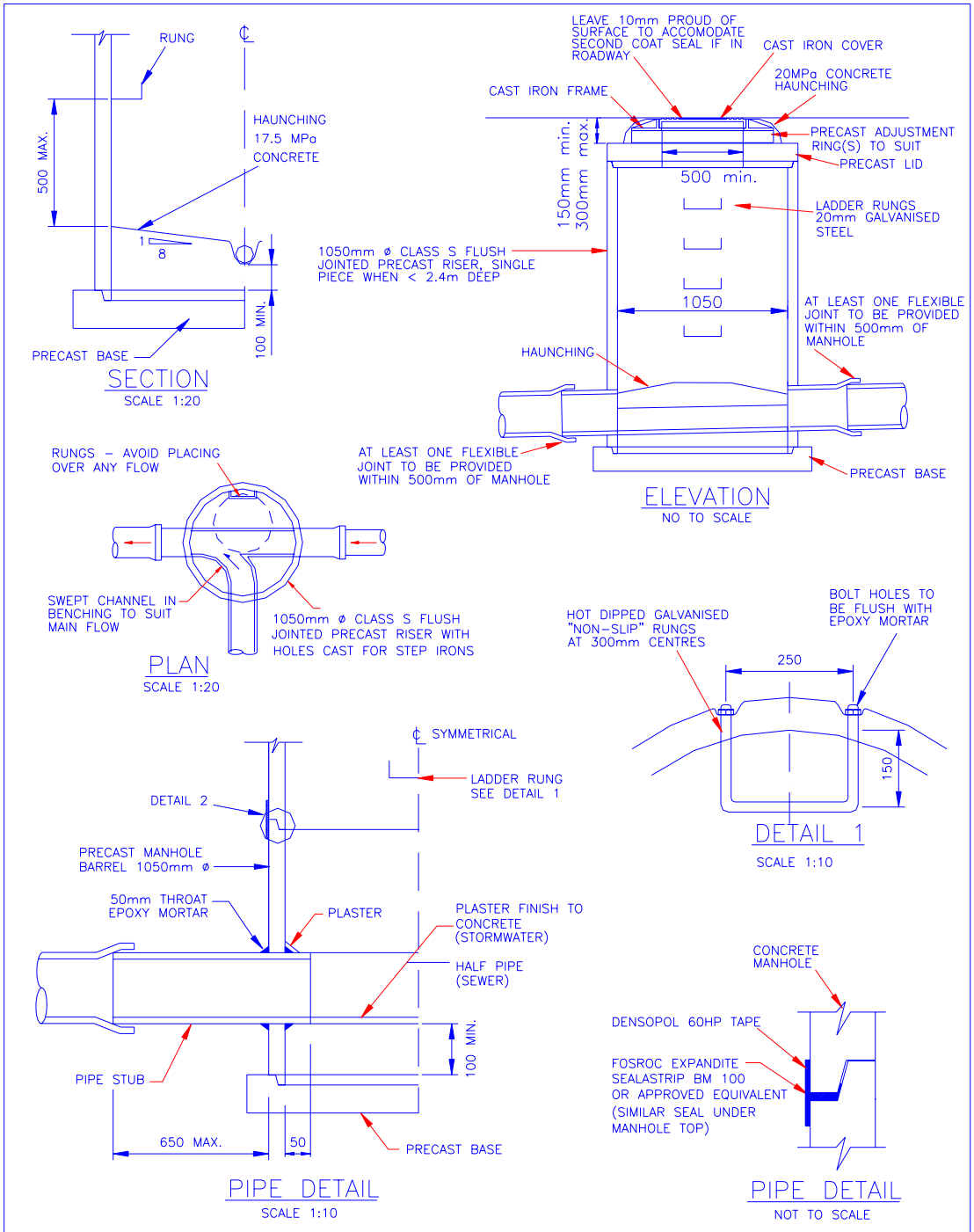
For watercourses and open drains the Council will generally require an easement to be created, with a width as follows:

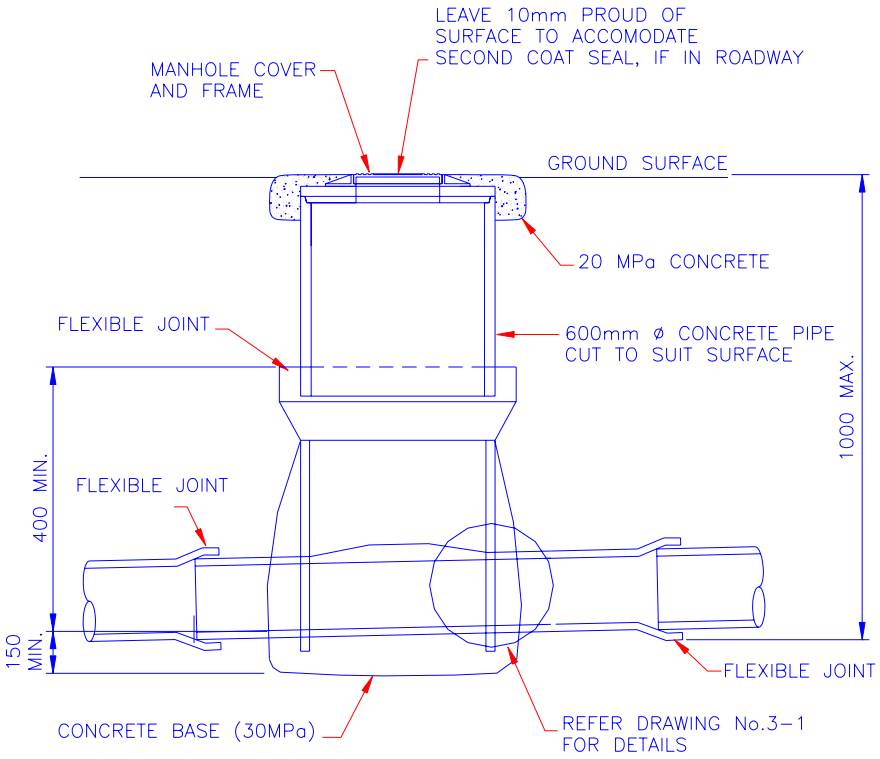
A width equal to the width of the primary channel and secondary berms, which shall be provided on each side of the primary channel. In all cases the flood berm width used shall be not less than 6 metres to allow access for maintenance vehicles.

In urban areas where paths/accessways or broad swales are used the easement width shall be the larger of the designed width required or 3 metres.

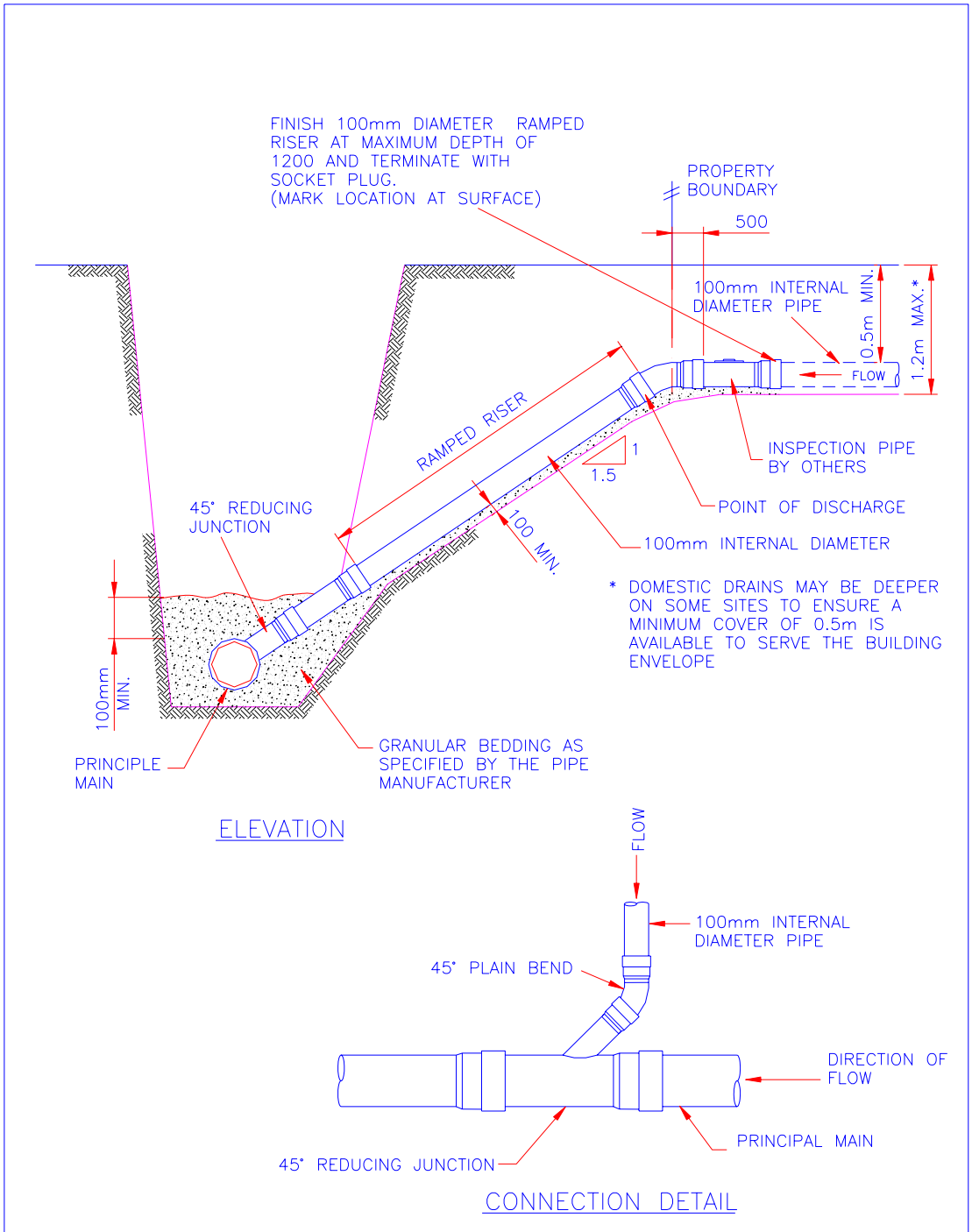
3.6.3 As Built Plans

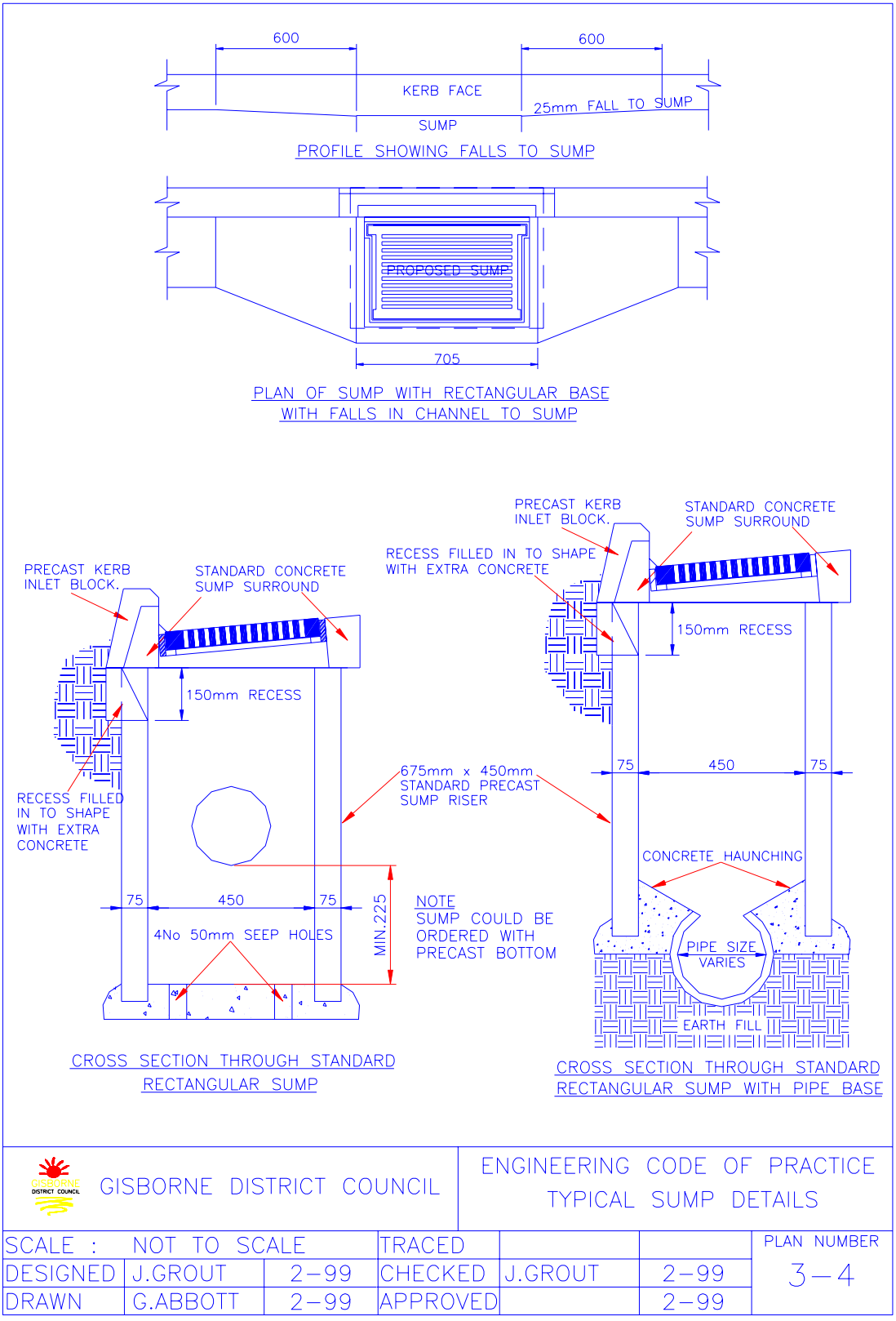
On completion of the works, as-built plans must be provided, in accordance with the standards set out in Section 7 of this Code of Practice.


RUNG
℄
HAUNCHING
17.5 MPa
CONCRETE
500 MAX.
1
8
100 MIN.
PRECAST BASE
SECTION
SCALE 1:20
LEAVE 10mm PROUD OF SURFACE TO ACCOMODATE SECOND COAT SEAL IF IN ROADWAY
CAST IRON COVER
20MPa CONCRETE HAUNCHING
CAST IRON FRAME
PRECAST ADJUSTMENT RING(S) TO SUIT
PRECAST LID
150mm min. 300mm max.
500 min.
LADDER RUNGS 20mm GALVANISED STEEL
1050mm ø CLASS S FLUSH JOINTED PRECAST RISER, SINGLE PIECE WHEN < 2.4m DEEP
1050
AT LEAST ONE FLEXIBLE JOINT TO BE PROVIDED WITHIN 500mm OF MANHOLE
HAUNCHING
AT LEAST ONE FLEXIBLE JOINT TO BE PROVIDED WITHIN 500mm OF MANHOLE
PRECAST BASE
ELEVATION
NO TO SCALE
RUNGS – AVOID PLACING OVER ANY FLOW
SWEPT CHANNEL IN BENCHING TO SUIT MAIN FLOW
1050mm ø CLASS S FLUSH JOINTED PRECAST RISER WITH HOLES CAST FOR STEP IRONS
PLAN
SCALE 1:20
HOT DIPPED GALVANISED "NON-SLIP" RUNGS AT 300mm CENTRES
BOLT HOLES TO BE FLUSH WITH EPOXY MORTAR
250
150
DETAIL 1
SCALE 1:10
℄ SYMMETRICAL
LADDER RUNG SEE DETAIL 1
DETAIL 2
PRECAST MANHOLE BARREL 1050mm ø
50mm THROAT EPOXY MORTAR
PLASTER
PLASTER FINISH TO CONCRETE (STORMWATER)
HALF PIPE (SEWER)
100 MIN.
PIPE STUB
650 MAX.
50
PRECAST BASE
PIPE DETAIL
SCALE 1:10
CONCRETE MANHOLE
DENSOPOL 60HP TAPE
FOSROC EXPANDITE SEALASTRIP BM 100 OR APPROVED EQUIVALENT (SIMILAR SEAL UNDER MANHOLE TOP)
PIPE DETAIL
NOT TO SCALE
GISBORNE DISTRICT COUNCIL
ENGINEERING CODE OF PRACTICE
STANDARD STORMWATER MANHOLE DETAILS
SCALE : AS SHOWN
TRACED
PLAN NUMBER
DESIGNED J.GROUT 2-99
CHECKED J.GROUT 2-99
3-1
DRAWN G.ABBOTT 2-99
APPROVED

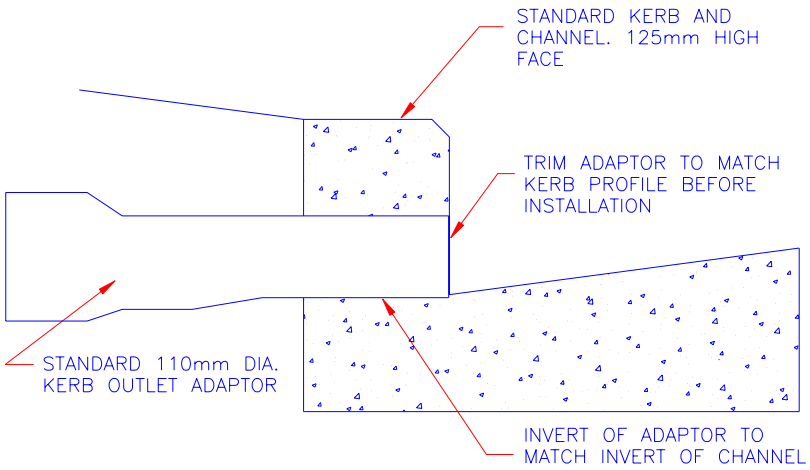


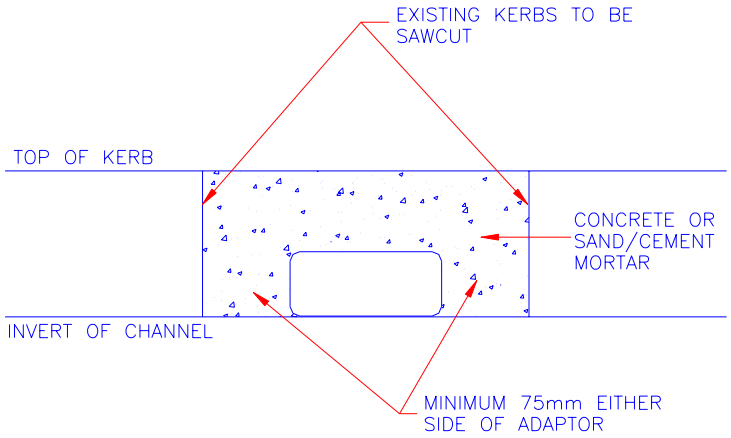
GISBORNE DISTRICT COUNCIL						ENGINEERING CODE OF PRACTICE SHALLOW STORMWATER MANHOLE
SCALE : NOT TO SCALE			TRACED			PLAN NUMBER
DESIGNED	J.GROUT	2-99	CHECKED	J.GROUT	2-99	3-2
DRAWN	G.ABBOTT	2-99	APPROVED		2-99	


FINISH 100mm DIAMETER RAMPED RISER AT MAXIMUM DEPTH OF 1200 AND TERMINATE WITH SOCKET PLUG. (MARK LOCATION AT SURFACE)
PROPERTY BOUNDARY
500
100mm INTERNAL DIAMETER PIPE
0.5m MIN.
1.2m MAX.*
FLOW
RAMPED RISER
1
1.5
INSPECTION PIPE BY OTHERS
POINT OF DISCHARGE
100mm INTERNAL DIAMETER
45° REDUCING JUNCTION
100 MIN.
* DOMESTIC DRAINS MAY BE DEEPER ON SOME SITES TO ENSURE A MINIMUM COVER OF 0.5m IS AVAILABLE TO SERVE THE BUILDING ENVELOPE
100mm MIN.
PRINCIPLE MAIN
GRANULAR BEDDING AS SPECIFIED BY THE PIPE MANUFACTURER
ELEVATION
FLOW
100mm INTERNAL DIAMETER PIPE
45° PLAIN BEND
DIRECTION OF FLOW
PRINCIPAL MAIN
45° REDUCING JUNCTION
CONNECTION DETAIL
GISBORNE DISTRICT COUNCIL
ENGINEERING CODE OF PRACTICE
DOMESTIC CONNECTION WITH RAMPED STORMWATER RISER
SCALE : NOT TO SCALE
TRACED
PLAN NUMBER
3–3
DESIGNED J.GROUT 2–99
CHECKED J.GROUT 2–99
DRAWN G.ABBOTT 2–99
APPROVED 2–99


600
600
KERB FACE
25mm FALL TO SUMP
SUMP
PROFILE SHOWING FALLS TO SUMP
PROPOSED SUMP
705
PLAN OF SUMP WITH RECTANGULAR BASE
WITH FALLS IN CHANNEL TO SUMP
PRECAST KERB
INLET BLOCK.
STANDARD CONCRETE
SUMP SURROUND
150mm RECESS
RECESS FILLED
IN TO SHAPE
WITH EXTRA
CONCRETE
675mm x 450mm
STANDARD PRECAST
SUMP RISER
75
450
75
4No 50mm SEEP HOLES
MIN.225
NOTE
SUMP COULD BE
ORDERED WITH
PRECAST BOTTOM
CROSS SECTION THROUGH STANDARD
RECTANGULAR SUMP
PRECAST KERB
INLET BLOCK.
STANDARD CONCRETE
SUMP SURROUND
RECESS FILLED IN TO SHAPE
WITH EXTRA CONCRETE
150mm RECESS
75
450
75
CONCRETE HAUNCHING
PIPE SIZE
VARIES
EARTH FILL
CROSS SECTION THROUGH STANDARD
RECTANGULAR SUMP WITH PIPE BASE
GISBORNE DISTRICT COUNCIL
ENGINEERING CODE OF PRACTICE
TYPICAL SUMP DETAILS
SCALE : NOT TO SCALE
TRACED
PLAN NUMBER
DESIGNED J.GROUT 2-99
CHECKED J.GROUT 2-99
3-4
DRAWN G.ABBOTT 2-99
APPROVED 2-99

NOTE: STORMWATER OUTLETS
TO BE ROUTED AWAY
FROM VEHICLE CROSSINGS





GISBORNE DISTRICT COUNCIL			ENGINEERING CODE OF PRACTICE TYPICAL STORMWATER KERB OUTLETS			
SCALE : SCALE 1:5			TRACED			PLAN NUMBER
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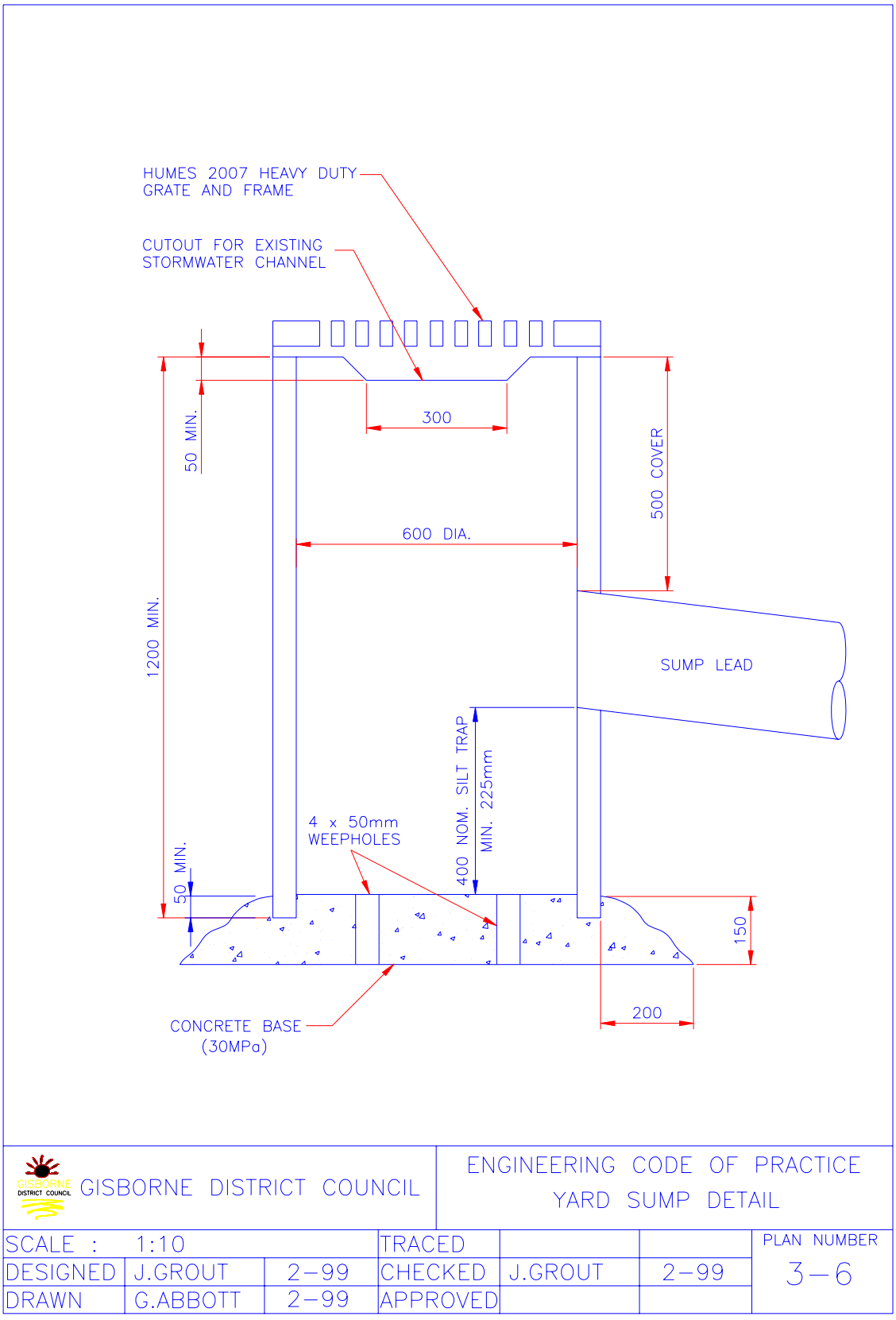
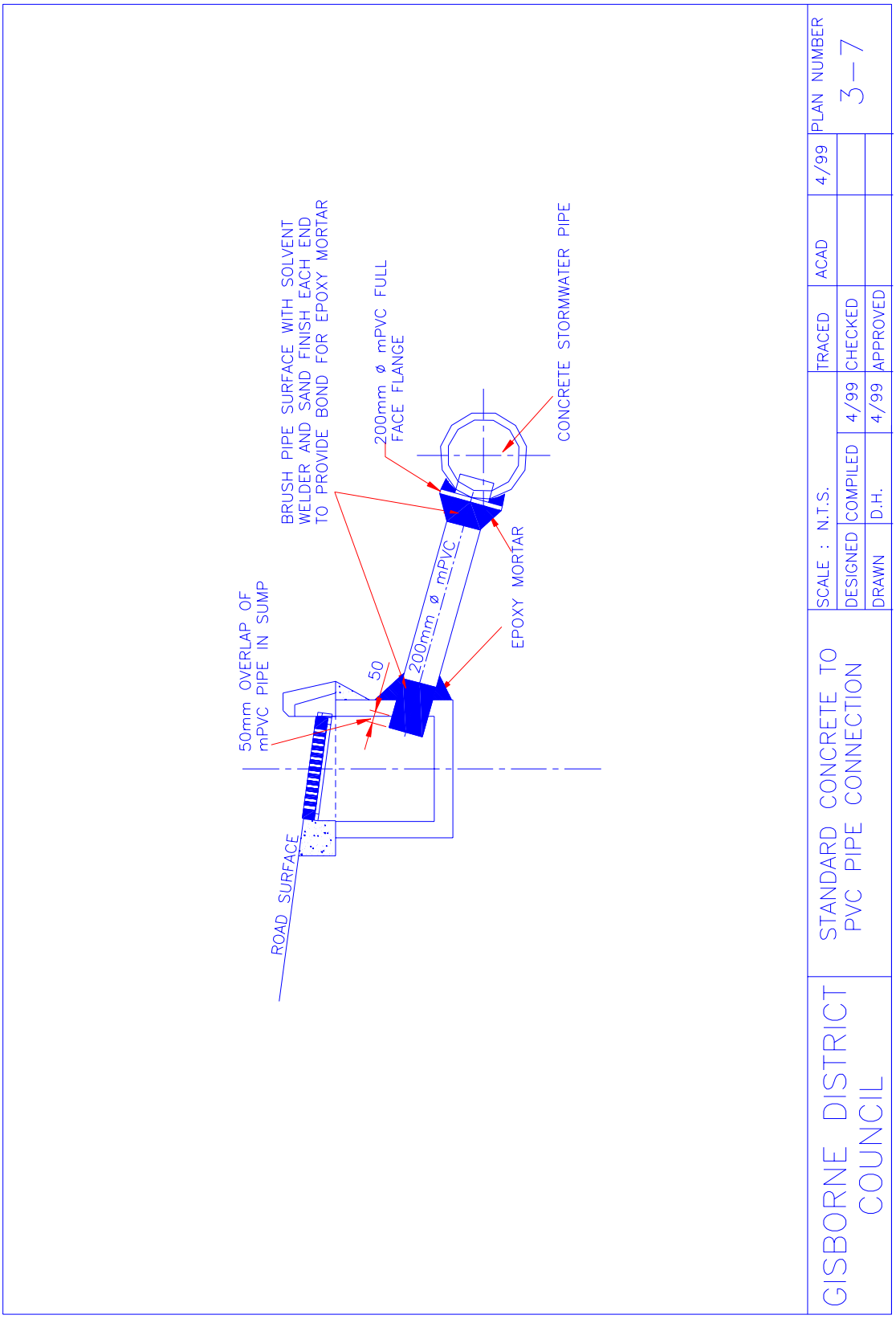
DRAWN	G.ABBOTT	2–99	APPROVED			


HUMES 2007 HEAVY DUTY GRATE AND FRAME
CUTOUT FOR EXISTING STORMWATER CHANNEL
300
50 MIN.
500 COVER
600 DIA.
1200 MIN.
SUMP LEAD
400 NOM. SILT TRAP
MIN. 225mm
4 x 50mm WEEPHOLES
50 MIN.
150
200
CONCRETE BASE (30MPa)
GISBORNE DISTRICT COUNCIL
ENGINEERING CODE OF PRACTICE
YARD SUMP DETAIL
SCALE : 1:10
TRACED
PLAN NUMBER
3-6
DESIGNED J.GROUT 2-99
CHECKED J.GROUT 2-99
DRAWN G.ABBOTT 2-99
APPROVED


BRUSH PIPE SURFACE WITH SOLVENT WELDER AND SAND FINISH EACH END TO PROVIDE BOND FOR EPOXY MORTAR
200mm ø mPVC FULL FACE FLANGE
CONCRETE STORMWATER PIPE
EPOXY MORTAR
200mm ø mPVC
50
50mm OVERLAP OF mPVC PIPE IN SUMP
ROAD SURFACE
GISBORNE DISTRICT COUNCIL
STANDARD CONCRETE TO PVC PIPE CONNECTION
SCALE : N.T.S.
DESIGNED
DRAWN
COMPILED
D.H.
4/99
4/99
TRACED
CHECKED
APPROVED
ACAD
4/99
PLAN NUMBER
3 – 7

Section 4
Sanitary Sewerage

Contents

The Contents of this Section are as follows:

Section 4: Sanitary Sewerage

4.1 Introduction

This section provides a set of Engineering standards for the design and construction of sanitary sewerage schemes which are to come under Gisborne District Council (GDC) ownership. The intention is to:

- ensure all schemes are designed and constructed to meet necessary regulatory and bylaw requirements.
- ensure design flow standards are met
- provide guidance for effective supervision, leading to high construction standards, thereby ensuring that the design standards are met through "best practices".

Note:
Please refer to Chapter 14 of the Gisborne District Combined Regional Land and District Plan for information regarding service provisions.

4.2 Performance Criteria for Sanitary Sewerage System

4.2.1 Capacity and Layout

A sewerage system shall:

a) Be of a capacity capable of carrying the peak flows anticipated during its lifetime, with due allowance for infiltration and inflow.

b) Be designed to serve the ultimate population for the whole of the natural upstream catchment and other such areas considered necessary by Council. All sections of the catchment shall be considered to be fully developed to the extent permitted by the operative District Plan.

c) Efficiently convey sewage to an approved discharge point by gravity flow, unless otherwise approved by GDC.

d) Comply with any applicable Regional or District Plans and Resource Consent(s).

e) Minimise whole of life costs.

f) Maintain adequate self-cleansing velocities under dry weather flow.

g) Have no adverse effects on, and be compatible with, the existing sewerage system. This may require network modelling of the proposal using Councils existing model.

h) Not unduly restrict the location of any future buildings.

i) Where practical utilise mechanical, electrical, alarm and telemetry equipment that is compatible with existing equipment used by GDC.

j) Ensure that mechanical and electrical equipment is either designed for submergence, or located above, the 100 year design flood level (1% probability of exceedance) plus 100mm freeboard. The developer should consult GDC to confirm the necessary flood level.

4.2.2 Structural Integrity

A sewerage system shall:

a) Have all pipework constructed of materials that are compatible with the characteristics of the sewage being conveyed, suitable for the intended duty with a anticipated design life of 100 years, and with a demonstrated performance or lifecycle testing.

b) Use pumps, electrical and mechanical equipment which provides the best whole of life cost over the design life of the system.

c) Keep leakage, infiltration, and inflow, for the design life, within the peak wet weather flow assumed in design.

d) Minimise the likelihood of blockage, and ensure that the system can be readily cleaned, by using best practice in design construction, meeting appropriate manufacturers' standards.

e) Withstand all anticipated superimposed loads including seismic loads as required by the Building Code.

4.3 Design Guidelines

The following topics are included in the discussion of design guidelines:

4.3.1 Flow Calculations

4.3.2 Sewers

4.3.3 Manholes

4.3.4 Connections

4.3.5 Location of Sewer Pipes

4.3.6 Sewerage Pumping

4.3.7 Vicinity of Other Services

4.3.8 Miscellaneous facilities

4.3.1 Flow Calculation

Calculation of sewage design flows and flow capacities shall be based on the following assumptions:

- For residential areas the design flow shall be :

  ADWF (average dry weather flow) = 200 l/p/day
  PDWF (peak dry weather flow) = 2.5 x ADWF
  PWWF (peak wet weather flow) = 4 x ADWF

  Where l/p/day = litres per person per day

  If the dwelling unit density of the subdivision is known and the subdivision is fully developed, then this density shall be used in the computation of flow. Where this is not fully developed the ultimate population must be used where the number of residents per dwelling unit shall be 3.2, and the minimum section size as defined in the District Plan shall be considered. (Note: this allows for infill housing)

  Where the dwelling unit density is unknown (e.g. in an undeveloped upstream catchment), the following figures can be used as a guide.

  Existing development 35 person / ha
  New Subdivisions 40 person / ha

  The area in this case is the net useable area, excluding reserves, road ways etc.

- For commercial and industrial flow and trade wastes, design flow shall be the actual flows, where known.

- Where information is not available, the provision for domestic and trade wastes from industrial areas must be confirmed with GDC. As a guideline only, the following flows may be used as a basis for design:

Average Dry Weather Flows, Industrial Areas by Type

Industry Type	ADWF l/s/ha (m^3/ha/d)
Mixed	0.23 (20)
Warehouses	0.07 (6)
Food Manufacture & Materials	0.69 (60)
Chemical Manufacture etc	0.35 (30)

PDWF = 3 x ADWF
PWWF = 3 x ADWF

- The design of sewerage systems for "wet" industries (very heavy water usage) shall be based on the specific requirements for that industry.

- For retail and suburban commercial areas, the design flow guidelines are:

  ADWF = 0.07 l/sec/ha (6 m^3/ha/d)
  PDWF = 3 x ADWF
  PWWF = 3 x ADWF

  The flows for each site need to be confirmed with Council.

Allowance shall be made for any future development in the vicinity of the proposed subdivision, which could flow into any or all of the proposed system, when determining design flows. For this purpose the designer must check with GDC whether such development is possible. If this check indicates an increase in pipe size, above that required for the particular development, any increase in cost above that required for the particular development may be met by Council.

4.3.2 Sewers

Pipes shall be sized to carry the PWWF when running just full, according to Colebrook White formula or any other generally accepted method, such as Colebrook-White. Supporting calculations shall be submitted to GDC for approval. Appropriate allowance shall be made for head losses at changes of direction and in manholes, (see below for further details). The following overall coefficients, Council believes, allow for aging, joints and other fittings:

Colebrooke White (ks) 1.5

Where practicable, the gradients of pipelines shall be such that the velocity at PDWF shall be not less than 0.7 m/sec. However, at the discretion of the Gisborne District Council, this requirement may be relaxed where strict adherence would require the construction of additional pumping facilities.

As a guide, gradients steeper than 1:150 for a 150mm ID sewer will normally be permitted without special conditions but flatter gradients may be approved subject to conditions requiring additional works to ensure the satisfactory operation of the system. Maximum pipe velocities shall not exceed 4.0 m/sec. Best design practice also suggests that a minimum pipeline gradient shall be 1:300.

Allowance for energy head losses in manholes, unless derived from more detailed calculations, shall be made as follows:

- $\frac{0.8V^2}{2g}$ for haunched manholes with no change in direction of the main flow, where V = pipe flow velocity (m/sec) and g = 9.81 m/sec^5.

- an increase of 10% on the values above for every 10° change in direction of the main flow.

Allowance for head losses shall be made either by a drop in invert level in the manhole, or by increasing the gradients of the adjacent pipes. Section 4.3.3 provides some guidance on this calculation.

No sewer pipe, except for connection to lots, shall be less than 150mm internal diameter, to help prevent blockage of the pipe.

4.3.3 Manholes

- ***General***

  Manholes shall be provided on all pipelines, at each change of direction and/or gradient, at changes of pipe size, at the junctions of all pipelines greater than 100mm in diameter, at the termination of mains, and at a spacing of not more than 80m. Typical manhole details are shown on the Drawings.

- ***Standard Manholes***

  Standard manholes are to be circular with an internal diameter of 1050mm and shall be used on pipelines deeper than 600mm.

  The precast manholes shall consist of 1050mm internal diameter spun concrete pipe to *NZS 3107:1978* Class S with holes cast in the side for step irons. The manhole shall be constructed of pre-cast concrete manhole risers, pre-cast concrete bases, pre-cast concrete lids and cast iron frames and covers, as shown on the Drawings.

Manholes shall be constructed from the longest available risers relative to the depth of the manhole, in order to reduce the number of joints. This will normally mean that no joints will be permitted in the risers for manholes less than 2.4m deep.

In addition to manufacturers standard jointly details all joints must be wrapped externally with a waterproof "Densopol 60 HT" tape or similar for additional infiltration protection.

Cast in-situ manholes can be used but require specific approval from GDC. If used GDC would expect these to be constructed using high strength concrete (40 MPa) vibrated to give maximum density and watertight construction.

- ***Shallow Manholes***

  Shallow manholes of 600mm maximum depth may be constructed using 600mm diameter reinforced concrete pipe (½ sump barrels) to *NZS 3107*, subject to specific approved from GDC.

- ***Manholes on Large Pipelines***

  Manholes on large pipelines where the use of a standard manhole is not suitable shall be specifically designed to the approval of GDC. Manholes on straight sections of pipelines of 1.2m diameter and larger may be constructed using pre-formed tees.

- ***Deep Manholes***

  Manholes deeper than 5 metres shall be subject to specific design and separate approval by GDC, in particular to meet specific access conditions.

- ***Hydraulic Flow in Manholes***

  Losses in a manhole shall be compensated for by a drop in the invert across the manhole equivalent to 20mm plus 5mm per 10° of change in direction of flow, or as determined from a specific calculation. For a pipeline greater than 1m in diameter the drop shall be determined by specific design. Reference for assistance with these calculations can be made to Section 4.3.2, the *Australian Rainfall and Runoff Manual: 1987,* and *Hydraulic Design Manual of Concrete Pipe Association of Australia (available from Humes).*

- ***Benching***

  The pipe invert and benching through manholes shall be as detailed in the Drawings. Edges shall be rounded and the benching given a form and finish which facilitates smooth flow, non-entrapment of debris, and easy access with cleaning rods. Where possible the internal benching will include a continuous "half" pipe through the manhole.

- ***Steps and Ladders***

  Manholes other than shallow manholes shall be provided with approved hot dipped galvanised steel step irons. Step irons shall be of the "dropper" or "safety" type such that a foot will not slide off and shall be spaced at 300mm centres. For detailing see the Drawings.

- ***Manhole Lids and Covers***

  Manhole lids and covers shall be as detailed on the Drawings. Aluminium covers are not permitted. The lids and covers shall be precast 200mm thick extra heavy duty within the roadway of arterial roads (HN-HO-72 loading) and 150mm thick heavy duty within the roadway of residential and subdivision roads (0.85 HN-HO-72 loading). Light duty lids and covers can be used in footpaths and berms.

- ***Manholes in Soft Ground***

  Where a manhole is to be constructed in soft ground (<2 blows per 50mm on the Scala Penetrometer) the foundation needs to be specifically designed and approved by Council. Typically a softer foundation will be undercut and backfilled with suitable hardfill to provide an adequate foundation. On very soft ground the use of geotextile and geogrid should also be considered. Alternatively, subject to specific approval, the manhole shall be constructed on a reinforced concrete pad at least twice the plan area of the manhole.

- ***Pipe Connections to Manholes***

  The typical pipe connection to manholes is detailed in the Drawings. For intrusions through the manhole using PVC pipe, the surface of the pipe must be roughened in accordance with the manufacturers recommendations (e.g. sanded connections) so that the pipe adheres to the mortar used.

- ***Drop Connections***

  Drop connections at sewer manholes will not normally be required.

- ***Manhole Requirements for Pipe Inter-Connections***

  Branch lines 300mm diameter and smaller may be saddled directly onto pipelines 900mm diameter or larger, providing a manhole or other surface opening is supplied on the branching line within 50m of the main line.

  Where a smaller diameter pipe is connected into a larger pipe the soffit to soffit of the two pipes shall be set at equal height, with the first joint within 450mm, to assist with rendering and sealing the joint, as shown on the Drawings.

4.3.4 Connections and Laterals

The connection of laterals (or service connections) to sewer mains shall be made either at manholes or at "Y" junctions. Connecting at manholes is the preferred option, using shared laterals if appropriate. The angle formed by the lateral and the exit pipe shall not be less than 45 degrees. Saddle connections are not permitted.

A connection laid to a residential lot shall end not less than 1.0 inside the boundary, and end capped as per the Drawings.

The grading of laterals shall allow for at least 450mm of cover at the end where the house terminal might reasonably be expected to be. The minimum permitted gradient is 1:100. Unless topographical considerations dictate otherwise, the lateral shall not be deeper than 1.5m at the lot boundary.

All laterals are to be terminated with a factory manufactured watertight seal in accordance with the manufacturer's recommendations.

Each lot shall have a connection where sewerage is available within 60m of the main. Up to six residential lots may be serviced by a single 100mm diameter lateral, and can be directly connected to the main. A common lateral connection for more than six lots shall be appropriately sized and terminate at a manhole.

Where an existing or proposed sewer is more than 3.5m deep to the crown of the pipe connections shall not be made to it. A new shallower branch sewer shall be laid from a manhole on the deep sewer and connections made to the branch sewer for the lots to be served.

To provide maintenance of 100mm sewer lateral connections (such as jet cleaning etc.) it is not allowed to use bends that exceed 30° (1/12 circle). This will prevent damages of bends and junctions sewer lateral during maintenance period.

All connections shall rise on a constant grade to the property boundary.

4.3.5 Location of Sewer Pipes

In residential areas sewers shall be laid within the road reserve where possible. Due account shall be taken of the location of other services when defining sewer alignments.

Wherever practicable, sewers shall be laid where vehicle access for maintenance is available at all times.

Sewers on private land shall be sited to minimise reduction of the building area available; e.g., in yard spaces as defined in the Gisborne District Combined Regional Land and District Plan or in grass berms. Sewers shall be laid at least 1.0m clear of existing buildings.

Sewerage pipes including manholes, shall be located clear of boundaries and at least 0.5m from kerblines.

Sewers shall be extended to the upper boundary of a subdivision unless otherwise requested by GDC. Easements, or some other legal mechanism to protect the right to use, maintain and replace public drains on private private property shall be provided for any public sewer on private property, and for private sewer connections crossing land in other ownership.

4.3.6 Sewage Pumping

Sewage pumping will only be approved where gravity conveyance is not feasible. Pumping stations that will come under the ownership of GDC shall be designed as follows:

- Only pumps manufactured by ABS or Flygt are acceptable, for compatibility with those already installed in the GDC network. This helps to facilitate maintenance and holding of spares. Other pumps will be considered where ABS or Flygt don't meet the design requirements, subject to approval by GDC.

- A single pump shall be capable of coping with peak wet weather inflows.

- Sewage pumps shall have non clogging impellers capable of handling maximum solid size of 75mm discharging into 100mm diameter or larger rising mains. Smaller diameter rising mains may be approved subject to specific design calculations submitted to GDC.

- The effects of water hammer pressures shall be addressed and measures to limit their impact shall be designed as necessary. Rising mains shall be rated appropriate to the maximum total head but not less than Class C (90 metres), and with not less than 2 pumps operating shall deliver not less than six time (6) ADWF.

- Pumps and chambers shall be designed for a maximum of 12 starts per hour.

- A system curve shall be developed for the pump station and rising main. Pumps shall be selected to operate efficiently at the design flow rate on the system curve.

- Pumps shall be fitted in pairs so that while one pump is acting as duty pump, the other is on automatic standby; i.e., all pumping installation shall have 100% standby capacity. Each pump operating separately shall be capable of delivering the design wet weather flow. The duty sequence shall be automatically interchangeable, with a manual override.

- Pumps shall be protected by non return valves and isolated for maintenance purposes by gate valves housed in a separate chamber. A station valve shall be incorporated to enable the whole pump station to be isolated. Valving of pumps shall be such that maintenance can be undertaken on the standby pump and check valve without interfering with the operation of the duty pump.

- Within the pump station, pipes of 100mm minimum diameter shall be ABS, API Schedule 40mm line pipe, ductile iron or cast iron, with all bends and valves adequately protected against movement. All iron and steel shall be internally and externally protected against corrosion to the requirements of *AS/NZS 4158*. Flanged or welded fittings shall be provided throughout, with a proprietary dismantling joint or similar in the system to facilitate dismantling. Outside the pump station, the rising main can also be in mPVC or similar material of appropriate class, accounting for pressure, abrasion, chemical and temperature effects.

- Pump chambers and the reticulation system shall be designed to be of adequate size to provide emergency flow storage i.e., 4 hours minimum of design flow (PWWF), and still be safe to enter for work and repairs. Provision shall be made for overflow and standby functionality; e.g., generators etc. Chambers shall be designed against flotation when empty. The wet well capacity should be designed to allow time for emergency backup measures to be put in place in the event of a major pump failure, pipework or power supply failure i.e., 1 hour minimum design flow (PWWF) above the high water alarm level without causing overflow.

- All electrical switch gear is to be located above ground level and above the 100 year flood level (1% probability of exceedence) +100mm freeboard, in a separate building such as a precast killing shed or similar. This helps with maintenance of the pump station. The building shall be fixed in such a way that it blends in with the surrounding environment. Pump stations shall incorporate all necessary control, monitoring, and alarm and telemetry systems to GDC standards at the time of design.

Radio linkage shall be provided to every new pumping station. All electrical control equipment shall be Y2K compliant.

- All electrical equipment and cabling shall be safety rated for its particular location and use, and constructed, installed and setup in accordance with the current *GDC Specification EW.US8 "Urban Services Standard Electrical Specification for Sewer Pump Stations"* or its current replacement.

- A water supply with backflow prevention to the approval of GDC must be provided to the immediate vicinity of the station, and within 3m of the wet well. This is provided to assist with the wash down on the well.

- Pumping stations shall be located on a separate lot in the subdivision. A sealed accessway of not less than 3 metres width shall be provided to the nearest public street. Provision will be made close to the pumping station for the turning circle requirements of a light 5 to 7 tonne truck. The immediate area around the station shall be fenced and provided with a locked gate.

- Overflow facilities are to be provided to the immediate vicinity of the pump station in case of mechanical or electrical failure, or blockage to pumps or rising mains. Council must approve the location of the overflow.

- Pump station wet wells shall be vented to limit the buildup of odours. The vent shall be a minimum of 3m high, and made of 200mm diameter mPVC pipe.

- Rising mains shall have a minimum velocity of 0.75m/sec. To limit the effects of hydrogen sulphide, the main should be kept full at all times. This can be best achieved by incorporating a pronounced upturn or water trap at the outlet to exclude free air from the main. Rising mains should be sized so that sewage is not held in an anaerobic situation for more than 6 hours, in order to avoid the release of odours at the discharge point and minimise sulphate attack on concrete pipes and manholes.

- Rising mains shall be provided with access points every 200m for clearing and inspection purposes.

- Where the ultimate population will not be achieved in the three years after construction, and the six hour holding limitation cannot be achieved as a result, the developer shall insert a smaller diameter pipe in the rising main, or alternatively provide odour control at the discharge.

4.3.7 Vicinity of Other Services

Where the sewer pipe crosses another service pipe, a minimum clearance of 150mm shall be maintained between the pipes. Due care must be given to proper compaction of the fill between the pipes, and around the pipes, in accordance with the manufacturer's recommendations. A smaller clearance may be accepted if the upper pipe is supported on a pedestal either side of the lower service, as shown on the Drawings.

4.3.8 Miscellaneous Facilities

There may be components that have not been specified that may be proposed for use in sewerage systems. Possible examples include additional sewerage storage, on site generation, rising mains, odour control facilities. Any such items will be subject to the specific approval of the GDC.

4.4 Guidelines for Specifications

4.4.1 General

The following clauses relate specifically to construction specifications that apply to sanitary sewerage works. Reference should also be made to Section 7 of this Code of Practice which provides a general overview of construction specifications.

Specifications must clearly explain in combination with the related construction drawings the scope of works. They shall indicate the circumstances and conditions the contractor may expect to face during the works, and standards the work is to comply with. While standard clauses may be used, the whole specification must be prepared and edited for each specific work.

The following topics are included in the discussion of guidelines for specifications:

4.4.1 General

4.4.2 Standards

4.4.3 Construction

4.4.4 Pipes

4.4.5 Joints

4.4.6 Cover to Pipelines

4.4.7 Pipe Strength, Bedding and Pipe Surrounds

4.4.8 Backfilling and Reinstatement

4.4.9 Testing

4.4.10 Connection to the Council System

4.4.2 Standards

The Standards and Codes of Practice below may be referred to in this section. The design, materials and methods of construction shall comply with these standards and codes as applicable. The standards shall incorporate the latest amendments. Standards superseding those listed shall automatically apply.

NZS 3107:1978	*Specification for Precast Concrete Drainage and Pressure Pipes*
NZS 3109:1997	*Specification for Concrete Construction*
NZS 4442:1988	*Welded Steel Pipes and Fittings for Water, Sewage and Medium Pressure Gas*
NZS/AS 3725:1989	*Loads on Buried Concrete Pipes*
NZS 4452: 1986	*Code of Practice for the Construction of Underground Pipe Sewers and Drains*
NZS 7604:1981	*Specification for High Density Polyethylene Drain and Sewer Pipe and Fittings*
NZS 7643:1979	*Code of Practice for the Installation of Unplasticized PVC Pipe Systems*
AS/NZS 3500.2.2:1996	*National Plumbing & Drainage Code, Sanitary plumbing and drainage, Acceptable solutions*
AS/NZS 1260:1996	*PVC pipes and fittings for drain, waste and vent applications*
PINZ14-1 : 1997	*Modified Poly Vinyl Choride (PVC-M) Pipes for Pressure Applications*

4.4.3 Construction

All elements of a sewerage facility must be constructed in accordance with the relevant New Zealand Standards, and with the specific requirements of the design prepared in accordance with this Code of Practice.

4.4.4 Pipes

The acceptability of materials to be used in the construction of sewerage systems, depends on the pipe manufacturer's ability to demonstrate to Council's satisfaction that a 100 year design life can be achieved.

Currently, GDC accepts the use of the following materials:

- Vitrified clay pipes to *AS 1741:1991 "Vitrified Clay Pipes"*

- Reinforced concrete to *NZS 3107:1978 "Pre-cast Concrete Drainage and Pressure Pipes"* provided that the concrete is resistant to chemical attack and/or abrasion, or is suitably lined for use in sewers

- mPVC (modified PVC) Currently this product has no NZ Standard. Therefore the pipes must be from a manufacturer approved by Council. The minimum acceptable class of mPVC is PN12.

- The use of polyethylene pipe, ductile cast iron and lined steel may also be considered in special situations, but is not encouraged because their use does not help create standardisation within the Council system.

4.4.5 Joints

Where thermal expansion of the pipe may occur flexible joints capable of accommodating the expected movement for a temperature rise of 25°C shall be used.

All sewer pipe shall be joined in accordance with the particular manufacturer's recommendations. Non- flexible joints (e.g. solvent welding) shall only be used where fittings and/or configuration make their use unavoidable. Polyethylene pipe may be butt welded, but the internal bead is an obstruction, and must be considered in design or removed.

All metal components will have a Denso 3 wrap system (grease, mastic and tape) or equivalent applied to them. Where gibaults are applied to rigid pipe systems, the gibaults must be nylon coated. Dissimilar metals must not be used, or must be electrically separated.

4.4.6 Cover to Pipelines

The following Table gives the minimum cover to finished surface level above the crown of pipes in different locations. Any design involving a cover less than the minimum shown, shall demonstrate that compliance is impractical and be supported with full calculations for approval.

Minimum Cover Above The Crown of Sewer Pipes (including connections)

Location	Minimum Cover (mm)
Private property (public drain)	500
Carriageways, driveways, road reserve, and parking areas	750
Berms and paths	600

The designer shall check that in any particular case the surface load does not require more cover for the chosen pipe. In the roadway this will require protection from HN-HO-72 loading, on main arterial roads, and 0.85 HN-HO-72 loading on residential and subdivision roads, as defined in the roading hierarchy in the District Plan.

Where topographical conditions do not allow the prescribed cover to be achieved, reinforced or unreinforced concrete protection can be provided over the pipelines to the approval of GDC provided that the concrete is physically separate from the pipe, and the cover is designed by an appropriately qualified professional.

4.4.7 Pipe Strength, Bedding and Pipe Surround

Pipe strength, bedding and pipe surround shall be selected for suitability under the design loading conditions, using the appropriate pipe material standard, and the manufacturer's pipe laying publication.

As a general guideline, with good ground conditions, bedding and other trench details shall be as shown Appendix C, NZS 4452:1986 Type B and Type D.

In poor ground conditions, potentially unstable ground, under extreme loadings or if the pipeline gradient is steep (exceeds 1 in 10); pipe strength and bedding shall be specifically designed and certified by an appropriately qualified professional. Where the pipeline gradient exceeds 1 in 10 anti-scour blocks shall be constructed as shown in the Drawings, at the spacings shown in the following Table.

Spacing of Anti Scour Blocks

Grade	Spacing (m)
Steeper than 1 in 5	5
1 in 5 to 1 in 10	10

- **Concrete and Ceramic**

Backfilling of pipe surround shall be carried out in accordance with the manufacturer's recommendations and in general agreement with NZS 4452:1986 for a Type B pipe bedding. The selected fill (free of organic materials, lumps larger than 75mm, and stones larger than 40mm) shall be placed in 150mm layers and compacted with a hand operated vibrating compactor with a total static weight not exceeding 0.5 tonne, to a density of not less than 95% of Maximum Dry Density as determined by NZS 4402.1:1986, Test 4.1.2. Careful attention to the control of moisture content and material variability is required. Compaction control with a Nuclear Densometer is recommended.

- **All Other Pipes**

Blackfilling of pipe surrounds shall be carried out in accordance with the manufacturer's recommendations and in general agreement with NZS 4452:1986 for Type D pipe bedding using granular material as pipe surround to a minimum of 100mm above the top of the pipe. The granular material shall be selected clean free draining material with the maximum particle size shall generally not exceed 20mm. The presence of an occasional particle between 20mm and 40mm is acceptable provided that the total quantity of such particles is less than 5 percent of the whole. If particles over 40mm are present, the material shall be rejected. It can also include naturally occurring sand which is free of organic or other deleterious material.

Typically bedding material shall be placed in layers not exceeding 150mm and shall be carefully compacted, with particular attention to compacting under the pipe haunches. The material shall not be dropped from a height of greater than 600mm. The fill shall be compacted to a density of not less than 95% of the Maximum Dry Density as determined by *Test 4.1.2 of NZS 4402.1:1986*. Careful attention to the control of moisture content and material variability is required. Compaction control with a Nuclear Densometer is recommended.

- **Trench Width**

The designer must clearly identify on the Construction Drawings the intended trench widths for pipeline installations. If narrow trench technology is proposed, the methods of backfill must be clearly identified and agreed with Gisborne District Council.

4.4.8 Backfilling and Reinstatement

- ***Pipeline in Road Reserve***

Within a road reserve, filling above the pipe surround shall be in accordance with the GDC *Specification for Service Maintenance Operations and New Service Installations within Road Reserve.*

- ***Pipeline in Land Not in Road Reserve***

Pipe trenches may be backfilled with suitable excavated material (ordinary fill), as determined by the certifying Engineer. If the excavated material is unsuitable, as determined by the certifying Engineer approved imported material shall be used.

Typically backfill material shall be placed in layers not exceeding 150mm and shall be carefully compacted, with particular attention to compacting under the pipe haunches. The material shall not be dropped from a height of greater than 600mm. The fill shall be compacted to a density of not less than 95% of the Maximum Dry Density as determined by *Test 4.1.2 of NZS 4402.1:1986*. Careful attention to the control of moisture content and material variability is required. Compaction control with a Nuclear Densometer is recommended.

4.4.9 Testing

Sewers, manholes and connections will be water tested after backfilling takes place. Manholes are to be tested after backfilling. The Developer shall provide all fittings and materials to carry out the test, complete the testing and provide GDC with a copy of and appropriate certification of the final test results. The testing shall be supervised and certified by an independently qualified professional.

The test method shall be the water test described in *NZS 4452:1986*. For mPVC pipework the acceptable limit for water loss shall be 0.2ml per hour per mm of internal diameter per m of pipeline length. (Note that this is one tenth of the limit in the code but is supported by local measurements for mPVC pipes). For other types of sewer pipes the allowable loss shall be less than 2 ml per hour per mm diameter per m. Other tests may be required depending on the particular situation. (e.g. very steep lines). These shall be in general accordance with *NZS 4452:1986.*

Manholes shall be tested for water tightness by filling with water and following soaking for at least 24 hours, shown to maintain their water level for 30 minutes. Water for testing can be obtained from the nearest hydrant or toby, following GDC approval.

All pipelines shall be tested for ovality after backfilling, using CCTV (closed circuit television) technology. GDC can provide guidance on the test methods. The cost

of CCTV testing will be met by the developer. As above, the certified test results will be supplied to GDC.

4.4.10 Connection to the Council System

The developer may only make application for connection to the existing GDC sewerage system when the new system has been certified and approval is given by GDC.

4.5 Quality Assurance, Inspection during Construction, As Built Record and Compliance Reporting

To provide Council with the confidence that the sewerage systems within any subdivision have been constructed to the specified standards, the developer shall ensure that at all times quality assurance records are maintained, and that at the end of construction these records are provided to the GDC along with certification from an appropriately qualified professional that all inspections and test results have met the standards specified in the Engineering Code of Practice.

The attached table, and Section 7 of this Code of Practice, lists the quality assurance information, as built records and reporting that GDC considers would be the minimum documentation required for submission to Council for Compliance.

For sewerage works, in all cases inspections on site shall be carried out by a person with a good knowledge of sanitary drainage theory and construction practice, who shall have reasonable liaison with the design engineer for works being inspected.

The appropriately qualified professional will be required to certify the accuracy of all inspection records and test results that are submitted to Council for Compliance.

Specific attention must be given to as built plans for pump stations.

Council reserves the right to, and shall be granted access upon 24 hours written notice, to independently inspect the works. Where work or material is found to be unsuitable it shall be removed and replaced to the satisfaction of Council prior to further work being carried out. The cost of the independent inspection shall in this case be charged to the Contract/Developer.

4.6 General Requirements for Private Developers

4.6.1 Resource Consents

The developer shall be responsible for obtaining any necessary
1. Regional or District resource consents from the Council.
2. Compliance with other general Regional or District rules.

4.6.2 Easements

Easements, or some other legal mechanism to protect the right to use, maintain and replace drains on private property shall be provided as necessary by the developer. Public sewers shall be vested in the Gisborne District Council, but at Council's discretion and by agreement.

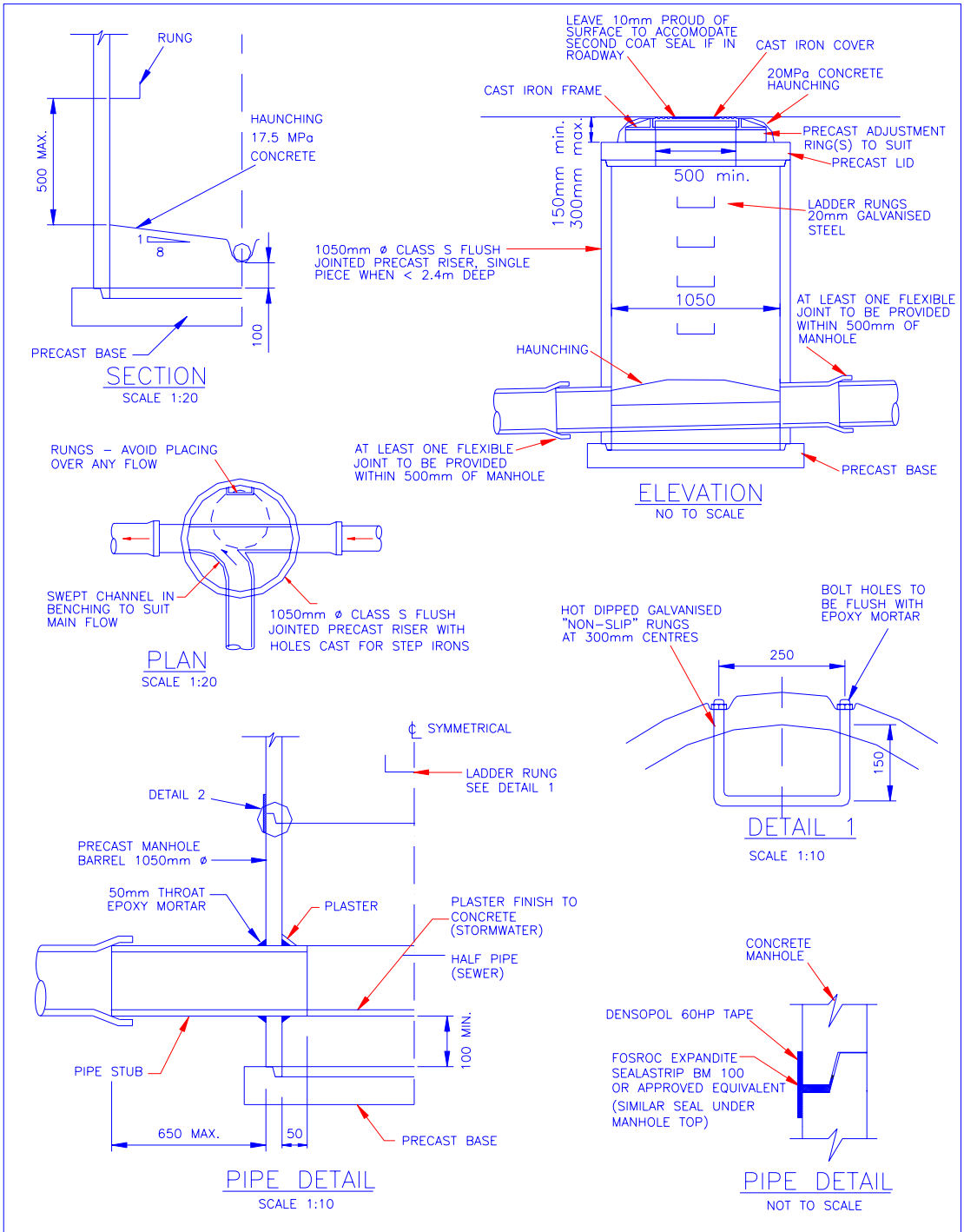
Easement widths shall be the larger of:

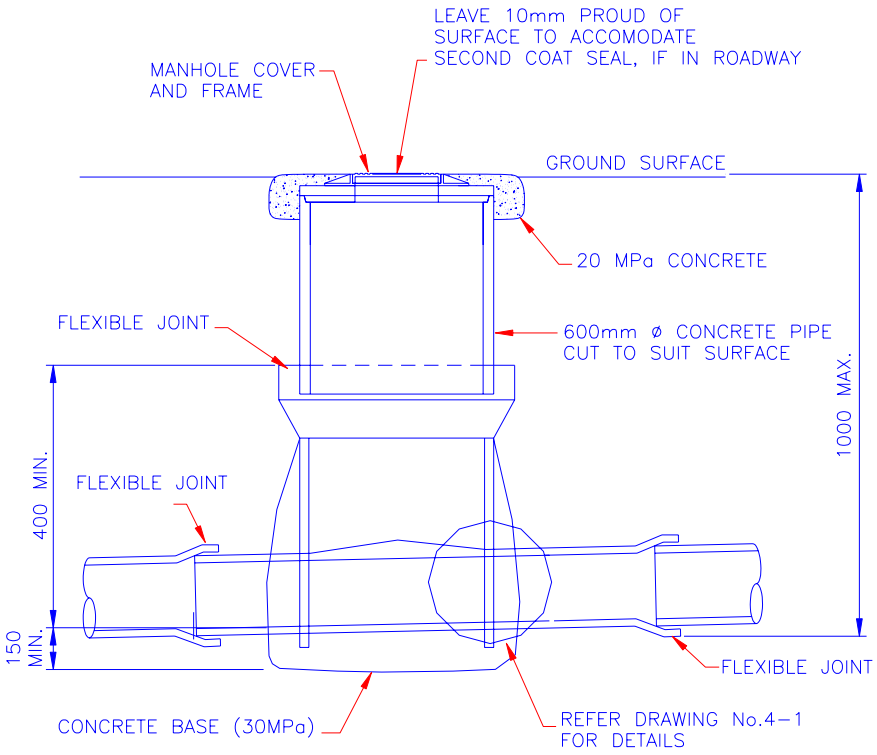
(a) a width equal to 1.5 times the depth to invert with the service laid in the centre, or

(b) a minimum of 3 metres with the service laid in the centre.

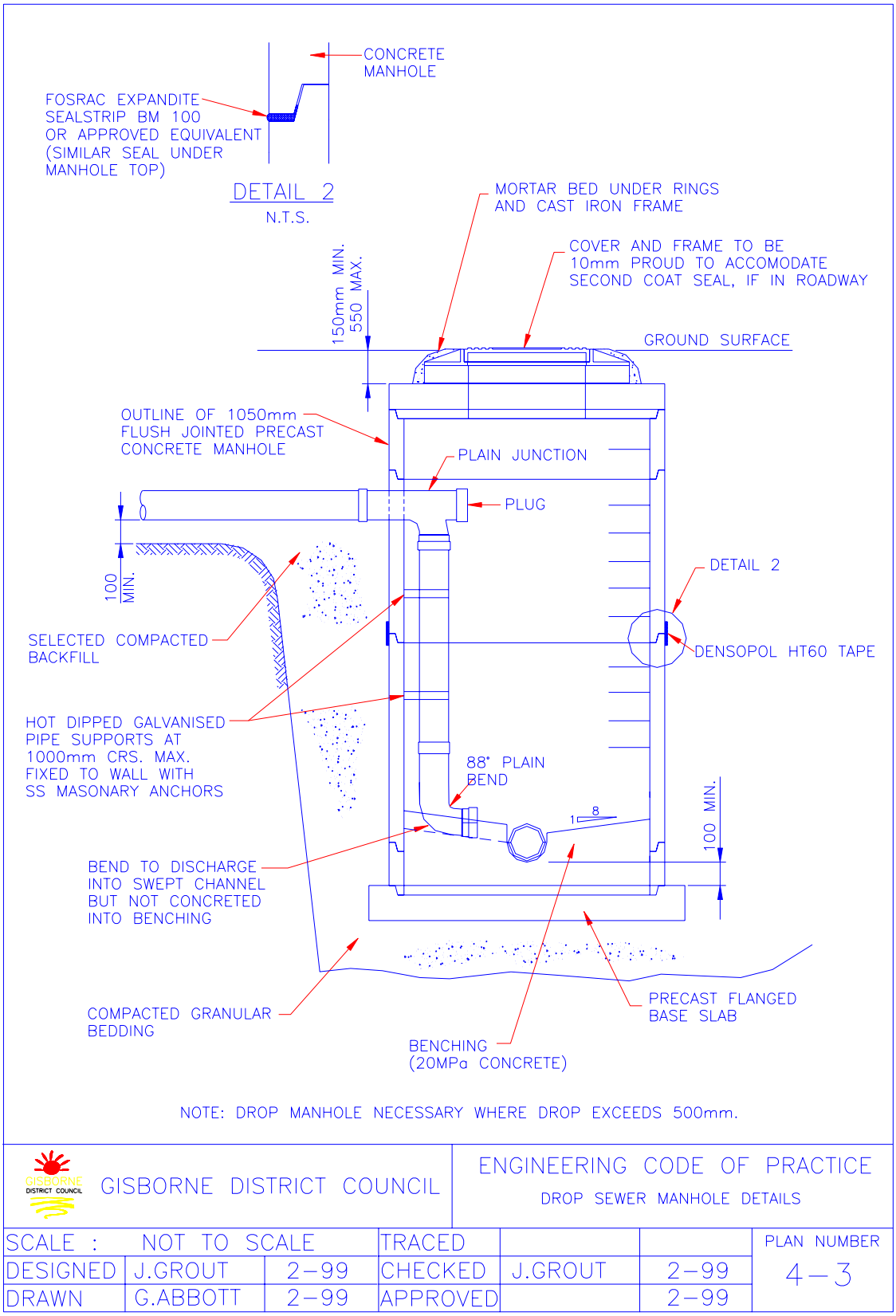
4.6.3 As Built Plans

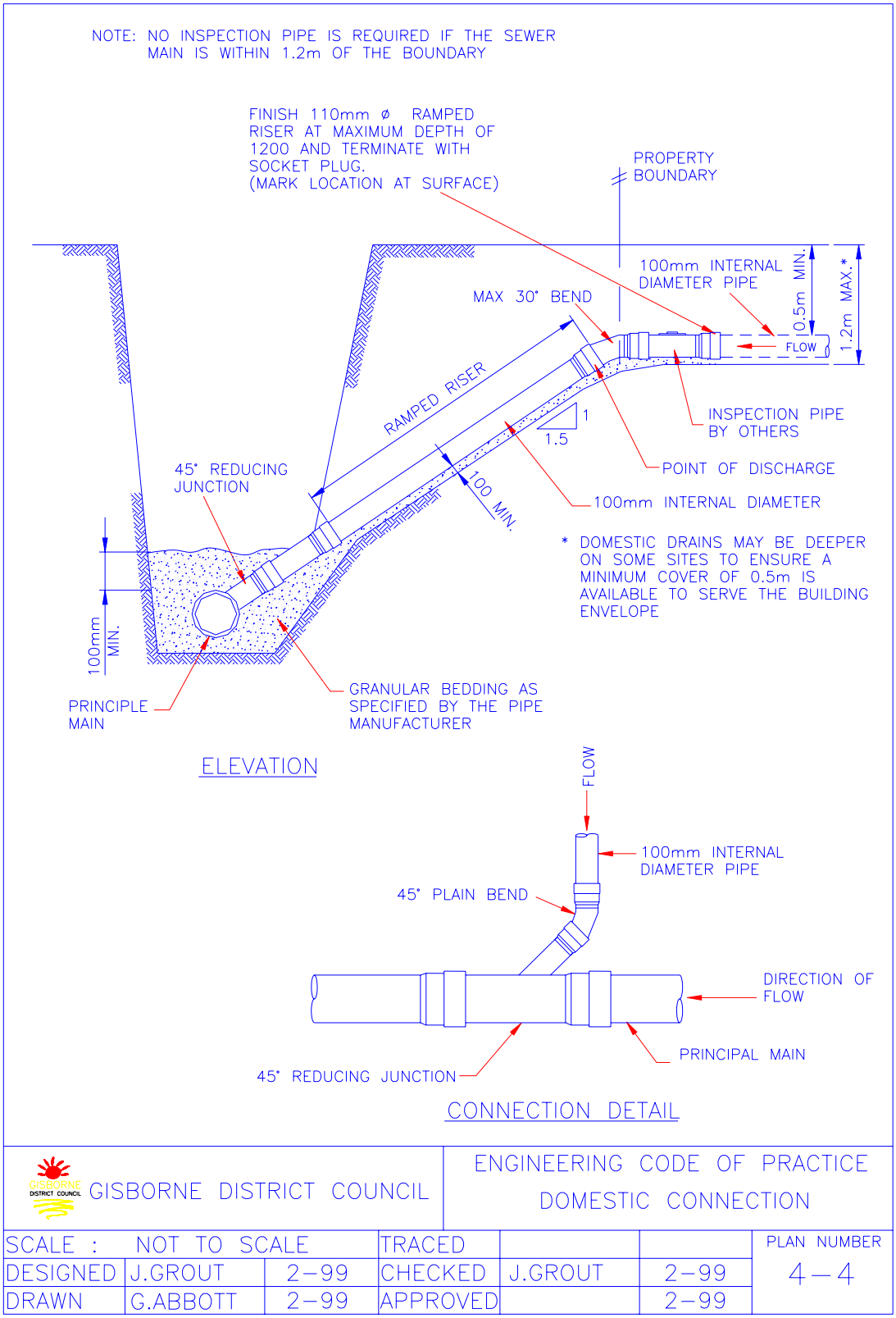
On completion of the works, as-built plans must be provided (refer Section 7).

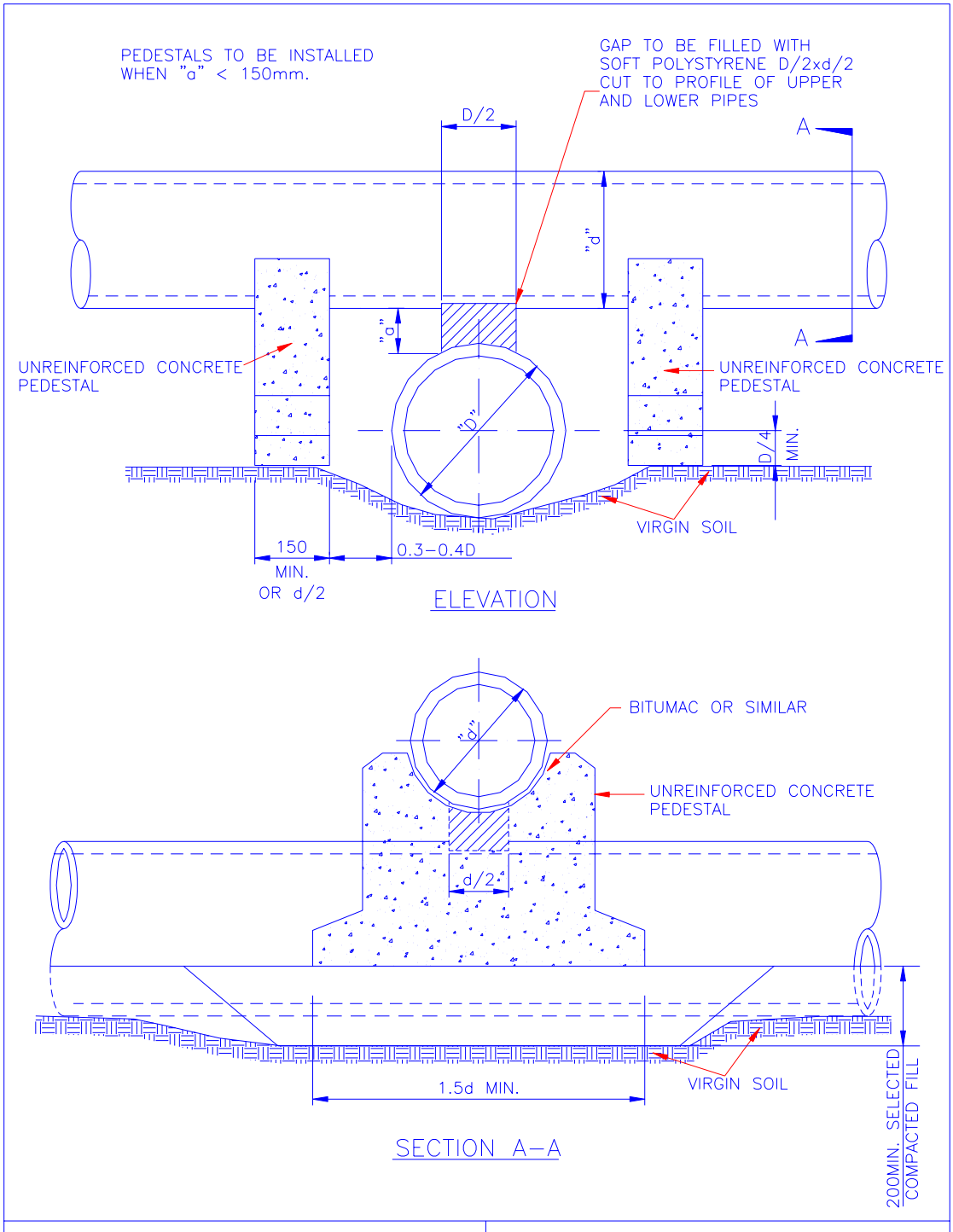

RUNG
500 MAX.
HAUNCHING
17.5 MPa
CONCRETE
1
8
100
PRECAST BASE
SECTION
SCALE 1:20
LEAVE 10mm PROUD OF SURFACE TO ACCOMODATE SECOND COAT SEAL IF IN ROADWAY
CAST IRON COVER
20MPa CONCRETE HAUNCHING
CAST IRON FRAME
PRECAST ADJUSTMENT RING(S) TO SUIT
PRECAST LID
150mm min. 300mm max.
500 min.
LADDER RUNGS 20mm GALVANISED STEEL
1050mm ø CLASS S FLUSH JOINTED PRECAST RISER, SINGLE PIECE WHEN < 2.4m DEEP
1050
AT LEAST ONE FLEXIBLE JOINT TO BE PROVIDED WITHIN 500mm OF MANHOLE
HAUNCHING
AT LEAST ONE FLEXIBLE JOINT TO BE PROVIDED WITHIN 500mm OF MANHOLE
PRECAST BASE
ELEVATION
NO TO SCALE
RUNGS – AVOID PLACING OVER ANY FLOW
SWEPT CHANNEL IN BENCHING TO SUIT MAIN FLOW
1050mm ø CLASS S FLUSH JOINTED PRECAST RISER WITH HOLES CAST FOR STEP IRONS
PLAN
SCALE 1:20
HOT DIPPED GALVANISED "NON-SLIP" RUNGS AT 300mm CENTRES
BOLT HOLES TO BE FLUSH WITH EPOXY MORTAR
250
150
DETAIL 1
SCALE 1:10
℄ SYMMETRICAL
LADDER RUNG SEE DETAIL 1
DETAIL 2
PRECAST MANHOLE BARREL 1050mm ø
50mm THROAT EPOXY MORTAR
PLASTER
PLASTER FINISH TO CONCRETE (STORMWATER)
HALF PIPE (SEWER)
100 MIN.
PIPE STUB
650 MAX.
50
PRECAST BASE
PIPE DETAIL
SCALE 1:10
CONCRETE MANHOLE
DENSOPOL 60HP TAPE
FOSROC EXPANDITE SEALASTRIP BM 100 OR APPROVED EQUIVALENT (SIMILAR SEAL UNDER MANHOLE TOP)
PIPE DETAIL
NOT TO SCALE
GISBORNE DISTRICT COUNCIL
GISBORNE DISTRICT COUNCIL
ENGINEERING CODE OF PRACTICE
STANDARD SEWER MANHOLE DETAILS
SCALE : AS SHOWN
TRACED
PLAN NUMBER
DESIGNED J.GROUT 2-99
CHECKED J.GROUT 2-99
4-1
DRAWN G.ABBOTT 2-99
APPROVED



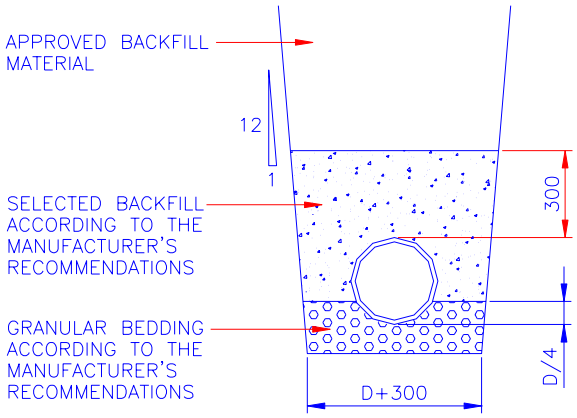
GISBORNE DISTRICT COUNCIL						ENGINEERING CODE OF PRACTICE SHALLOW SEWER MANHOLE
SCALE : NOT TO SCALE			TRACED			PLAN NUMBER
DESIGNED	J.GROUT	2-99	CHECKED	J.GROUT	2-99	4-2
DRAWN	G.ABBOTT	2-99	APPROVED		2-99	


CONCRETE MANHOLE
FOSRAC EXPANDITE SEALSTRIP BM 100 OR APPROVED EQUIVALENT (SIMILAR SEAL UNDER MANHOLE TOP)
DETAIL 2
N.T.S.
MORTAR BED UNDER RINGS AND CAST IRON FRAME
COVER AND FRAME TO BE 10mm PROUD TO ACCOMODATE SECOND COAT SEAL, IF IN ROADWAY
150mm MIN. 550 MAX.
GROUND SURFACE
OUTLINE OF 1050mm FLUSH JOINTED PRECAST CONCRETE MANHOLE
PLAIN JUNCTION
PLUG
100 MIN.
DETAIL 2
SELECTED COMPACTED BACKFILL
DENSOPOL HT60 TAPE
HOT DIPPED GALVANISED PIPE SUPPORTS AT 1000mm CRS. MAX. FIXED TO WALL WITH SS MASONARY ANCHORS
88° PLAIN BEND
1
8
100 MIN.
BEND TO DISCHARGE INTO SWEPT CHANNEL BUT NOT CONCRETED INTO BENCHING
COMPACTED GRANULAR BEDDING
PRECAST FLANGED BASE SLAB
BENCHING (20MPa CONCRETE)
NOTE: DROP MANHOLE NECESSARY WHERE DROP EXCEEDS 500mm.
GISBORNE DISTRICT COUNCIL
ENGINEERING CODE OF PRACTICE
DROP SEWER MANHOLE DETAILS
SCALE : NOT TO SCALE
TRACED
PLAN NUMBER
4–3
DESIGNED J.GROUT 2–99
CHECKED J.GROUT 2–99
DRAWN G.ABBOTT 2–99
APPROVED 2–99

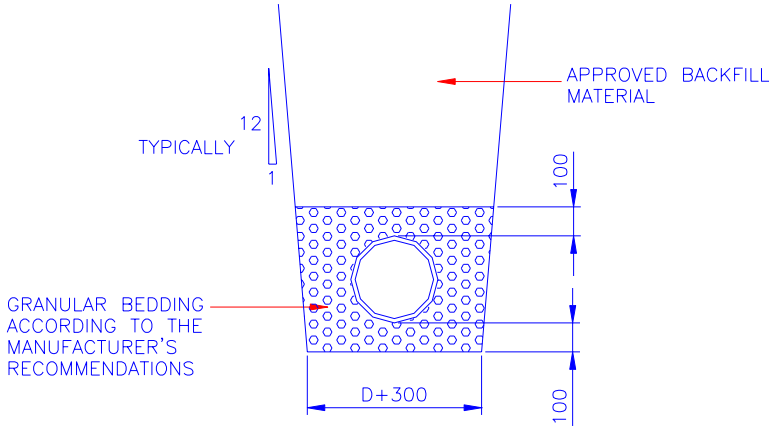

NOTE: NO INSPECTION PIPE IS REQUIRED IF THE SEWER MAIN IS WITHIN 1.2m OF THE BOUNDARY
FINISH 110mm ø RAMPED RISER AT MAXIMUM DEPTH OF 1200 AND TERMINATE WITH SOCKET PLUG. (MARK LOCATION AT SURFACE)
PROPERTY BOUNDARY
100mm INTERNAL DIAMETER PIPE
MAX 30° BEND
0.5m MIN.
1.2m MAX.*
FLOW
RAMPED RISER
1
1.5
INSPECTION PIPE BY OTHERS
POINT OF DISCHARGE
45° REDUCING JUNCTION
100 MIN.
100mm INTERNAL DIAMETER
* DOMESTIC DRAINS MAY BE DEEPER ON SOME SITES TO ENSURE A MINIMUM COVER OF 0.5m IS AVAILABLE TO SERVE THE BUILDING ENVELOPE
100mm MIN.
PRINCIPLE MAIN
GRANULAR BEDDING AS SPECIFIED BY THE PIPE MANUFACTURER
ELEVATION
FLOW
100mm INTERNAL DIAMETER PIPE
45° PLAIN BEND
DIRECTION OF FLOW
PRINCIPAL MAIN
45° REDUCING JUNCTION
CONNECTION DETAIL
GISBORNE DISTRICT COUNCIL
ENGINEERING CODE OF PRACTICE
DOMESTIC CONNECTION
SCALE : NOT TO SCALE
TRACED
PLAN NUMBER
4–4
DESIGNED J.GROUT 2–99
CHECKED J.GROUT 2–99
DRAWN G.ABBOTT 2–99
APPROVED 2–99



GISBORNE DISTRICT COUNCIL			ENGINEERING CODE OF PRACTICE CLOSE PIPE CROSSING DETAIL				
SCALE : NOT TO SCALE			TRACED			PLAN NUMBER	
DESIGNED	J. GROUT	2-99	CHECKED	J. GROUT	2-99	4-5	
DRAWN	G.ABBOTT	2-99	APPROVED		2-99		



CONCRETE AND CERAMIC PIPES



PVC, CLS, AND HDPE PIPES

NOTE: ALL FILL INCLUDING ORIGINAL MATERIAL SHALL BE FREE OF ORGANIC MATERIAL AND BE COMPACTED TO A DENSITY OF NOT LESS THAN 95% OF MAXIMUM DRY DENSITY AS DETERMINED BY NZS 4402. TEST 4.1.2. REFER SECTION 2.4.4.8.

GISBORNE DISTRICT COUNCIL			ENGINEERING CODE OF PRACTICE TYPICAL BEDDING AND PIPE SURROUND DETAILS			
SCALE : 1:20			TRACED			PLAN NUMBER
DESIGNED	J.GROUT	2–99	CHECKED	J.GROUT	2–99	4–7
DRAWN	G.ABBOTT		APPROVED			

Section 5
Water Supply

Contents

The Contents of this Section are as follows:

Section 5: Water Supply

5.1 Introduction

This section provides acceptable engineering standards for the design and construction of drinking-water reticulation systems that are to come under Gisborne District Council (GDC) jurisdiction and/or ownership. The section also provides guidance for effective and systematic construction supervision leading to high standards.

Our objective in design and construction is to distribute water for consumption and fire fighting which meets the appropriate standards and level of service for these uses.

Note:
Please refer to Chapter 14 of the Gisborne District Combined Regional Land and District Plan for information regarding service provisions.

5.2 Performance Criteria

5.2.1 Hygiene

A water reticulation facility shall:

a) Deliver water to the point of supply that complies with the *New Zealand Drinking Water Standards (NZDWS), 1995*.

b) Minimise the risks of contamination being introduced into the water.

c) Meet the water supply performance criteria defined by *Council Bylaws.*

d) Have due regard for the *New Zealand Building Code.*

5.2.2 Capacity and Layout

A water reticulation facility shall:

a) Have sufficient capacity to provide adequate flow and pressure to meet the anticipated demand over its lifetime.

b) Meet the fire protection requirements of the NZ Fire Service Code of Practice for *Fire Fighting Water Supplies*

c) Be located in such a way as to adequately service each lot, and provide reasonable access for maintenance.

d) Minimise adverse effects on, and be compatible with, the existing water reticulation network.

e) Minimise disruption to other parts of the network during maintenance; by having adequate interconnections, valves, and separating trunk main supplies from local reticulation.

f) Where practical utilise mechanical, electrical, alarm and telemetry equipment which is compatible with existing equipment used by GDC.

g) Where the expected life of any component is less than that of the system of which it is a part, make provision for access and maintenance of that component.

h) Ensure that mechanical and electrical equipment is either designed for submergence, or located above the 100 year design flood level.

i) Minimise whole of life costs.

5.2.3 Structural integrity

A water reticulation facility shall:

a) Be constructed of materials compatible with the chemical properties of the water being conveyed, suitable for the intended duty with a minimum design life of 100 years, and having a proven performance record.

b) Minimise leakage, eliminate the ingress of contaminants, and the penetration of roots, using current best practice.

c) Provide electrical and mechanical equipment with a life span and quality of the best currently available technology.

d) Withstand all anticipated superimposed loads and network pressures (including those from transient surges that could reasonably be expected from pump failure, pump starts, and sudden valve closure).

5.3 Design Guidelines: Reticulated Areas

5.3.1 General

A reticulated water supply shall be installed in all subdivisions and provide a domestic and fire fighting supply at all times to each lot in the subdivision.

In localities where either the existing system is inadequate or where a higher pressure supply system is required, the subdivider or developer shall provide and meet the cost of supply and installation of all pumping facilities, pumping mains, storage facilities, reticulation mains, rider mains, and backup facilities (e.g. generation) as required.

In the case of larger subdivisions, and/or areas difficult to supply, the proposal should be discussed at an early stage with GDC who will advise of any special requirements or conditions.

The approval of GDC shall be obtained for any proposed connection to a piped water supply service under GDC control. Approval shall be obtained in writing before work commences. Approval to connect will be based on the capacity available (which will be checked by GDC staff at the applicant's expense using the GDC reticulation model), as well as the engineering aspects for the proposed works. Connections to piped systems controlled by the GDC will be carried out by GDC or their nominated representative at the applicant's expense.

The requirements for on-site storage for areas outside the Gisborne Urban Area will need to be confirmed with GDC. On-site storage will need to include provision for fire protection.

The following topics are included in the discussion of design guidelines for a reticulated area:

5.3.1 General

5.3.2 Pipe Capacity to Meet Demand

5.3.3 Storage

5.3.4 Provision of Alternative Flow Path

5.3.5 Pipe Pressure Ratings

5.3.6 Reticulation Layout

5.3.7 Service Pipe Sizes

5.3.8 Water Meters

5.3.9 Service Valves

5.3.10 Backflow prevention

5.3.11 Valve Location

5.3.12 Thrust Blocks

5.3.2 Pipe Capacity to Meet Demand

Domestic Supply

The mains shall be designed to provide the minimum residual pressures, as set out below, at the flow which is the greater of either:

- the required fire flow plus two thirds of the peak domestic demand or:
- the peak domestic demand.

The Design demand figures for the reticulation system shall be:

- Average consumption : 330 litres/person/day.
- Minimum service pressure at the point of supply of 300kPa, and instantaneous flow of 40 litres/minute, unless the site is located in a designated low pressure area. The location of designated low pressure areas can be confirmed with Council.
- Average population per household shall be taken as 3.2

Commercial Supply

Design demand for commercial and industrial areas, shall be the required fire flow plus the peak demand as required for the specific users to be served (quantity and pressure), and subject to a design check.

Fire Fighting Supply

The water reticulation system shall be designed to comply with the New Zealand Fire Service *Code of Practice for Fire Fighting Water Supplies, 1992* and amendments.

5.3.3 Storage

If a storage reservoir is necessary to support the development it shall be provided to the approval of GDC and at the expense of the developer. Any structure shall have a minimum design life of 50 years.

Storage requirement shall be based on:

a) 500 litres per person per day for residential and rural developments, allowing a minimum of two days storage

b) and the fire storage as given in the NZ Fire Service *Code of Practice for Fire Fighting Water Supplies.*

c) Specific design for non-residential development

Reservoirs shall have scour and overflow connections and fall shall be provided in the floor to the scour outlet. Depth monitoring and telemetry equipment shall be to the approval of the GDC.

The reservoir design must ensure adequate circulation at all times (to prevent short circuiting and uneven chlorine distribution). An external sample point must be provided to give access to a representative water sample.

Reservoir roofs shall have sufficient fall to prevent ponding of rain water. The design shall use best practices to minimise the risk of contamination. Provision must be made for raised access hatches above roof level. Any monitoring equipment shall be locked and sealed in a separate building.

A Building Consent is required for all storage structures.

A resource consent may be required for storage reservoir overflows.

5.3.4 Provision of Alternative Flow Path

In order to provide an alternative flow path in the event of a pipe failure or routine maintenance, the required capacity of certain mains may be governed by a situation where parts of the network are out of service. Consideration shall be given to this aspect at the design stage.

In establishing a reticulation system Council may determine that in certain cases the requirements of the reticulation network override the specific needs of a particular development.

5.3.5 Pipe Pressure Ratings

All pipes shall have a minimum pressure rating of 1200 kPa. For pipes in the vicinity of a pumping station, the pump flow may govern the size of main needed. The manufacturer's recommendations for pressure de-rating of pipes and fittings must be allowed for in the design. Pressure ratings shall be increased as required for pumping mains. In Rural areas the minimum pipe pressure rating is 1000 kPa.

5.3.6 Reticulation Layout

Layout of mains shall, wherever possible, provide a ringmain system so as to avoid dead ends and provide alternative flow paths.

A water main of not less than 100mm internal diameter (principal main) shall be laid on one side of all through streets. The layout of the principal main shall include fire hydrants as specified in the New Zealand Fire Service *Code of Practice for Fire Fighting Water Supplies*. Wherever possible water mains shall be laid parallel with property boundaries, within the berm, and if these are present, between the footpath and the kerb and channel. Watermains shall not be placed under footpaths, beneath verandahs in the CBD or shopping areas, or within 200mm of road kerbs.

A rider main (50mm minimum internal diameter) shall be laid to serve lots on the opposite side of the road to the principal main. Individual road crossings for a service connection will not be accepted.

Rider mains shall be supplied from a principal main at both ends, except for rural roads, non-residential roads and private ways. Intermediate connections to a principal main will be required for rider mains longer than 100 metres in urban areas. Special conditions may need to apply to staged developments. These will need to be agreed with GDC. Longer distances may be permitted, subject to a capacity check by the designer.

All service pipes will be laid generally at right angles to the main.

The alignment may vary from these standards as circumstances dictate, provided prior approval is obtained from the Council.

In arterial roads, dual carriageway roads and commercial and industrial areas principal mains may be required on both sides of the road.
In commercial and industrial areas pipe sizes shall be specifically designed for the likely demand and shall recognise the minimum requirements for effective sprinkler systems.

The layout of the reticulation system shall provide adequate clearance from other services. Acceptable minimum clearances are:

- Horizontal 150mm between the outside edge of the principal mains and other services.
  100mm between the outside edge of the rider mains (<100mm diameter) and other services
  300mm from any boundary

- Vertical (i.e. pipe cross-overs) 150mm

These clearances must also take into account the specific requirements of others utility operators such as Telecom and Power. For example, a water main must be at least 1m away from 11 kV power lines. The designer will be required to verify the clearances in all cases.

Where water mains are laid on slopes steeper than 1 in 4, they shall be suitably tied and anchored in accordance with the manufacturer's recommendations.

In roads that may be extended in the future, mains shall be laid to the end of the legal road, unless a staged development is agreed with GDC. If the principal mains have dead ends then provision for scouring must be made, by placing a hydrant at the end of any principal main and a scour valve at the end of any rider main.

The Drawings provide guidance on the typical layout for water reticulation services, and rider main details.

5.3.7 Service Pipe Sizes

In general the internal diameter of a domestic water service pipe shall be 20mm, unless otherwise agreed with GDC.

Any domestic service supply pipe totaling more than 50m in length shall be regarded as a special case and pipe sizes shall be designed accordingly.

The diameter of industrial and commercial service pipes shall be based on water demand but shall not be less than 20mm internal diameter. The requirements for internal fire fighting with reference to hose reels and sprinkler systems shall be considered by the designer when sizing connections. The designer must allow for head losses through backflow preventers and meters, etc.

Extraordinary supply connections, or those above 20mm internal diameter, shall be made available only subject to a specific design check of the mains capacity and the network capacity.

5.3.8 Water Meters

Water meters will only be installed for extraordinary supply. These will be installed at the point of supply unless otherwise agreed with GDC. Each application for a metered water supply shall be subject to GDC approval. Where meters are required, they will be supplied and installed at the developer's expense. The meters will become Council property. The class of water meter used will be confirmed with GDC before installation. Kent Class B or C rated to design flow is preferred.

5.3.9 Service Valves

Normally the service valve will be housed within a proprietary box (GDC prefers "Acuflow" 305mm Water Meter Box or equivalent) below ground and shall be installed so that the inside edge of the box is 200mm from the outside of the property boundary. In rights-of-way or private streets the service box shall be in common land, and not within the trafficked area. (e.g. roadway, carpark or private access)

"Acuflow" manifold type valves or an approved equivalent, incorporating a service valve, double check backflow device and facility for a water meter will be provided, as shown on the Drawings.

5.3.10 Backflow Prevention

Backflow prevention shall be incorporated into the water reticulation design, to protect the potable water supply at the point of supply.

For industrial/commercial supplies backflow prevention at the point of supply shall be specifically designed according to flow requirements, the hazard of the particular premises, and to the approval of GDC. This is in addition to the requirements of the Building Act.

5.3.11 Valve Location

The maximum distance between valves on mains with service connections shall be 450m, and 900m for mains without service connections. Generally valves shall be placed on two of the three legs leading from each tee section and on three legs of a four-way junction. The maximum number of properties without water during a shutdown is to be 40. Valves should not be placed within the road carriageway unless otherwise approved by GDC.

The Drawings give typical valve details.

On mains 200mm diameter and larger, scour outlet valves may be required at low points with suitable drainage provided.

Air valves may be required at high points on both principal and ridermains. They shall be fitted on trunk mains (> 200mm internal diameter) at high points and intervals not exceeding 1000m. Air valves shall be sized by specific design for approval by GDC.

The location of the air valve needs to take into account backflow issues where the air valve is below ground or where stormwater/groundwater inundation is possible. Generally Council prefers air valves to be above ground and protected, as shown on the Drawings.

5.3.12 Thrust Blocks

Where required by the pipe material being used, cast in situ concrete thrust blocks shall be provided at all points where an unbalanced thrust may occur on mains greater than or equal to 100mm diameter. Thrust blocks are required at:

- Tees
- Changes in size of main e.g. tapers
- Blank ends
- Bends and curves (horizontal and vertical)
- All valves 100 mm diameter and larger

The design of thrust blocks shall be based on the site soil strength (to a maximum of 75 kPa). Thrust blocks shall be sized according to test pressure or estimated water hammer whichever requires the greater. The inner face of the block shall be larger than the diameter of fittings/pipework and constructed so not to impair access to fittings, bolts, joints or future main extensions. Thrust blocks shall be poured against natural ground. Refer to Drawings for standard thrust block details.

5.4 Guidelines for Specifications

5.4.1 General

The following clauses relate specifically to the material supply for, and construction aspects of public water supply works. Reference should also be made to Section 2.7 of this Code of Practice which provides a general overview of construction specifications, and provides guidelines for the quality assurance, as built record and compliance reporting that Council will expect will be a part of the construction works.

Contract specifications must clearly explain, in combination with the related construction drawings, the scope of works. They shall indicate the circumstances and conditions the contractor may expect to face during the works and requirements the work shall comply with. While standard clauses may be used, the whole specification must be prepared and edited for each specific work.

Due attention shall be given to safety aspects. All work shall be in accordance with current OSH regulations, in particular "*COP – Safety in Excavations and Shafts for Foundations,"* and *"Confined Spaces – Safe Working "*.

The following topics are included in the discussion of guidelines for specifications:

5.4.1 General

5.4.2 Standards

5.4.3 Principal Mains, Rider Mains and Fittings

5.4.4 Pipe Laying

5.4.5 Service Connections

5.4.6 Hydrants

5.4.7 Valves

5.4.8 Valve and Hydrant Boxes

5.4.9 Testing

5.4.10 Cleaning and Disinfection

5.4.2 Standards

The Standards and Codes of Practice listed below may be referred to in this section. The design, materials and methods of construction shall comply with the current standards and codes as applicable.

The standards used shall incorporate the latest amendments. Standards that supersede those listed shall automatically apply:

Ministry of Health *New Zealand Drinking-Water Standards, 1995*

NZ Fire Service *Code of Practice for Fire Fighting Water Supplies, 1992*

NZS 4402.1:1986 *Methods of testing soils for civil engineering purposes*

NZS 4501:1972 *Code of practice for the location marking of fire hydrants*

NZS 7643:1979 *Code of practice for the installation of uPVC pipe systems*

5.4.3 Principal Mains, Rider Mains and Fittings

Council requires blue, polyethylene pipe for all new mains, rider mains, and service connections up to 150mm nominal diameter. On larger diameter pipes, other materials may be used, but these must be approved by GDC. In all cases the following standards will be used:

- *Polyethylene Pipe to AS/NZS 4130:1997*
- *Electrofusion fittings to AS/NZS 4129:1997 (interim)*
- *Ductile iron pressure pipes and fittings to AS/NZS 2280:1995*
- *Sluice valves for waterworks purposes to AS 2638:1991*
- *Metallic Flanges for waterworks purposes to AS 4087:1996*
- *PVC pipes and fittings for pressure applications to AS/NZS 1477:1996*
- *Concrete lined steel to NZS 4442:1988*
- *Specification for underground fire hydrants and surface box frames and covers, BS 750:1984*

- *Iron Castings - Grey cast iron to AS 1830:1986*

- *Metallic flanges for waterworks purposes, AS 4087:1996*

- *Sluice valves for waterworks purposes AS 2638:1991*

Approved gibault joints shall be used wherever a dismantlable joint is required. Polyethylene pipes will be butt or fusion welded in accordance with the manufacturer's recommendations, and the above standards.

The pressure rating used shall be one class above the maximum anticipated service pressure, but not less than 1200 kPa (except note Section 5.3.5)

Joints for mPVC pipes shall be spigot and socket rubber ring type (Z joint). Solvent cement joints shall not be used.

Steel pipe may use either flanges or gibault joints, or be welded by a certified welder. Internal corrosion protection is required, that is suitable for use with potable water supply.

Fittings for mPVC pipe shall be nylon coated. Nylon coatings on other pipe fittings shall be used where these are available.

In all cases, fittings (valves, hydrants, gibaults, talbot ferrules) and any other exposed metal components shall be wrapped using the "Denso" protection system incorporating grease, mastic and "denso" tape (or equivalent), in accordance with the manufacturer's recommendations.

5.4.4 Pipe Laying

General

All pipes and fittings shall be transported, handled, stored and laid in accordance with the manufacturer's recommendations. All pipes, valves, fittings and service connection fittings that are to be part of any permanent works shall be laid during construction to ensure they are included in all inspections, testing and disinfection.

All pipes and fittings used in water mains and service connections shall be kept clean and free from contamination. Blank caps shall be fitted temporarily to the ends of exposed pipes while no work on the pipe is being undertaken. Fire hydrants and gate valves shall be kept closed. Pipes shall not be laid while water is lying in the trench.

Cover to Pipes

Water pipes shall have the minimum and maximum covers to the crown shown in the following table.

Minimum and Maximum Cover to Water Supply Services

Type	Location	Minimum Cover to Crown	Maximum Cover to Crown
Mains 100 mm NB or greater	Under grass berms or footpaths Under carriageways	800mm 800mm	1200mm 1200mm
Rider mains	Under grass berms or footpaths Under carriageways	800mm 800mm	1200mm 1200mm
Service Connections (at toby)		250mm below finished level	300mm

Pipes in rural water supply systems shall have a minimum ground cover of 800mm.

Setting Out of Mains

The watermains in new subdivisions shall be set out in accordance with the plans.

Bedding and Pipe Surround

Pipe bedding shall be selected for suitability under the design loading conditions. The type of bedding shall be in accordance with the manufacturer's pipe laying recommendations

Where flexible walled pipes subject to high surcharge loads are used, special care will be required, and additional protection e.g. concrete cover may be necessary. This will need specific design input from an appropriately qualified professional.

Backfill around and above pipes shall be carried out in accordance with the manufacturer's recommendations. Following good engineering practice, bedding material shall be placed in layers not exceeding 150 mm and shall be carefully compacted, with particular attention to compacting under the pipe haunches. The material shall not be dropped onto the pipe from a height of greater than 600mm. The fill shall be compacted to a density of not less than 95% of the Maximum Dry Density as determined by *Test 4.1.2 of NZS 4402.1:1986*. Careful attention to the control of moisture content and material variability is required. Compaction control with a Nuclear Densometer is recommended.

Backfilling and Reinstatement

- Services in Road Reserve

Within a road reserve, filling above the pipe surround shall be in accordance with Council's *Specification for Service Maintenance Operations and New Service Installations within Road Reserve*.

- Services in Land not in Road Reserve

Pipe trenches may be backfilled with suitable excavated material (ordinary fill). If the excavated material is unsuitable, as determined by the certifying Engineer, approved imported material shall be used. In all cases, rubbish and other contaminants (tree roots etc) will be removed from the fill before placing and compaction. GDC recommends that topsoil will only used as backfill within 200mm of the surface to help reinstate the vegetation.

Again, following good engineering practice, backfill material shall be placed in layers not exceeding 150mm and shall be carefully compacted, with particular attention to compacting under the pipe haunches. The fill shall be compacted to a density of not less than 95% of the Maximum Dry Density as determined by *Test 4.1.2 of NZS 4402.1:1986*. Careful attention to the control of moisture content and material variability is required. Compaction control with a Nuclear Densometer is recommended.

5.4.5 Service Connections

Each service connection to a principal main or rider main shall be connected as required by the manufactured recommendations. In the case of polyethylene pipes connections will be by approved tapping tee and electrofusion fitting, as shown on the Drawings.

Service connections shall be laid at right angles to the main. Typical locations are as shown on the Drawings.

5.4.6 Hydrants

Hydrants shall be to *BS 750:1984* with flanges to *AS 4087:1996.* The tall pattern shall be used although short or medium may be allowed, in specific circumstances with the approval of GDC.

The following modifications shall be specified:

- Hydrants shall close by turning the spindle clockwise

- All steel nuts and bolts used in the construction of the hydrant shall be hot dip galvanised (or stainless steel) with bolts of the hex headed type.

- The hydrant shall be coated internally and externally with an approved coating, e.g Rilsan nylon 11.

- The washer shall be nitrile rubber

- No frost plug drain is to be fitted.

A hydrant riser shall be used where necessary to ensure the spindle top is between 150 and 250mm below finished surface level.

The location marking of fire hydrants shall be as per *NZS 4501:1972*. Council also requires that the hydrant location be marked by a blue bi-directional RPM in the centerline of each road directly opposite the hydrant.

5.4.7 Valves

All valves shall be coated both externally and internally with an approved nylon protective coating on all external parts subject to corrosion.

The valves on the principal main shall be resilient seated sluice valves, with non-rising spindles and anti-clockwise closing, manufactured in accordance with *AS 2638:1991.* The spindle seal rings shall be replaceable under main pressure. Flanges will be to *AS 4087:1996.*

Valves on rider mains and service valves shall have resilient seats and be spindle type valves. Retaining nuts shall be of corrosion resistant material.

5.4.8 Valve and Hydrant Boxes

Ductile iron surface boxes within the precast top block, shall be fitted over fire hydrants, valves and other fittings on the principal and rider main which allow access for operation and maintenance. Service valves can be fitted in approved plastic surface boxes.

Boxes and surrounds shall be constructed so that no load can be transferred to any pipe or fitting. They shall not move under expected loads. Wood shall not be used as packing between surrounds or surrounds and boxes. Valve and hydrant boxes shall be bedded on compacted granular backfill as shown on the Drawings.

The lids of valve boxes shall be painted light blue, and hydrant boxes painted yellow.

5.4.9 Testing

After construction is completed the principal mains, rider mains, services and fittings shall be tested in the presence of an appropriately qualified professional. The test method will depend on the pipe material used. The proposed test method shall be submitted with the design calculations and/or plans and be approved by GDC before construction begins.

The Contractor/Developer shall provide all fittings and materials to carry out the work, and ensure test requirements can be met. All mains and services shall undergo a thorough flushing before testing. This will include “swabbing” prior to filling.

All joints must be kept clear so that they may be readily inspected. Testing against shut valves is not acceptable, except where the open end of the valve can be observed. The main must be filled with water and all air released.

All hydrants and service connections will be tested to confirm that the minimum flow and pressure requirements listed in Section 5.3.2 are achieved in all cases.

5.4.10 Cleaning and Disinfection

General

All cleaning and disinfection shall be completed by the developer or his agent, in the presence of an appropriately qualified professional. The following notes shall apply:

Thorough flushing, cleaning and disinfection is absolutely crucial for preventing waterborne disease in the Gisborne community.

All water supply pipes, valves, services and other fittings shall be disinfected by means of chlorination before connection into existing services.

The developer shall provide all special tappings etc, for the introduction and draining of the chlorine solution.

Disinfection

The Contractor/Developer shall disinfect the entire length of each pipeline after pressure testing, and flushing.

A solution of sufficient Free Available Chlorine (FAC) concentration, shall be introduced into the pipeline. A residual FAC after the minimum contract period (as given in the following table) shall be at least 10mg/litre.

The minimum Ct value (the product of FAC concentration and contact time) achieved, shall be 7,200 (mg/litre, minutes) subject to a pH of less than 8.5. To achieve this Ct value, the FAC and/or the contact time may be adjusted according to the following table.

Relationship between Contact Time and Minimum FAC

Contact Time (hours)	Minimum FAC (mg/litre)
12	10
10	12
8	15
6	20
4	30
2	60

After the disinfection period the sterilising solution in the pipeline must be flushed into the sewerage system with water from the GDC reticulation. When connecting to the GDC reticulation, adequate backflow prevention must be provided at the point of connection. GDC has a hydrant stand with a backflow device that is suitable for this purpose and will make this device available for the developer's use at a charge. The developer will also be charged for the water used when testing. A maximum flow rate of 2.5 l/sec shall be allowed during the filling period to maintain adequate fire flows within the existing reticulation.

The flushing will need to be carefully controlled to avoid surcharging the existing sewers. Alternatively the Contractor/Developer may de-chlorinate the discharge and dispose of it to the stormwater system or a natural watercourse. If de-chlorination is undertaken, testing shall be carried out to confirm that the chlorine concentration of the wash-out water has been reduced to less than 0.3 mg/litre. A Consent to Discharge from GDC will be required.

The FAC of the wash-out water shall be tested at regular intervals during the flushing period to confirm the uniformity of the disinfection solution and to avoid unnecessary waste of flushing water.

The flushing shall continue until the FAC residual has been reduced to not more than 0.5 mg/litre, and the main left to stand for at least 6 hours. At the completion of the standing time, bacteriological samples shall be taken from the pipeline, at the rate of at least one sample for every 300 m of principal main pipe length.

Bacteriological Testing

It is the Developer's responsibility to ensure that all samples shall be tested for faecal coliforms by a IANZ registered laboratory. Note that sampling should be carried out by trained, IANZ registered personnel to avoid the possibility of

contamination of the sample. GDC can assist with the testing if required, at the Developers expense.

The Developer shall provide GDC with a certified report from the testing laboratory detailing the date, the sampling point location/s and the results achieved. If the results conform to the following requirements, the main may be connected to the existing reticulation. If the results of the bacteriological testing are unsatisfactory, the Developer shall repeat the full sterilising procedure until "clear" microbiological results are achieved.

Sample results will be considered acceptable if

1. Faecal coliforms per 100ml Nil

2. HPC (hetrotrophic plate counts) count per 1ml Nil

It should be noted that the use of a non-bactericidal jointing lubricant may prevent the achieving of the above results, and that 24 hours is required to obtain nil test results.

If any contaminated water is allowed to enter the pipeline (for any reason), after disinfection (e.g. during connecting up or flooding of the site), the Developer shall re-disinfect the whole pipeline and carry out further confirming tests.

Disinfection of Connection System

Any pipes or fittings used to connect to the existing reticulation system shall be:

- thoroughly cleaned and flushed to remove any dirt or foreign matter

- disinfected by washing with a sterilising solution of not less than 10 mg/litre FAC chlorine.

5.5 Quality Assurance, Inspection during Construction, As Built Record and Compliance Reporting

To provide Council with the confidence that the drinking water systems within any subdivision have been constructed to the specified standards, the developer shall ensure that at all times quality assurance records are maintained, and that at the end of construction these records are provided to the GDC along with certification from an appropriately qualified professional that all inspections and test results have met the standards specified in the Engineering Code of Practice.

The attached table, and Section 7 of this Code of Practice, lists the quality assurance information, as built records and reporting that GDC considers would be the minimum documentation required for submission to Council for Compliance.

For water supply works, in all cases inspections on site shall be carried out by a person with a good knowledge of water supply theory and construction practice, who shall have reasonable liaison with the design engineer for works being inspected.

The appropriately qualified professional will be required to certify the accuracy of all inspection records and test results that are submitted to Council for Compliance.

As built plans of any rural water supply system and operating instructions shall be lodged with GDC, who in this respect will act as librarian.

Council reserves the right to, and shall be granted access upon 24 hours written notice, to independently inspect the works. Where work or material is found to be unsuitable it shall be removed and replaced to the satisfaction of Council prior to further work being carried out. The cost of the independent inspection shall in this case be charged to the Developer.

5.6 General Requirements for Private Developers

5.6.1 Connection to the Council System

Connection to the existing reticulation system will be carried out at the Developers cost by Council's nominated contractor after testing and disinfection to the satisfaction of Council.

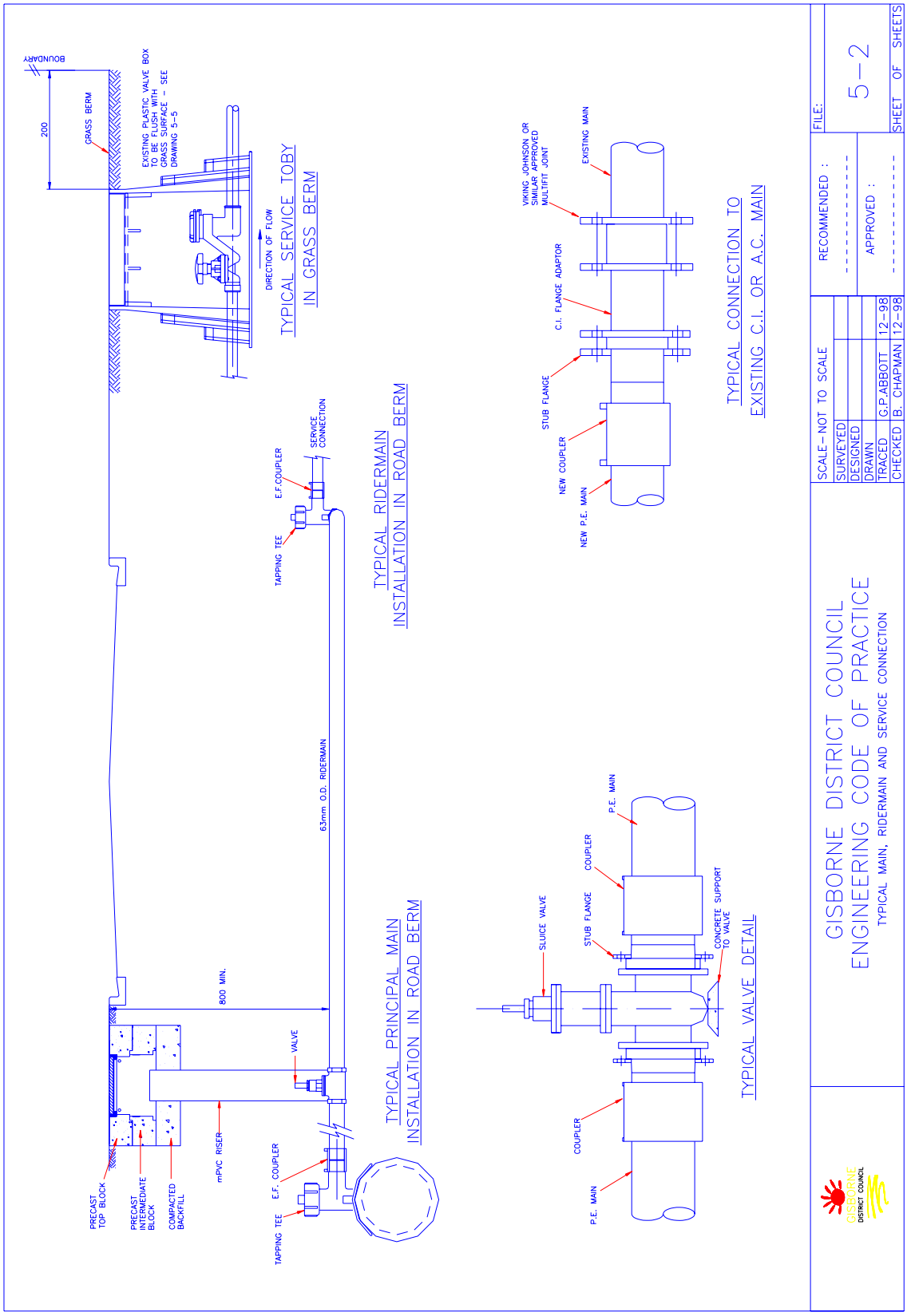
5.6.2 Easements

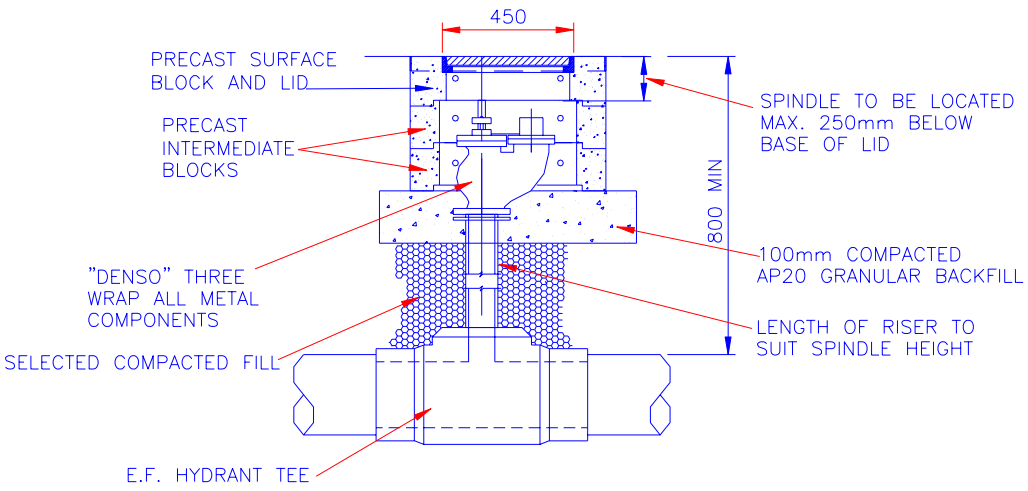
The subdivider shall create easements for all water supply mains, and ridermains in gross in favour of Council.

Easement or reserve widths shall be the larger of:

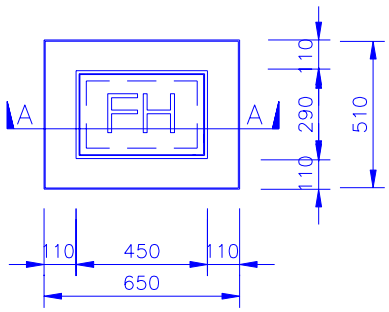
- a width equal to 1.5 times the depth to invert with the service laid in the centre, or

- a minimum of 3 metres with the service laid in the centre


BOUNDARY
200
GRASS BERM
EXISTING PLASTIC VALVE BOX TO BE FLUSH WITH GRASS SURFACE - SEE DRAWING 5-5
DIRECTION OF FLOW
TYPICAL SERVICE TOBY IN GRASS BERM
SERVICE CONNECTION
E.F.COUPLER
TAPPING TEE
63mm O.D. RIDERMAIN
TYPICAL RIDERMAIN INSTALLATION IN ROAD BERM
800 MIN.
VALVE
mPVC RISER
PRECAST TOP BLOCK
PRECAST INTERMEDIATE BLOCK
COMPACTED BACKFILL
E.F. COUPLER
TAPPING TEE
TYPICAL PRINCIPAL MAIN INSTALLATION IN ROAD BERM
VIKING JOHNSON OR SIMILAR APPROVED MULTIFIT JOINT
EXISTING MAIN
C.I. FLANGE ADAPTOR
STUB FLANGE
NEW COUPLER
NEW P.E. MAIN
TYPICAL CONNECTION TO EXISTING C.I. OR A.C. MAIN
P.E. MAIN
COUPLER
STUB FLANGE
SLUICE VALVE
CONCRETE SUPPORT TO VALVE
COUPLER
P.E. MAIN
TYPICAL VALVE DETAIL
GISBORNE DISTRICT COUNCIL
ENGINEERING CODE OF PRACTICE
TYPICAL MAIN, RIDERMAIN AND SERVICE CONNECTION
SCALE - NOT TO SCALE
SURVEYED
DESIGNED
DRAWN G.P.ABBOTT 12-98
TRACED
CHECKED B. CHAPMAN 12-98
RECOMMENDED : ----------
APPROVED : ----------
FILE: 5-2
SHEET OF SHEETS
GISBORNE DISTRICT COUNCIL

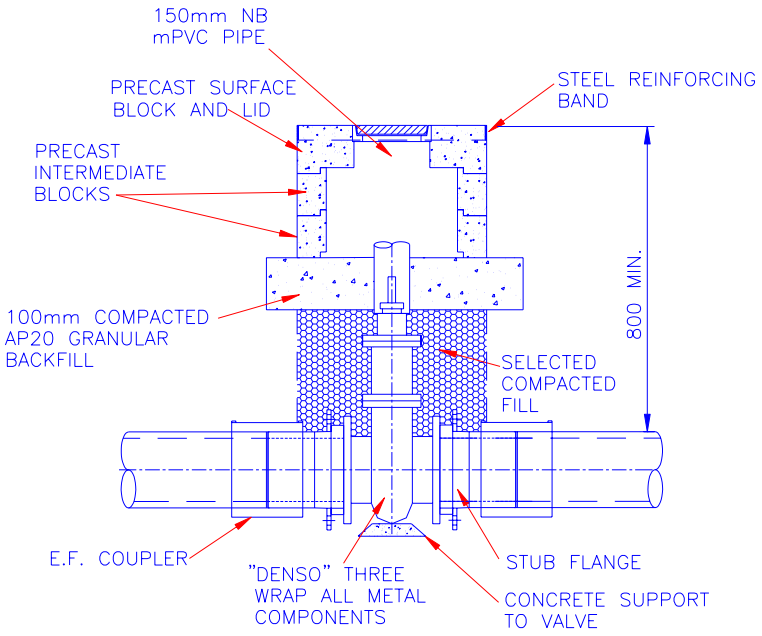


SECTION A–A

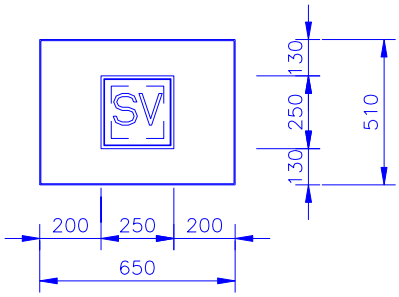


HYDRANT
SURFACE BLOCK

GISBORNE DISTRICT COUNCIL ENGINEERING CODE OF PRACTICE TYPICAL FIRE HYDRANT INSTALLATION	DESIGNED			PLAN NUMBER
	DRAWN	G.P.A.	12–98	5–3
	APPROVED			SCALE : N.T.S.

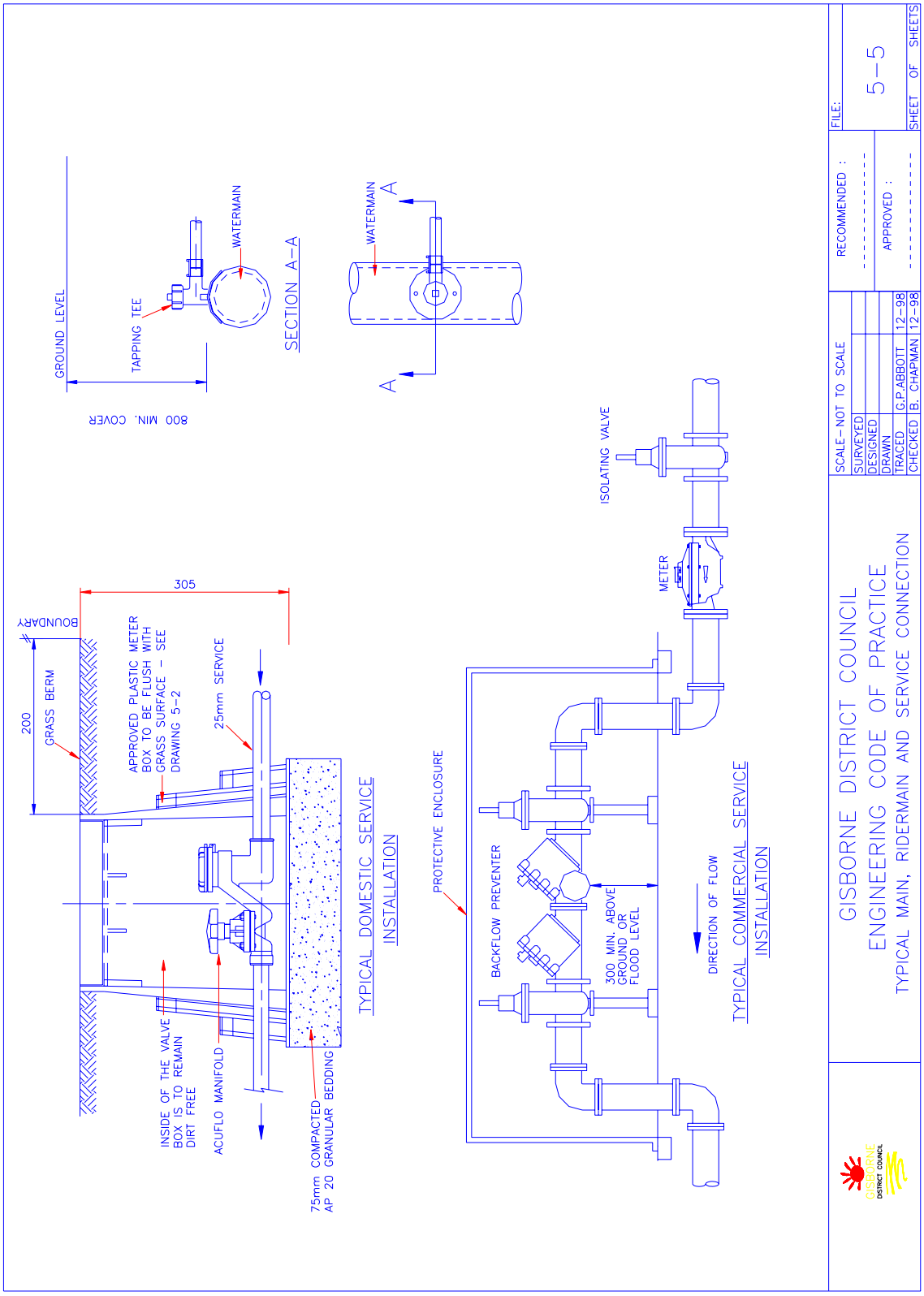


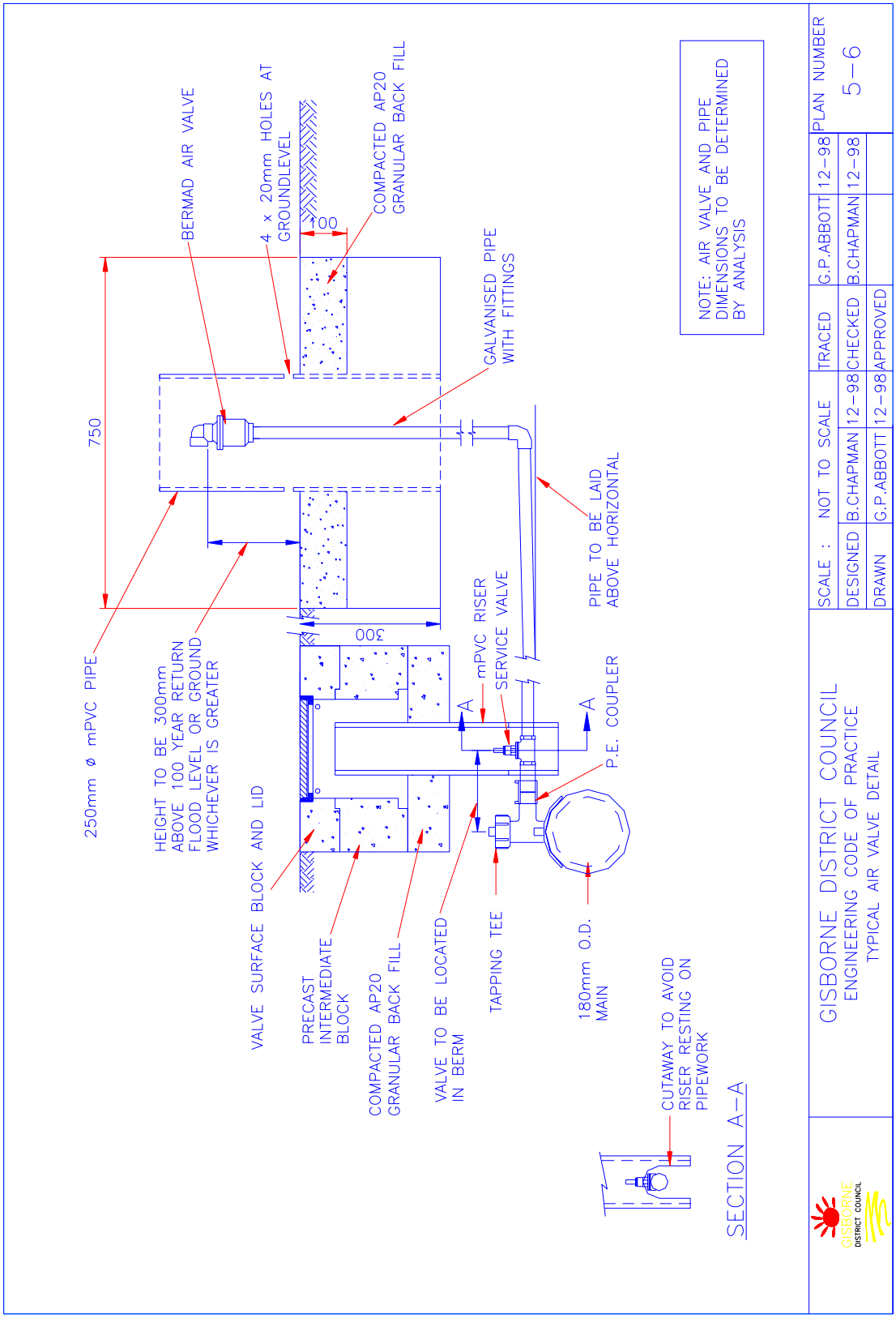
TYPICAL SECTION THRU' VALVE 1:20

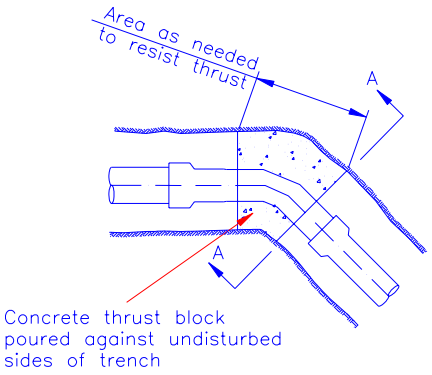


VALVE SURFACE BLOCK 1:20

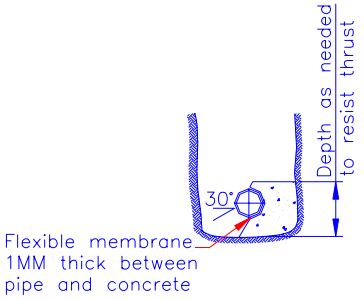
GISBORNE DISTRICT COUNCIL ENGINEERING CODE OF PRACTICE TYPICAL SLUICE VALVE INSTALLATION	DESIGNED			PLAN NUMBER 5—4
	DRAWN	G.P.A.	12-98	
	APPROVED			SCALE : N.T.S.


GISBORNE DISTRICT COUNCIL
ENGINEERING CODE OF PRACTICE
TYPICAL MAIN, RIDERMAIN AND SERVICE CONNECTION
SCALE - NOT TO SCALE
SURVEYED
DESIGNED
DRAWN G.P.ABBOTT 12-98
TRACED
CHECKED B. CHAPMAN 12-98
RECOMMENDED :
APPROVED :
FILE:
5-5
SHEET OF SHEETS
GROUND LEVEL
TAPPING TEE
WATERMAIN
800 MIN. COVER
SECTION A-A
WATERMAIN
A
A
BOUNDARY
305
200
GRASS BERM
APPROVED PLASTIC METER BOX TO BE FLUSH WITH GRASS SURFACE - SEE DRAWING 5-2
25mm SERVICE
INSIDE OF THE VALVE BOX IS TO REMAIN DIRT FREE
ACUFLO MANIFOLD
75mm COMPACTED AP 20 GRANULAR BEDDING
TYPICAL DOMESTIC SERVICE INSTALLATION
ISOLATING VALVE
METER
PROTECTIVE ENCLOSURE
BACKFLOW PREVENTER
300 MIN. ABOVE GROUND OR FLOOD LEVEL
DIRECTION OF FLOW
TYPICAL COMMERCIAL SERVICE INSTALLATION


BERMAD AIR VALVE
4 x 20mm HOLES AT GROUNDLEVEL
COMPACTED AP20 GRANULAR BACK FILL
100
GALVANISED PIPE WITH FITTINGS
750
NOTE: AIR VALVE AND PIPE DIMENSIONS TO BE DETERMINED BY ANALYSIS
PIPE TO BE LAID ABOVE HORIZONTAL
300
mPVC RISER
SERVICE VALVE
A
A
P.E. COUPLER
250mm ø mPVC PIPE
HEIGHT TO BE 300mm ABOVE 100 YEAR RETURN FLOOD LEVEL OR GROUND WHICHEVER IS GREATER
VALVE SURFACE BLOCK AND LID
PRECAST INTERMEDIATE BLOCK
COMPACTED AP20 GRANULAR BACK FILL
VALVE TO BE LOCATED IN BERM
TAPPING TEE
180mm O.D. MAIN
CUTAWAY TO AVOID RISER RESTING ON PIPEWORK
SECTION A-A
GISBORNE DISTRICT COUNCIL
ENGINEERING CODE OF PRACTICE
TYPICAL AIR VALVE DETAIL
SCALE : NOT TO SCALE
DESIGNED B.CHAPMAN 12-98
DRAWN G.P.ABBOTT 12-98
TRACED G.P.ABBOTT 12-98
CHECKED B.CHAPMAN 12-98
APPROVED
PLAN NUMBER
5-6
GISBORNE DISTRICT COUNCIL

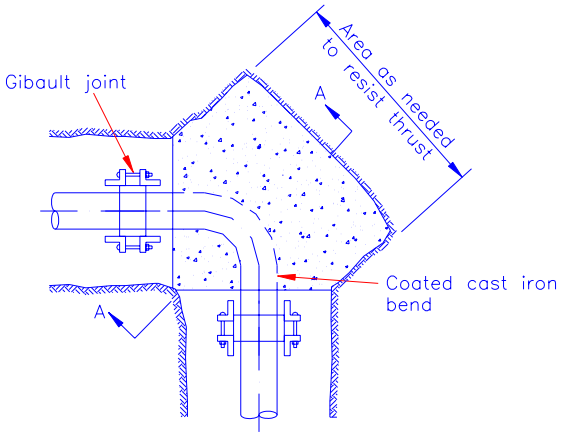


PLAN OF 45° PVC BEND

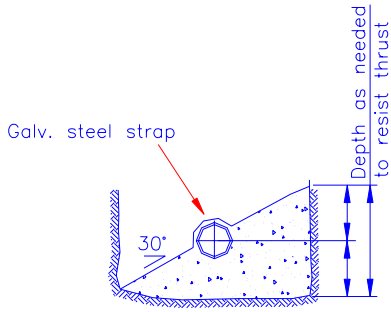


SECTION A–A

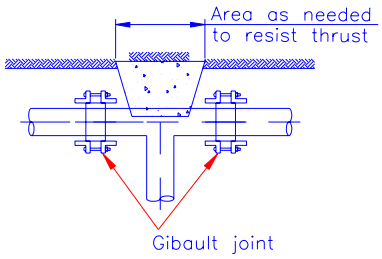
(Note that there are limits on the deflection angle for various diameters of PVC pipe formed bends)



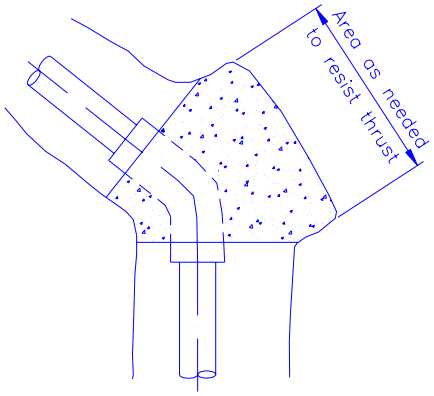
PLAN OF 90° CAST IRON BEND



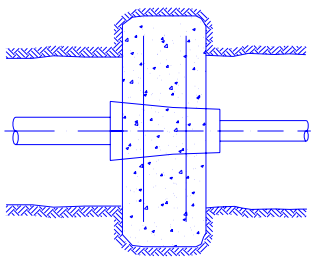
SECTION A–A



SECTION A–A



PLAN OF 45° DUCTILE IRON BEND



PLAN OF REDUCER

GISBORNE DISTRICT COUNCIL ENGINEERING CODE OF PRACTICE TYPICAL THRUST & ANCHOR BLOCK INSTALLATION	DESIGNED			PLAN NUMBER 5–7
	DRAWN	G.P.A.	12–98	
	APPROVED			SCALE : N.T.S.

Section 6
Road and Traffic Engineering

Contents

The Contents of this Section are as follows:

Section 6: Road and Traffic Engineering

6.1 Introduction

This section of the Code of Practice provides standards for the design and construction of new roads and vehicle crossings which may be required as a condition of a subdivision or land use consent.

The District Plan rules for Subdivision require that every new allotment created by a subdivision, must be connected to an existing, formed public road which is part of the District Roading Network. Where an existing public road is required to be extended to connect a subdivision site to the roading network, or where a new public road is needed, the subdivider will be required to design and construct the road (or make provision for it within the design of the subdivision site) in accordance with the relevant rules of the Gisborne District Combined Regional Land and District Plan.

The standards for public roads however, vary according to their classification under the Council's District Roading Hierarchy These standards are provided to ensure that any new roads are compatible with the type and character of the existing roads which they are connected to.

In making applications for resource consents, subdividers or developers will need to outline the intended methods by which the rules of the Gisborne District Combined Regional Land and District Plan and the standards of the Code of Practice will be met for Road and Traffic Engineering.

Council will only take responsibility for the roading facility after the necessary certification and reporting has been received and after the requirements of the Gisborne District Combined Regional Land and District Plan have been met.

Generally, all roads, rights of ways and accessways shall be constructed and finished at the expense of the Developer to a standard acceptable to the Council. The minimum standards are as set out in this Code of Practice.

6.2 Roading Hierarchy

A roading hierarchy is an essential component in the management of the District's Roading Asset. The Gisborne District Council has chosen to use a hierarchy which has five classifications for roads. These are outlined in the following Table.

Roading Hierarchy for Roads in Gisborne District

Classification	Description	Typical Function
National Routes	Roads which : - form part of a network of strategic importance, and - are a significant element in the national economy	State Highways which are administered by Transit New Zealand
Arterial Roads	Roads which are : - of strategic regional importance, and - a significant element in the regional economy	State Highways not included in National Routes category. Roads giving access to important tourist areas of significant areas of population, roads linking different transport modes, roads providing significant inter - urban links and, all other roads of regional inter regional importance
Principal Roads	Roads which are : - of strategic importance, and - a significant element in the local economy	Links between residential, commercial, industrial or recreational land use activities. Generally such roads would be within urban areas but in some localities such roads would provide alternative links between centres of population or be significant for the movement about a district of goods or produce.
Collector Roads	Routes which are : - locally preferred between or within areas of population or activities - complementary arterial roads, and	Primarily suited to urban situations, yet have a place in rural areas. In rural areas, where land use activity is relatively intensive, it is necessary to provide links between local roads and arterial roads. Unless defined as a District Arterial all roads in industrial areas will meet Collector Route criteria.
Local Roads	Roads whose primary function is property access	All other roads servicing land use activity.

The key point to note this Table is that the roads are classified by their function and character rather than by the volume of traffic they can carry. Of the five classifications, the classification "National Routes" refers specifically to the State Highway Network. The other four classifications generally refer to roads that are administered and maintained by the Gisborne District Council.
Appendix 12 of the Gisborne District Combined Regional Land and District Plan identifies the classification of roads within Gisborne District
Note: The Gisborne District Combined Regional Land and District Plan includes National Routes in it's classification of Arterial Roads

This Code of Practice will refer to this roading hierarchy in its standards for roading subdivision and land development.

6.3 Road Reserve and Carriageway Criteria

6.3.1 Introduction

This section of the Code of Practice provides the Engineering Standards for road reserve and carriageway criteria.

The Contents are as follows:

The road reserve is defined as all of the area of land which comprises of legal road under the control of a road controlling authority (see also definitions under the Local Government Act 1977 and Transit New Zealand Act 1989). The carriageway is defined as that part of the road that is intended for vehicular traffic, which includes moving vehicles, parked vehicles and bicycles. Each proposed new road reserve will be specifically designed to take account of the following features:

- the carriageway shall have sufficient width to meet the needs of the estimated future vehicle, cycle and pedestrian traffic, both in terms of the current development and any future development, as permitted by the District Plan. This aspect should be discussed with Council at an early stage.

- the need for and location of pedestrian footpaths and cycleways,

- the location of existing and future services, including drainage, overhead and underground utility services, and road furniture including signs and lighting

- the cross-section of the carriageway, including the grading of berms, batter cuts and fills and roadside drainage,

- the location and geometry of roadside property access
- the natural landscape and topography, and any future landscape proposals.

6.3.2 Distinction Between Urban and Rural

For Engineering purposes, within this Code, urban includes any area with a 70km/hr or 50km/hr speed restriction. All other areas are considered to be rural.
Note: The zonings of land within the Gisborne District Combined Regional Land and District Plan may differ from the identification of urban or rural land used in the Code.

6.3.3 Urban Road Reserve and Carriageway Criteria

Drawing 6-5 describes the terms typically associated with various sections of the urban road reserve. The carriageway width is the total of the widths of lanes required for parked and moving traffic. The following Table provides the minimum dimensions for the sealed sections within the road reserve, and the link between these, the Roading Hierarchy and Potential Users.

When using this Table, particular attention needs to be paid to the following points:

1. Provision for parking on berms is required, i.e., mountable kerb, for low volume Local Roads, if no provision is made within carriageway for parking.
2. With 9.0m carriageway or less, parking lanes are not road marked.
3. Cycle facilities will be the subject of special design, refer Section 6.3.4.
4. Allowance for extra width should be made at the end of cul de sacs for turning circles for service and emergency vehicles e.g. fire service vehicles. Refer Section 6.4.10.
5. In local roads where mountable kerb is acceptable, for safety reasons the outside edge of the footpath will be located at least 1 metre behind the face of the kerb.
6. Where the volume of traffic is such that high numbers of bicycles and motor vehicles are in a lane-sharing situation, or on-street parking is required, additional carriageway width will be required.

Minimum Road Reserve and Carriageway Width Criteria

Zone		Potential USERS	Road Reserve Width (Metres)	Carriage Way Width (Metres)	Footpaths	Traffic Lanes
Service Lane	All	NA	4.5	3.5	Optional	
Local	Rural	NA	20	6.0	Optional	2 x 2.75
	Residential	<20	12	6.0	1	2 x 3.0
		≥20	18	8.0	2	2 x 3.0
	Industrial and Commercial	<10	15	10.0	1	2 x 3.5
		≥10	18	12.0	2	2 x 3.5
	Port	NA	18	12.0	2	2 x 3.5
Collector	Rural	NA	20	7.0	Optional	2 x 3.0
	Residential, Commercial, Industrial and Port	NA	20	12.0	2	2 x 3.5
Principal	Rural	NA	22	8.0	Optional	2 x 3.5
	Residential, Commercial, Industrial and Port	NA	22	12.0	2	2 x 3.5
Arterial	Rural	NA	Requires Specific Design		Optional	
	Residential, Commercial, Industrial and Port	NA	Requires Specific Design		2	

Note: *Potential users are defined in the District Plan.*

6.3.4 Location of Underground and Overhead Services

Underground and if necessary overhead services should be located in the berm. The location of services must be determined on a case by case basis in conjunction with the appropriate service authority. The required cover to underground services will likewise need to be confirmed.

6.3.5 Rural Road Reserve and Carriageway Criteria

The drawings describe the terms associated with various sections of the rural road reserve. The sealed width (if appropriate) consists of the traffic lane required for the moving vehicles and the sealed shoulder. If the road is unsealed the same traffic lane and shoulder widths will apply. The Table provides the minimum dimensions for the sections within the road reserve, and the link between these, the Roading Hierarchy and Potential Users.

When using the Table, particular attention needs to be paid to the following points:

1. The Verge extends to the invert of surface water channel and includes 2 x 100mm unsealed shoulders (see typical cross-section in Drawings).

2. Verge widths may be reduced to 2 x 2.0m and incorporate kerb and channel or dish drain where topography makes construction difficult.

3. For local roads in rural areas with low traffic volumes (0-50 vpd) an unsealed option may be considered.

4. Road Reserve and Berm width may vary depending on topography.
   Note: Reducing road reserve widths below the minimum standards specified in the Gisborne District Combined Regional Land and District Plan will be subject to resource consent approval.

5. Cycle facilities will require special design, refer Section 6.3.6.

6.3.6 Cyclists and Pedestrian Traffic

Where provision needs to be made for cycle and pedestrian traffic, in particular disabled pedestrian access, the following references shall be used:

Guide to Traffic Engineering Practice, Part 13 Pedestrians, Part 14 Bicycles, AUSTROADS, 1993.

NZS 4121: 1985, Code of Practice for Design and Access and Use of Buildings and facilities for Disabled Persons.

6.4Geometric Design

6.4.1 Introduction

The use of consistent geometric design standards in roads allow the Gisborne District Council to achieve consistent and operationally effective and safe road designs. The objective of these standards are to:

- To establish and maintain uniformity throughout the District

- To provide functional, safe, durable and cost effective road designs for both rural and urban areas

- To promote the conservation of land and construction materials consistent with utility, safety and user convenience

The following discussion of the topics associated with road geometry is provided to assist Developers to meet these objectives.

The Contents of this Section are as follows:

The following references shall also be used, except that in all cases, the information contained in the Code takes precedence where there is a variance e.g., carriageway widths, Section 6.3.

Rural Road Design - Guide to the Geometric Design of Rural Roads - AUSTROADS, 1989

Section 302.1, NZS 4404 : 1981, Code of Practice for Urban Land Subdivision

6.4.2 Speed Environment

To produce a safe road design, the various features and elements which control or influence vehicle operation such as horizontal alignment, visibility and terrain need to be related to the vehicle speeds on the road.

Of the four speed related features which need to be considered for a section of road, these being:

- the Desired Speed
- the Speed Environment
- the Design Speed
- the Limiting Curve Speed Standard,

the speed environment needs particular attention.

In an urban environment 50km/hr is normally the maximum speed, in the rural, 100km/hr. A speed environment < 50km/hr may be desirable in residential areas. This may require traffic calming measures, see Section 6.15 of this Code of Practice.

6.4.3 Horizontal Alignment

The horizontal alignment of a road is usually a series of straights (tangents) and circular curves connected by transition curves.

As a vehicle transverses a circular curve, its travel is affected by a force provided by side friction developed between tyre and pavement, and by superelevation. Superelevation on curves is not normally necessary in a 50km/hr zone or less. Where superelevation is required, good design practice suggests that it shall not exceed 10 percent, depending on curve radius and vehicle speeds. These terms are discussed in more detail in the references.

As an initial guide horizontal curves are normally circular with a minimum centreline radius of 15m for Urban Local roads and 45m for Urban Collector, Distributor and Arterial roads. Transitions on horizontal curves in 50km/hr zones need only be provided on request from Council. In the rural area a minimum centreline radius of 45m is appropriate.

6.4.4 Width of Traffic Lanes and Carriageway

This aspect of road geometry is discussed in detail in Section 6.3 of this Code of Practice. Particular attention needs to be paid to the following:

- the carriageway shall have sufficient width to meet the needs of the estimated and potential future vehicle, cycle and pedestrian traffic,
- the need for and location of pedestrian footpaths and cycleways,
- the location of existing and future services, including drainage, overhead and underground utility services, and road furniture including signs and lighting
- the cross-section of the carriageway, including the grading of berms, batter cuts and fills, and roadside drainage,
- the location and geometry of roadside property access (refer Section 6.6 of the Code of Practice)
- the natural landscape and topography, and any future landscape proposals

6.4.5 Sight Distance

A principal goal of road design is to ensure that the driver is able to perceive any possible road hazards in sufficient time to take action to avoid an accident. To provide a calculable parameter which can be related to the geometry of the road, the concept of Sight Distance is used.

Chapter 6 of *Rural Road Design, Guide to the Geometric Design of Rural Roads, AUSTROADS, 1989* provides standards in relation to sight distance design on rural roads. *Table 1, Guidelines for Visibility of Driveways, RTS6, Land Transport Safety Authority, Revision 1, October 1993* for both the rural and the urban (50km/hr) environment also applies.

Note that the Gisborne District Combined Regional Land and District Plan has specific requirements for the establishment and maintenance of sight lines.

6.4.6 Vertical Curves

Vertical curves are introduced on vertical alignments to connect two grades so that the change in grade takes place at a uniform rate. The length of the curve depends on

- the speed environment of the road;
- the algebraic difference of grades;

- safe stopping sight distances
- safe passing sight distances
- whether the curve is a sag or crest;
- and if a sag curve whether the road has lighting or not

Guidelines for obtaining design lengths of curves are available in the references.

6.4.7 Grades

It is seldom practical to construct roads with grades sufficiently flat to permit all vehicles to operate at the same speed. Therefore it is necessary to adopt a standard, in which limits are placed on steepness and length of grade. Minimum grades are also required to ensure adequate drainage.

As a guideline, the minimum longitudinal gradient on urban roads is 0.5 percent. The maximum gradient on urban roads is 10 percent on Local Roads, and 8 percent for Collector, Distributor and Arterial Roads. On rural roads, grades as steep as 15 percent can be used on low volume roads, although a 10 percent maximum grade is desirable.

6.4.8 Crossfall

Crossfall is the slope of the surface of a carriageway measured normal to the centreline. The purpose of crossfall is to drain the carriageway on straights and curves and to provide superelevation on horizontal curves.

As a guide, normal crossfall is 3 percent. Where it is not practicable to apply 3 percent crossfall, variation between 2 percent and 4 percent is permitted, although the reasons for the variation will need to be outlined in the design report.

6.4.9 Kerbs

Kerbs for drainage purposes are usually provided in urban areas, or in rural areas with difficult topography, refer Sections 6.3 and 6.9 of the Code of Practice. Note: Refer to Chapter 15 of the Gisborne District Combined Regional Land and District Plan.

6.4.10 Vehicle Turning Circles

Provision shall always be made for vehicles turning circles in the road design. On local roads access for emergency and commercial vehicles, e.g., refuse truck,

and in particular fire service vehicles shall always be maintained. A number of references or Computer Software Packages for determination of turning circle geometry are available. One such reference is the *On-Road Tracking Curves published April 1995, Land Transport Safety Authority*. On-Road tracking curves for cul de sacs shall at least accommodate an 8m Rigid Truck in residential areas and an 11m Rigid Truck elsewhere.

6.4.11 Suggested Design Procedure for Roads, including Geometric Design

A suggested design procedure involves a three stage process. These stages are outlined below. These outlines should be used as a guide only and not limit the design input for a particular or project.

Stage 1
Several alternative designs shall be prepared.
The following site conditions shall be taken into account.

- Site topography and geological/soil conditions.
- Physical features and items of historical and cultural significance.
- Alignment of intersecting roads.
- Possible future alterations and additions to the existing road facilities.
- Sight distance requirements.
- Overhead and underground utility services, both existing and proposed.
- Location, nature and condition of existing drainage systems.
- Property boundaries.
- Present and future land usage.
- Access provisions.
- Existing pavement condition, if any.
- Safety requirements.
- Special requirements of Council

Stage 2
Using information from Stage 1 as a guide the most suitable design alternatives shall be examined critically with regard to the following criteria:

- Adaptability.
- Attainability.
- Desirable design standards as opposed to minimum standard.
- Operational effectiveness.
- Safety.
- Driver comfort.
- Accessibility for the disabled.
- Management of traffic during construction.

- Stage development.
- Economic factors.
- Future development.

Particular attention shall be given to the following aspects on Arterial and collector routes

- Adequate capacity, i.e., levels of service.
- Minimal delays.
- Priority to commercial traffic movements where these are significant.

Reference in this case should be made to *Guide to Traffic Engineering Practice, Roadway Capacity, Part 2, NAASRA, 1988.*

Specific urban local road objectives may include:

- Restricting the entry of large vehicles.
- Discouraging the entry of through traffic.
- Controlling vehicle speeds.
- Providing greater emphasis to pedestrians and cyclists.

Stage 3
Following the completion of **Stage 1** and **2** above the most advantageous design should then be chosen.
Particular attention can then be given to features such as:

- Road Layout Plans, Long sections, and Cross-sections.
- Kerb types.
- Traffic control devices.
- Location of footpaths and other pedestrian provisions.
- Treatment of median and traffic island surfaces.
- Landscaping.
- Relocation of utilities.
- Location of stormwater facilities such as sumps and manholes.

6.5Intersection Design

6.5.1 Introduction

This section of the Code of Practice will outline the design procedures most suitable for the design of intersections in the District, including priority controls, roundabouts and traffic signals.

The Contents are as follows:

In any Intersection design it is important that:

- An appropriate intersection design is achieved which is compatible with the Roading Hierarchy.
- The number of points of conflict are minimised by using methods such as channelisation.
- Design preference is given to major movements.
- Speed is controlled through alignment and traffic control.
- Traffic paths are clearly defined.

Fundamentally there should be little difference in the design method adopted for rural and urban intersections. However, the design should reflect the fact that the characteristics of traffic in a rural area are different from those of urban traffic, particularly in relation to speed and traffic mix.

6.5.2 Data Collection

If an intersection is to be designed successfully it is important to have accurate information on the traffic mix that will be using it.

The following traffic data is normally required:

- Traffic volumes including turning volumes. Hourly flow for a period 7am to 7pm should be recorded. In rural areas an Annual Average Daily Traffic (AADT) value may be adequate for design purposes. Estimates of future growth shall be included.
- Traffic delay and queuing data.

- Vehicle mix. Cars and commercial vehicles shall be recorded separately. The need to accommodate larger vehicles such as semi-trailers will influence the design.

- Vehicle operating speeds.

- Intersection sight distances.

- Pedestrian and cycle movements. Special provisions may be required for disabled persons.

- Public transport requirements such as location of bus stops, movements through intersections and frequency of services need to be considered.

- Accident history over the last 5 years. Council should be consulted with respect to obtaining this data.

- Parking requirements.

The *AUSTROADS Guide to Traffic Engineering Practice, Part 5, Intersections at Grade, 1988,* will be of assistance when completing the above.

6.5.3 Intersections at Grade

Intersections at grade in both the urban and rural environment include tee and cross-road intersections.

The references *Guide to Traffic Engineering Practice, Part 5, Intersections at Grade, 1988, and Guidelines for the Implementation of Traffic Control at Crossroads, RTS1, Land Transport Safety Authority, 1990* provides effective guidelines to be used in conjunction with this Code of Practice. Particular attention shall be made of the following:

- The type of priority control needs careful consideration.

- The vehicle turning-path design shall be specific to each intersection. As a guide the minimum vehicle configuration to be catered for in most intersection design is a standard B-train, or 19m semi-trailer on main roads or industrial subdivisions.

- Through-lane widths at intersections may vary. The actual value will depend on the hierarchy of the intersecting roads. This will require specific design.

- Council has developed a preferred splitter island detail, as shown on the Drawings attached. Island alignment subject to specific design.

- Lighting, Signage and Roadmarking at intersections are discussed in Sections 6.11, 6.12 and 6.13 of this document.

- Flush medians can be used on main roads in particular. Refer to *Guidelines for Flush Medians, RTS4, Land Transport Safety Authority, 1991* and *Manual of Traffic Signs and Roadmarkings.*

6.5.4 Roundabouts

The reference *Guide to Traffic Engineering Practice, Part 6, Roundabouts, AUSTROADS 1993* is to be used in conjunction with this Code of Practice. Particular attention shall be paid to the following:

- Each roundabout shall be specifically designed for its locality and purpose. As a guide the minimum vehicle configuration to be catered for in most roundabout design is a standard B-train, or 19m semi-trailer on main roads or industrial subdivisions.

- Roundabouts within the Central Business District (CBD) shall be built to accommodate at least a 11.0 metre Rigid Truck.

- Mountable lips are appropriate for roundabouts in urban areas in particular. Council has an preferred roundabout detail which is shown in the Drawings.

6.5.5 Traffic Signals

The reference *Guide to Traffic Engineering Practice, Part 7, Traffic Signals, AUSTROADS, 1993,* provides details on the design of signalised intersections.

6.6 Vehicle Crossings

6.6.1 Introduction

This section of the Code of Practice provides the Engineering Standards for vehicle crossings.

The Contents are as follows:

A vehicle crossing is defined for the purpose of this Code as the facility that allows safe passage from the edge of the sealed or unsealed roadway to the legal boundary of the lot adjacent to the road, for vehicles, pedestrians, and bicycles. Vehicle crossings are required at the entrance to all lots requiring access from the road. Lots requiring vehicle crossings include front lots, private ways, service lanes, access lots, industrial and commercial access, and other frequently used entrances. In general:

- For each lot the location of the crossing shall be determined by taking into account the contour of the land where this is significant

- Vehicle crossing locations shall be confirmed with Council prior to construction.

- All vehicle crossings shall be constructed at the expense of the Developer.

6.6.2 Design Requirements for Urban Vehicle Crossings

A vehicle crossing shall be provided between the kerbline, or the edge of the road carriageway if there is no kerb, and the property boundary. The following design and construction details shall be taken into account.

- The visibility requirements for urban vehicle crossings shall be in accordance with Table 1 in *Guidelines for Visibility at Driveways, RTS6, Land Transport Safety Authority, Revision 1, October 1993.*

- Where concrete kerb and channelling exists, or in new developments, concrete vehicle crossings shall be provided for private residential properties. Vehicle crossings shall be built with dimensions as shown on Drawing 6-4; and

shall have a minimum 28 day compressive strength of 20 MPa when tested according to *NZS 3112: Part 2*, constructed on a compacted basecourse conforming to the current *TNZ M/4 Specification* with a minimum depth of 50mm.

- Where crossings for private residential properties are Asphaltic Concrete or Bituminous Seal. They shall be constructed on a compacted basecourse conforming to the current *TNZ M/4 Specification* with a minimum depth of 150mm.

- Crossings for private residential properties utilising concrete block pavers shall conform to *NZS 3116 : 1991, Interlocking Concrete Block Paving.* Rectangular pavers (80mm) in a herringbone pattern founded on 20mm sand and a minimum 100mm of M/4 basecourse is acceptable although other patterns may be appropriate provided they are designed in accordance with the standard and certified by the designer. Specific foundation design shall be undertaken in areas of weak subgrade : CBR <3.

- No part of any crossing shall encroach any closer than 15m from the tangent of any side road (refer Drawing 6-9), or, no closer than 30m from commercial or industrial activities on arterial or principal roads.

- Crossings expected to carry industrial or commercial traffic may need to be specifically designed to accommodate the additional loading and usage. Some of the dimensions shown in the Drawings may need to be increased to accommodate the particular requirements of the vehicles entering the development, such as turning requirements. This can be assessed on completion of the "Application to Undertake Work on Legal Road" form available from Gisborne District Council offices.

- Crossings within the State Highway road reserve will require specific approval from Transit New Zealand.

6.6.3 Design Requirements for Pram and Wheelchair Crossings

Pram and wheelchair crossings are required at pedestrian crossings, accessways, and where footpaths cross a kerbline at road intersections.

- Crossings shall be sited to facilitate normal pedestrian movements in the road and where possible sumps shall be sited to reduce the flow of stormwater in the channel at the crossing point.

- Crossings shall be constructed to the standards contained in *NZS 4121 Part 2 :1985, Code of Practice for Design for Access and Use of Buildings and Facilities for Disabled Persons.* Refer to Drawing 6-3.

6.6.4 Design Requirements for Rural Vehicle-Crossings

Rural vehicle crossings generally exist in a higher speed environment, and often have more complex topography to accommodate. The Design of the vehicle crossing shall,

- protect the traffic on the existing road,
- protect the users of the accessway,
- prevent detritus material encroaching onto the road and
- A sealed vehicle crossing provides protection to the existing carraigeway, and prevents vehicles from eroding the edge of the existing road seal. Where the existing pavement is sealed the crossing shall also be sealed. See Drawing 6-10.

Note: Transit New Zealand retains control of the design and construction standards of crossings adjoining State Highways.

The Hierarchy of roads (Section 6.2 of this Code of Practice) and the associated carriageway dimensions (Section 6.3) ensure that minimum acceptable lane widths and shoulder treatments exist for the level of service that each road must provide. In order to simplify the requirements for vehicle access onto different rural roads within the established hierarchy, it has been necessary to define two levels of use. These are:

TYPE A **Vehicle Crossings for Single Rural Residential or Multiple Rural Residential Access, /Farming Activities or Forest Plantation Access**

Traffic using such a crossing is intended to service the property only. Drawing 6-10 sets minimum standards for Type A crossings.

TYPE B **Industrial Crossings / Commercial**

For the purposes of this Code of Practice, industrial / commercial use in the rural environment is defined as any operation involving sale of produce, packing or storage, on-site processing, on-site cool storage, etc. Drawing 6-11 sets minimum standards for Type B crossings.

Note: Type A and B Vehicle Crossings are minimum standards. However, Council reserves the right to require a higher standard of design / construction where the anticipated types of vehicles using the crossing and / or the frequency of use of the crossing, may render Type A or Type B crossings inadequate to

address the safety of people or property (including other traffic). Each situation will have to be assessed on application to Gisborne District Council for permission to undertake work within the legal road (Application forms are available from Gisborne District Council).

In these cases all vehicle crossings shall be specifically designed by an experienced professional and documented. Reference can be made to the *Guidelines for Visibility of Driveways, RTS6, Land Transport Safety Authority, 1993, including Revision 1, October 1993,* and to *Sections 6.4 and 6.5 of this Code of Practice.*

Particular attention in the design needs to be paid to the following features of the crossing:

- vehicle turning paths. Council will not allow vehicle manoeuvring on the road other than normal turning movements.
- sight distances.
- shoulder widths where either roadside parking or slip lanes and tapers are required to prevent interruption to traffic flow on the road.
- roadmarking
- drainage
- surfacing
- construction standards

RTS6, Figures 3 and 4, are useful guides to the design of commercial vehicle crossings. Alternative design options including the use of flush medians should also be considered.

The following general design considerations shall apply to all rural vehicle crossings.

Geometry

- Crossings must be constructed at right angles to the road. Where an accessway then turns, a minimum 8m long straight must be provided from the edge of the carriageway to the gate or boundary.
- The gradient of entrances shall not be steeper than +5% or -5% over the distance from the carriageway to the boundary and shall have adequate crossfall to prevent water flowing onto the rural road.

- Crossings expected to carry industrial or commercial traffic shall be specifically designed to accommodate the additional loading and usage. If necessary, the crossing width shall be greater than the standard dimensions.

Visibility

- Sight distance requirements for a range of speed environments are detailed in Table 1 *Guidelines for Visibility of Driveways, RTS6, Land Transport Safety Authority, Revision 1, October 1993.* Existing cuttings and batters may require cutting back both within the road reserve and on private property in order to meet sight distance requirements.

Pavement Design

- For commercial design the formation shall be constructed to the requirements set out in Section 6.7 of this Code of Practice.

Surfacing

- If the rural road adjoining the entranceway is sealed then the crossing shall be sealed with a two coat seal or approved alternative on a compacted basecourse designed in accordance with Section 6.7 of this Code of Practice.

Stormwater Control

- Where the vehicle crossing crosses a designated side drain a culvert shall be specifically designed. Consultation with the Council will be required for culverts crossings drains under their control, and a Resource Consent obtained prior to installation. Gisborne District Council staff should be consulted to determine whether a designated water channel is affected.

- All vehicle crossings shall be formed and maintained so that stormwater is controlled, and material such as mud, stone, chip and gravel is not carried out onto a public road or path.

- Where the vehicle crossing only affects a surface water channel, stormwater shall be piped and headwalled as detailed on the Drawings. In low flow situations a headwall option or alternatively a longer pipe (>1.0m beyond the toe of the 1.5H:IV batter) may be used.

- For pipe culverts reinforced concrete class X pipes are generally used or an approved equivalent.

- Minimum cover to the pipe shall be 150mm, in rural residential vehicle crossings. Cover to pipes under commercial crossings requires specific design.

- Stormwater pipes shall be designed and constructed in accordance with Section 3 of this Code of Practice.

6.6.5 Private Access

The Gisborne District Combined Regional Land and District Plan requires that each new lot within a Subdivision or Land Development provide safe access for vehicles and where necessary, pedestrians and bicycles, to a public road. Requirements for accessways are specified in Chapter 15 of the Gisborne District Combined Regional Land and District Plan.
Note: When designing an accessway on private land special consideration should be given to ensure that the accessway is constructed and maintained to ensure vehicle access is suitable for the site's intended use, and is adequate for use access by emergency service vehicles.

6.7 Pavement Design

6.7.1 Introduction

This section of the Code of Practice provides the Engineering Standards for road pavement design.

The Contents are as follows:

The key features of pavement design in the District are:

- Pavements are to be designed as thin surface flexible structures constructed from unbound granular material and/or incorporating stabilised material where suitable, sealed with chip seal or asphaltic concrete. See Drawing 6-12.

- The minimum pavement design life is 25 years.

- Asphaltic concrete should be considered as a surfacing in high stress areas such as roundabouts or cul de sacs, and where traffic noise needs to be mitigated, particularly in residential areas.

The Gisborne District Council uses pavement design guidelines prepared by and/or adopted by Transit New Zealand. These are:

AUSTROADS Pavement Design Manual, 1994, together with the Transit New Zealand 'Supplement' date of July 1997

6.7.2 Pavement Design Procedure

The design of a road pavement shall involve the following steps:

Step 1 : Assessment of Local Conditions

This should include:

- Local geology, soil and climate
- Drainage conditions
- Topography and the local environment
- Social considerations, e.g. traffic noise.

Step 2 : Subgrade Evaluation

- The principal subgrade strength measurement for flexible pavement design is the California Bearing Ratio (CBR).

- Subgrade CBR can be determined using the laboratory testing methods described in *NZS 4407 Methods of Sampling and Testing Road Aggregates Test 3.1.5,* or in situ testing using devices such as a Scala penetrometer, (figure 5.2 in *AUSTROADS*) The in situ tests should be used to give an indication of subgrade strength and variability over the site. The design CBR should be the 10th percentile value of CBR tested.

- Subgrade strength is highly dependent on the moisture condition of the soil. Where drainage is not feasible, design should be based on soaked CBR from laboratory tests.

- The use of lime or cement stabilisation methods to increase subgrade strength should be considered when the subgrade CBR is less than 10.

- Consideration should be given to the effect in-service conditions such as drainage improvement will have on subgrade CBR.

Step 3 : Pavement Layer Thickness Design

- Once determined, the typical CBR value or values for the subgrade can be used directly in the pavement design. In simple cases Figure 8.4 in *AUSTROADS* can be used.

Step 4 : Materials Selection

The following material types should be considered.

- Unbound sub base. Materials such as river gravels and quarry metals can be considered. Care needs to be taken in the specification and use of such materials. Reference should be made to *TNZ M/3 Specification, Notes for Sub base 1983*.

- Modified sub base. Lime or cement stabilised material including sub base material can significantly improve pavement performance. If an increase in CBR of less than three-fold is achieved it is said to be "modified". Pavements using such material should be designed as unbound pavements.

- Cemented sub base. Lime or cement stabilised material that exhibits an increase in CBR of three-fold or greater are said to be "cemented". Mechanistic design by an experienced professional will be required in this case.

- Other materials such as geofabric or geogrid may be considered. Specific design will be required in all cases.

- Basecourse materials. Basecourse meeting the *TNZ M/4, 1996 specification* will be used. Alternatively the Draft M/22 Specification can be used to assess alternative materials.

Step 5 : Comparison of Designs

It is often an advantage to compare various pavement designs with respect to the following, to ensure that the best design option is being presented:

- construction costs
- construction under traffic
- available equipment especially material mixing, placing and compaction plant
- maintenance and rehabilitation costs
- salvage value of the pavements at the end of the design life.

6.7.3 Design Traffic Loading

Pavement design requires the calculation of the design traffic loading for the 25 year minimum design life. The following guidelines are provided as a simplification to the process given in *AUSTROADS* as being appropriate for Local Road conditions. Any subdivision involving Arterial and Collector roads will require the more rigorous approach given in *AUSTROADS.*

- Design traffic loading is measured in terms of Equivalent Standard Axles (ESA).

- The data required in order to calculate the design traffic loading is:
  a. Annual Average Daily Traffic (AADT).
  b. Percentage of AADT that are Heavy Commercial Vehicles (HCVs).
  c. Average ESA/HCV. This is normally gathered from a Commodity Survey. The reference *The Guide to Traffic Engineering Practice Part 3, Traffic Studies, NAASRA, 1988* provides guidance on how to conduct traffic and commodity surveys. In the absence of a commodity survey a minimum ESA/HCV of 1.5 shall be used for Local Roads.

From this data the ESA/year for the first year of the pavement design life can be calculated.

- Design Traffic Loading
  To calculate the design traffic load over the design life of the pavement the following formula should be used:

$$T = \frac{P((1+r)^n - 1)}{\log_e(1+r)}$$

T=Total Traffic (ESA)
P=First year traffic (ESA/year)
n=Design life (years)
r=Growth rate (e.g. 1% per annum = 0.01)

The growth rate r required above for Arterial and Collector roads should be selected from the *Transit New Zealand, Project Evaluation Manual, or may be obtained from Council.* For Local Roads a minimum growth factor of 1% shall be used. For cul-de-sacs a minimum growth factor of 0.5% shall be used.

6.7.4 Seal Widening

- In situations where seal widening is required the extended pavement shall be designed as a new pavement.

6.8 Road Surfacing

6.8.1 Introduction

This section of the Code of Practice provides the Engineering Standards for the surfacing for roads in the Gisborne District.

The Contents are as follows:

All surfacing treatments are considered to be thin surfaces and their purpose is to provide protection for the underlying pavement. The surfacing is required as both a waterproof layer and a wearing surface.

Usually five different surfacing treatments are considered. They are;

1. Chip Seal
2. Asphaltic Concrete Paving (AC)/Friction Course (FC)
3. Slurry Seal
4. Interlocking Concrete Block Pavers
5. Unsealed.

6.8.2 Choosing the Appropriate Surface

The following factors should be considered when choosing the appropriate surfacing treatment:

- Urban residential areas should be designed for a pleasant appearance and low road noise.

- Traffic routes with a high percentage of heavy commercial vehicles are subject to high wear and often high turning stresses. The surfacing used such as AC or two coat chip seal should be designed to accommodate this.

- The surfacing in Retail areas should be designed for appearance as well as resistance to wear from high turning stresses, particularly power steering.

- The type of surface used must contribute to the safety of the road. For example, skid resistance is important in areas such as high speed corners. If the carriageway does not drain quickly then vehicles may experience aquaplaning on smooth surfaces, such as AC.

- Intersections, Cul de Sac heads and industrial pavements are subjected to stress from turning traffic. This especially applies to roundabouts and on heavy traffic routes. It is important that intersections experiencing high stress are sealed with a hard-wearing surface such as AC. A minimum AC thickness of 25mm of Mix 10 is recommended.

- Signalised intersections require sealing with 50mm of AC to allow the use of inductance loop traffic detectors.

- The type of surfacing used should be related to the traffic volume and the road hierarchy.

- The construction of unsealed roads require the specific approval of Council. The construction of new roads with an unsealed surface may be approved where the road is:
  - a local road (as classified by the roading hierarchy); and
  - is located in a rural area; and
  - the anticipated use of the road is less than 50 vehicles per day; and
  - there are no existing or proposed residential properties or horticulture that will be adversley effected by dust from the road.

6.8.3 The Design of Chip Seal

Chip sealing is the most common surface treatment used in both rural and urban areas. It usually involves a first coat seal, followed by a second coat seal.

First coat seal

First coat sealing shall be designed to TNZ specifications *M/1(Specification for Asphaltic Bitumen)* and *P/3 (Specification for First Coat Sealing)*. The sealing chips shall comply with TNZ specification *M/6 (Specification for Sealing Chip).*

Chip size for single first coat seals on rural Local roads should be at least Grade 4.

On Collector routes and industrial roads and in urban Local Roads, recent practice has shown that a two coat seal or a racked-in seal provides a more robust waterproofing of the pavement structure during its early life. The chip size for two coat seals is usually Grade 3 and Grade 5.

6.8.4 The Design of Asphaltic Concrete Paving

Asphaltic concrete pavements are generally more resilient than chip seal in high stress areas. They keep the amount of road noise to a minimum and have a more favourable appearance than chip seal.
AC paving is not considered to be a waterproof layer in itself, therefore a first coat seal shall be constructed before the asphaltic concrete is laid. The minimum first coat seal required to provide adequate waterproofing is a Grade 6 single coat seal, either with emulsion or hot bitumen.

Asphaltic concrete surfacing shall be designed in accordance with TNZ specifications *M/10 (Specification for Asphaltic Concrete)* and *P/9 (Specification for Construction of Asphaltic Concrete Paving)*.

The Developer shall provide Council with a certified "Job Mix Formula", in accordance with TNZ specification M/10 as part of the Construction Certification.

As an alternative to AC a friction course (FC) can be used. The design shall be carried out as detailed in TNZ specification *P/11 (Specification for Friction Course Materials)*.

As above a certified "Job Mix Formula", in accordance with TNZ specification P/11, shall be provided as part of the Construction Certification.

6.8.5 The Design of Slurry Seal

Generally a slurry seal will only be used as a second coat seal which may not be the developers responsibility. Design and construction of slurry seal shall be to *International Slurry Sealing Association (ISSA)* standards.

6.8.6 The Design of Interlocking Concrete Block Pavers

The use of concrete block pavers as a surfacing treatment on roads can be considered particularly in LATM threshold treatments, refer Section 6.15. Design of such surfaces shall comply with *NZS 3116:1991, Interlocking Concrete Block Paving*. Standard practice in traffic lanes is to use 80mm rectangular concrete pavers set out in a herringbone pattern.

Cement and Concrete Association of New Zealand:1988, Interlocking Concrete Block Road Pavements provides a guideline for the construction of paved roads.

As an alternative to Concrete Pavers, Clay Pavers may be used provided that appropriate design certification is provided.

6.8.7 The Design of Unsealed Road Surfaces

- The construction of unsealed, local, roads in rural areas may be appropriate where vehicle movements are anticipated to be less than 50 vehicles per day and there are no existing or proposed residential properties or horticulture that will be adversley effected by dust from the road.

AUSTROADS Pavement Design (1992) shall be used to provide to design and construction standards for unsealed roads.

6.9 Road Drainage

6.9.1 Introduction

This section of the Code of Practice provides the Engineering Standards associated with the design and construction of road carriageway drainage.

The Contents are as follows:

6.9.1 Introduction

6.9.2 Kerb and Channel

6.9.3 Sumps and Manholes

6.9.4 Dished Channels/Slotted Drains

6.9.5 Subsoil Drainage

6.9.6 Culverts and Bridges

The type of drainage system used will depend on factors such as the nature of the country, topography, alignment, the road hierarchy and whether the road is urban or rural.

The elements detailed in this section will need to be considered for both rural and urban situations. Consideration will also need to be given to stormwater disposal where reticulation is available, refer Section 3 of this Code of Practice.

In general carriageway drainage on urban roads uses kerb and channel although dish channels, slotted drains, subsoil drains, open drains or culverts can be considered. Stormwater will normally be connected to a sump which in turn is connected by a lead to a manhole on the main stormwater system.

On rural roads the provision of a surface water channel a minimum of 0.5m below the adjacent road surface is appropriate on a majority of rural roads where 5:1 verge slopes can be readily constructed. In situations where open drains are inadequate additional stormwater systems such as kerb and channel, sealed, paved or concrete channels and subsoil drains will be necessary. See Drawing 6-6.

Note: Refer also to the Gisborne District Combined Regional Land and District Plan and the Proposed Regional Plan for Discharges to Land and Water, Waste Management and Hazardous Substances; and the Gisborne District Combined Regional Land and District Plan.

6.9.2 Kerb and Channel

Kerb and channel is generally required on all urban roads and on rural roads where open drainage is impractical. Council uses the kerb and channel style shown on Drawing 6-7 and in Section 3 of the Code.
Note: Chapter 15 of the Gisborne District Combined Regional Land and District Plan also identifies situations where kerb and channelling may be required.

The following general standards shall be applied to kerbs and channel:

- The desirable minimum fall on channels is 1 in 400, with the absolute minimum fall being 1 in 500.
- A kerb and channel shall be concrete with a minimum strength of 20MPa at 28 days complying with *NZS 3109:1987, Specification for Concrete Construction*.

- All kerb and channel shall be placed on a foundation of not less than 150mm of compacted basecourse meeting the current *TNZ M/4 1996 Specification*. Specific foundation design is required where soft conditions (CBR < 3%) are encountered.

- New concrete shall be protected by covering with damp hessian or other approved material for a period of not less than 48 hours. When extreme conditions exist such as high temperatures the curing period will need to be extended.

- The use of mountable or non-mountable kerb is influenced by the roads intended function and position within the hierarchy. Mountable kerb is generally used when it is desirable for vehicles to park on the berm in a Local road.

- Stormwater connection is required between the kerb and the boundary where runoff from adjacent properties is to be directed into the roadside channel. This is usually provided by including a PVC adapter in the kerb and connecting this to the property boundary via. 100mm, PVC pipework laid in the footpath.

6.9.3 Sumps and Manholes

Stormwater within the kerb and channel will be collected by sumps, refer Section 3 of the Code of Practice.

- The spacing and location of stormwater sumps is discussed in detail in Section 3 of this Code of Practice.

- Sumps are normally connected to a manhole on the stormwater drainage system by sump leads, except that if the trunk stormwater drain is of a greater diameter than 600mm and a manhole is not conveniently located, the sump lead may be saddled directly into that drain, soffit to soffit. A manhole must be located within 40m of the sump lead connection, refer Section 3.3.10.

6.9.4 Dished Channels/Slotted Drains

Drainage in some carriageway areas, service lanes, parking bays and pedestrian accessways can require the use of dished channel drains rather than kerb and channel. The dish channel should be connected to a standard backsump, or alternatively a yard sump, this will require specific design.

6.9.5 Subsoil drainage

Subsoil drainage is required if:

- a permanent wet spot in the subsoil exists.

- the control of the groundwater level is necessary.

- the subgrade is not free-draining.

There are a range of subsoil drainage products on the market. In each case a specific design will be required, but for guidance use *Transit New Zealand Specification F/2.* See Drawing 6-13.

6.9.6 Culverts & Bridges

A culvert is defined by Transit New Zealand as one or more adjacent pipes or enclosed channels running across and below road formation level having a cross-sectional area of less than 3.4 square metres. Culverts of cross-sectional

area greater, than or equal to 3.4 square metres are defined as bridges and specific design by an experienced professional is required.

Note: Refer also to Chapter 5 and Chapter 7 of the Gisborne District Combined Regional Land and District Plan.

The following general standards shall be applied:

- Culverts should be installed to ensure longitudinal scouring of the water tables does not occur.

- Culverts controlling stormwater flow across the road are generally spaced no greater than 100 metres apart.

- Spacing is dependant on several factors including area rainfall intensity, slope, soil type and the existing natural watercourses, refer Section 3 of this Code of Practice.

- Minimum culvert sizes are 375mm for culverts passing under the road and 300mm for culverts at vehicle crossings. Council prefers culverts to be precast concrete to NZS 3107, and to a class as recommended by the Manufacturers.

- Stormwater runoff from a catchment or watershed, above a culvert or bridge, should be calculated in accordance with the Rational Method or Modified Rational Method. These methods are described in the *New Zealand Building Code, Approved Document E1 - Surface Water*. Alternative methods will be accepted subject to appropriate certification and approval by Council. Reference should also be made to the guidelines in *Waterway Design : A Guide to the Hydraulic Design of Bridges, Culverts and floodways, AUSTROADS, 1994* and Manufacturers recommendations.

- Design of appropriate inlet/outlet structures for larger structures should be undertaken by an experienced professional.

- No culverts are to be constructed in such a manner as to concentrate runoff into a neighbouring property without the consent of the owner of that property.

- Stormwater should, where possible, be directed onto stable virgin ground and energy dissipation by rock rip-rap or equivalent shall be provided in erosion prone areas. Where outlets are required on fillings or on unstable ground, fluming will be required.

- Bridge design and construction may incorporate precast or pre/post-stressed concrete steel or timber construction. Design features will include waterway area, bridge length, abutment design, foundation design and erosion

protection. In all cases the design shall be undertaken by an experienced professional. Reference should also be made to the *Bridge Manual, Transit New Zealand, May 1994* and subsequent amendments.

- The Developer must determine whether a Building Consent is required for any/all structures.

6.10 Footpaths

6.10.1 Introduction

This section of the Code of Practice provides standards for the geometric design and construction of footpaths.

The Contents are as follows:

6.10.1 Introduction

6.10.2 Geometric Considerations for footpaths

6.10.3 Construction of footpaths

Footpaths are required on most urban roads. In rural areas footpaths may be required for safety reasons. A footpath on either side of the carriageway in urban areas is desirable. In areas where topography makes it impractical or where the road width is insufficient (see Table in Section 6.3) one footpath will be sufficient.

The typical surfacing materials for footpaths are concrete, asphaltic concrete, and interlocking concrete blocks. Alternative surfacing materials will be considered provided specific design details are provided with the Consent Application.

6.10.2 Geometric Considerations for Footpaths

The minimum acceptable width of the footpath is 1.2m where the path is separated from the kerb, or 1.5m from kerb face to the edge of the path where the footpath is adjacent to the kerb. Footpaths in commercial areas shall be the full width of the berm.

The longitudinal grade of the footpath should follow that of the carriageway. Where a grade of steeper than 12.5 percent is applied a special surface treatment will be required. On steep grades consideration shall be given to the use of steps and handrails. Specific attention needs to be paid to disabled persons access. In this and other regards footpaths shall be designed in accordance with the following references, *NZS 4121 Part 2: 1985, Code of*

Practice for Design for Access and Use of Buildings and Facilities by Disabled Persons, and Guide to Traffic Engineering Practice, Part 12, Pedestrians, AUSTROADS, 1993.

Crossfall should be placed on the footpath surface towards the road sufficient to facilitate stormwater runoff to the street channel, while still preserving walking comfort. A crossfall of 2 percent is recommended.

Where due to the contour of the finished ground surface it is necessary to situate the footpath below the level of the road drainage in the form of a dished channel or alternative shall be provided. Refer Section 3 Stormwater.

6.10.3 Construction of Footpaths

The following guidelines are provided for reference. Specific design will be required in each case.

Concrete Footpaths

- Concrete footpaths shall be constructed of concrete to *NZS 3109: 1987, Specification for Concrete Construction* with a minimum 28 day strength of 20 MPa. The minimum depth shall be 75mm concrete on a minimum depth of 75mm compacted basecourse material. In areas where vehicle traffic is expected to park on or cross the footpath the minimum concrete 125mm. See Drawing 6-2. Specific foundation design shall be undertaken in areas of weak subgrade : CBR < 3.

Asphaltic Concrete Footpaths

- Asphaltic concrete footpaths shall have a minimum thickness of 25mm asphaltic concrete complying with the *TNZ Specification M/10/P (1992)* laid on a minimum 150mm of compacted basecourse complying with *TNZ Specification M/4, 1996*. Specific foundation design shall be undertaken in areas of weak subgrade : CBR <3.

Interlocking Concrete Blocks

- Interlocking concrete blocks provide an alternative to cast in situ concrete. The blocks are advantageous in areas such as shopping malls as they may be lifted and replaced readily, providing access to underground services.

- Interlocking concrete blocks used as a footpath surface shall comply with *NZS 3116: 1991, Interlocking Concrete Block Paving.* Rectangular pavers in a stretcher bond pattern founded on 20mm sand and a minimum 100mm of basecourse is acceptable although other patterns may be appropriate

provided they are designed in accordance with the standard. See Drawing 6-1. Specific foundation design shall be undertaken in areas of weak subgrade : CBR <3.

- *The Cement and Concrete Association of New Zealand: 1988, Interlocking Concrete Block Road Pavements* document provides a guideline for the construction of paved footpaths.

- Clay paving may be used as an alternative to concrete block paving but will require specific design.

6.11 Roadway Lighting

6.11.1 Introduction

This section of the Code of Practice provides standards for the lighting of urban and rural roads.

The Contents are as follows:

6.11.1 Introduction

6.11.2 Urban Roadway Lighting Design

6.11.3 Rural Roadway Lighting Design

This lighting is provided for traffic safety and public amenity value only. It is not intended that roadway lighting is provided for security purposes, although there will obviously be some mutual benefit.

The reference document AS/*NZS 1158.0 1999 (Parts 0, 1.1 and 1.3)* is the guideline preferred by Council for the design of roadway lighting. As a general philosophy the following aspects need to be considered:

- Lighting should be selected to have a high illuminating efficiency and to provide no more illumination than is necessary for safety. Lighting should be located to minimise light shining upon residential windows, or into the eyes of drivers, pedestrians or cyclists.

- The role of the lighting in relation to the roading hierarchy is a factor in determining the standard of lighting required.

- Lighting design needs to take into account the maintenance requirements of lights when in service. Council will not approve for use on District Roads lighting components which do not have a proven and certified maintenance

performance history, or which are made from inappropriate materials. Particular attention needs to be taken of the sensitivity of lighting components to UV damage.

6.11.2 Urban Roadway Lighting Design

In recent years the Gisborne District Council has invested considerable effort into improving the efficiency and effectiveness of the roadway lighting in the District. Drawing 6-14 shows the typical lighting arrangements which are now used within the District, and which have resulted from the research undertaken by Council. It shall be noted that the standard of lighting provided is linked closely to the road hierarchy, refer Section 6.2 of this Code of Practice. The lighting on urban roads should be designed to provide safety for vehicles, cyclists and pedestrians. Lighting for accessways in public areas will require specific design.

6.11.3 Rural Roadway Lighting Design

Lighting on rural roads is provided for vehicle safety in hazardous areas such as intersections. With new roads intersecting with a Rural Arterial or Collector road, a single Flag Light will not be sufficient lighting at an intersection. In this case one light on the opposite side of the main road, and one on the side road will be required.

6.12 Road and Traffic Signage

6.12.1 Introduction

This section of the Code of Practice provides standards on the construction and location of traffic signs and street names in the urban and rural areas.

The Contents are as follows:

6.12.1 Introduction

6.12.2 Traffic Signs and Street Name Signs

6.12.3 Rapid Numbering

Council has in recent years considerably upgraded the District's sign asset, standardising where possible the location, height, size and material composition of road and traffic signs. Developers will be expected to follow this philosophy.

Council also places great emphasis on the standard of manufacture and maintenance of traffic signs, posts and fittings. The reference, *Standard for the Manufacture and Maintenance of Traffic Signs, Posts and Fittings, Transit New*

Zealand and Road Safety Manufacturers Association , 1995, shall be used in this regard.

6.12.2 Traffic Signs and Street Name Signs

All traffic signs shall be designed and located in accordance with the reference *Manual of Traffic Signs and Markings , Part 1, Traffic Signs, TNZ, 1992*.

6.12.3 Rapid Numbering

Where required, the registration of a rapid numbering system in the rural area shall be undertaken.

6.13 Roadmarking and Delineation Standards

This section of the Code of Practice provides standards on roadmarking for rural and urban roads. The level of roadmarking required by Council is largely dependant on the roading hierarchy, refer to Section 6.2.

All roadmarking and delineation treatments in both urban and rural areas shall be designed with regard to the standards, and Table below.

Manual of Traffic Signs and Roadmarkings, Part 2, Markings : Transit New Zealand, 1994.

Guidelines for Rural Roadmarking and Delineation, RTS 5, LTSA, 1992.

The Table describes the link between roadmarking, delineation standards and the roading hierarchy with the District. The design of roadmarking required for specific intersection treatments such as roundabouts is referred to in the Section 6.5 of this Code of Practice.

The installation of roadmarking and delineation shall be in accordance with the *Specification for Pavement Marking TNZ P/12*, and the *Specification for Roadmarking Paints TNZ M/7.*

The Link Between Minimum Roadmarking and Delineation Standards and the Road Hierarchy

Roading Hierarchy	Minimum Treatment Required				
	Centreline	Edge Lines	R R P M	Edge Marker Posts	Intersection Marking (3)
URBAN					
Local Roads					

Carriageway Width 6m 8m 10m 12m	 No (note 1) Yes Yes Yes	 No No No Yes	 No No No No	 No No No No	 Yes Yes Yes Yes
Principal and Arterial	Yes	Yes	Yes	No	Yes
RURAL					
Local Road 6m	 No	 No	 No	 No	 Yes
Collector (note 4)	Yes	Yes	Yes	Yes	Yes
Arterial (note 4)	Yes	Yes	Yes	Yes	Yes

Note (1) On some narrow carriageways, a centreline will be required, following consultation with Council.

(2) On narrow rural roads (< 7m traffic width) isolated centrelines may be necessary on corners and intersections for safety reasons.

(3) In all cases, standards for Intersection Marking will be checked with Council.

(4) If the carriageway width is ≤ 7m, local road delineation standards apply.

6.14 Parking

6.14.1 Introduction

This section of the Code of Practice provides standards for the design of parking and loading bays in the urban and rural areas.
The rules governing the provision of off road parking that are required by Council in the approval process for subdivision and land development are set out in the Gisborne District Combined Regional Land and District Plan.

6.14.2 Design

The design of on-road parking needs to take into account many factors including the following:

- car park dimensions
- vehicle manoeuvring
- relationship with adjoining traffic lanes
- capacity
- parking control (meters?)
- pedestrian access

The required reference is *Guide to Traffic Engineering, Part II, Parking, NAASRA, 1988*.

Subject to the requirements of the Gisborne District Combined Regional Land and District Plan, the design of off-road parking may also take into account the above factors particularly for large developments.:

Loading Bays

The design for on-road loading bays may need to consider the following:

- Commercial vehicle manoeuvring and the need to ensure that vehicles can safely manoeuvre off –road. This will need careful consideration of entry/exit design and building/pavement geometry (refer section 6.4.10).

- Special pavement and vehicle crossing design.

The rules governing the provision of off road loading bays that are required by Council in the approval process for land development are set out in the Gisborne District Combined Regional Land and District Plan. However, the design for off-road loading bays may also need to consider the above factors.

6.15 Local Area Traffic Management

6.15.1 Introduction

This section of the Code of Practice provides guidelines on the approach to be taken to Local Area Traffic Management in the Gisborne District.

Local Area Traffic Management is concerned with planning the usage of road space within a local residential area to achieve goals, determined by the affected parties, for the improvement of the residential environment. It involves the installation of controls such as speed humps, chicanes, intersection controls and even sometimes complete road closure The object is to provide an environment which;

- provides a high level of safety for all street users including motorists, pedestrians and cyclists.

- provides a reasonable level of convenience to all users.

- makes residential streets pleasant places to live by minimising the impacts of traffic and providing opportunity for landscaping.

- defines clear boundaries between roads within the established hierarchy.

- limits the use of Local Roads as through roads or heavy traffic routes.

6.15.2 Design Guidelines

Council does not have standard LATM drawings except for splitter islands (Drawing 6-8) but will be prepared to discuss options with the Developer so that any works are in keeping with LATM treatments undertaken by Council. Specific design will be required in all cases. The following references are recommended:

Traffic Engineering Practice (4th Ed), KW Ogden and D W Bennett, June 1991

Towards Traffic Calming, A Practitioners Manual of Implemented LATM and Blackspot Devices, Australian federal Office of Road Safety September, 1993

Guide to Traffic Engineering Practice, Part 10, Local Area Traffic Management, NAASRA, 1988

6.16 Guidelines for Standards and Specifications

The following guidelines and standards apply to roading related works, including kerb and channel, footpath, road pavement and surfacing. Reference should also be made to Section 7 of this Code of Practice which provides a general overview of construction specifications.

Construction Specifications must clearly explain, in combination with the related construction drawings, the scope of works. They shall indicate the circumstances and conditions the contractor will encounter during the works, and the standards the work shall comply with. While standard clauses may be used, the whole specification must be prepared and edited for each specific project.

The *New Zealand Standards* and *Transit New Zealand Standards* recommended for use with the roading and traffic engineering aspects of a project are outlined in the relevant sub sections of Section 6 of this Code of Practice. The following list, whilst not exhaustive, summarises the most frequently used references and guidelines.

SCHEDULE OF USEFUL STANDARDS, GUIDELINES AND SPECIFICATIONS

National Policy and Design Documents

These documents are available from:

Customer Services
Standards New Zealand Association
Private Bag 2439
Wellington
Phone: (04) 498 5991

Fax: (04) 498 5994

Bridges and Culverts

- *Bridge Manual*: Transit New Zealand, 1994
- *Waterways Design: A Guide to the Hydraulic Design of Bridges, Culverts and Floodways;* AUSTROADS, 1994
- *New Zealand Building Code, Approved Document E1* – Surface Water

Geometric Design

- *Guide to Traffic Engineering Practice, Roadway Capacity, Part 2,* NAASRA, 1988
- *Guide to Traffic Engineering Practice, Part 13 Pedestrians, Part 14 Bicycles,* AUSTROADS, 1993
- *Rural Road Design - Guide to the Geometric Design of Rural Roads;* AUSTROADS, 1989
- *Guide to Traffic Engineering Practice Part 5: Intersections at Grade;* NAASRA, 1988
- *Guide to Traffic Engineering Practice Part 6: Roundabouts;* AUSTROADS
- *Unsealed Roads Manual: Guidelines to Good Practice;* AARB, 1993

Pavement and Surfacing

- *Bituminous Sealing Manual:* Transit New Zealand, 1993
- *Pavement Design: A Guide to the Structural Design of Road Pavements;* AUSTROADS, 1994 (plus New Zealand supplement of July 1997)
- APRG Report No 21: *A Guide to the Design of New Pavements for Light Traffic;* ARRB Transport Research/AUSTROADS

Safety

- *Policy Guidelines for Traffic Accident Reduction and Prevention;* Transit New Zealand/Ministry of Transport, 1990
- TR 11: *Recommended Practice for Pedestrian Crossings;* National Roads Board, 1988

- *Guidelines for Planting for Road Safety;* Transit New Zealand, 1991

- RTS 17: *Guidelines for Setting Speed Limits;* Land Transport Safety Authority, 1995

Signs and Markings

- *Manual of Traffic Signs and Markings;* Part 1 Traffic Signs; Transit New Zealand/Ministry of Transport, 1992

- *Manual of Traffic Signs and Markings;* Part 2 Markings; Transit New Zealand/Land Transport Safety Authority, 1994

- *Standard for the Manufacture and Maintenance of Traffic Signs, Post and Fittings;* Transit New Zealand/Road Safety Manufacturers' Association, 1995

- RTS 1: *Guidelines for the Implementation of Traffic Control at Crossroads;* Ministry of Transport, 1990

- RTS 2: *Guidelines for the Street Name Signs;* Ministry of Transport, 1990

- RTS 3: *Guidelines for Establishing Rural Selling Places;* Ministry of Transport/Transit New Zealand, 1992

- RTS 4: *Guidelines for Flush Medians;* Ministry of Transport/Transit New Zealand, 1991

- RTS 5: *Guidelines for Rural Roadmarking and Delineation;* Ministry of Transport/Transit New Zealand, 1992

- RTS 6: *Guidelines for Visibility at Driveways;* Ministry of Transport, 1993

- RTS 7: *Advertising Signs and Road Safety: Design and Location Guidelines;* Transit New Zealand/Land Transport Safety Authority, 1993

- RTS 8*: Guidelines for Safe Kerbline Protection;* Transit New Zealand/Land Transport Safety Authority, 1993

- RTS 9:*Guidelines for the Signing and Layout of Slip Lanes;* Transit New Zealand/Land Transport Safety Authority, 1993

Street Lighting and Traffic Signals

- *Code of Practice for Road Lighting;* NZS 6701, 1983

- *Guide to Traffic Engineering Practice, Part7, Traffic Signals,* AUSTROADS, 1993

Construction Specifications

These are available from:

Transit New Zealand
P O Box 5084
Wellington
Phone: (04) 499 6600
Fax: (04) 496 6666

Basecourse

TNZ B/2	Construction of Unbound Granular Pavement Layers

Equipment

TNZ E/4	Certification of Thermoplastic Roadmarking Applicators and Pre- Heating Tanks

Formation

TNZ F/1	Earthworks Construction
TNZ F/2	Pipe Subsoil Drain Construction
TNZ F/3	Pipe Culvert Construction
TNZ F/5	Corrugated Plastic Pipe Subsoil Drain Construction
TNZ F/6	Fabric Wrapped Aggregate Subsoil Drain Construction

General

TNZ G/1	Temporary Traffic Control
TNZ G/1	Addendum No 1: 1996 to the Specification for Temporary Traffic Control
TNZ G/2	Supply of Aggregate by Weight

Material

TNZ M/1	Asphaltic Bitumens
TNZ M/3 Notes	Sub-Base Aggregate
TNZ M/4	Basecourse Aggregate
TNZ M/6	Sealing Chip
TNZ M/7	Roadmarking Paints

TNZ M/10	Asphaltic Concrete
TNZ M/11	Pre-Coating Sealing Chips
TNZ M/12	Raised Pavement Markers
TNZ M/13	Adhesion Agents
TNZ M/14	Edge Marker Posts
TNZ M/15	Lime for use in Soil Stabilisation
TNZ M/16P	W-Section Highway Guardrail
TNZ M/17P	W-Section Bridge Guardrail
TNZ M/18P	Fibreglass Reinforced Plastic Highway Lighting Columns
TNZ M/19	Tubular Steel Lighting Columns
TNZ M/20	Thermoplastic Roadmarking Materials

Paving and Surfacing and Construction

TNZ P/3	First Coat Sealing
TNZ P/4	Resealing
TNZ P/5P	Rubber Latex in Reseal Binders
TNZ P/9	Construction of Asphaltic Concrete Paving
TNZ P/11	Open Graded Porous Asphalt
TNZ P/12	Pavement Marking
TNZ P/14	Installation of Raised Pavement Markers
TNZ P/15P	Fabrication and Assembly of Standard Guardrails and Handrails for Highway Bridges and Bridge Approaches
TNZ P/16	Installation of Edge Marker Posts
TNZ P/17	Performance Based Specification for Bituminous Reseals

Quality Assurance

TNZ QG Notes	Guideline on Roles in Quality Assurance
TNZ Q/1	Chipsealing
TNZ Q/2	Hot Mix Asphalt
TNZ Q/3	Normal QA Level Contracts
TNZ Q/4	High QA Level Contracts

Standards

TNZ S/5P	Concrete Weigh Pit
TNZ S/6	Bridge Inspection Policy

Testing

TNZ T/1	Benkleman Beam Deflection Measurements
TNZ T/3	Measurement of Texture by the Sand Circle Method
TNZ T/4	Description of Test Locations on Highways
TNZ T/5	Size, Shape and Grading of Grades 1-4 Sealing Chips

TNZ T/6	Pore Size Distributions of Filter Fabrics
TNZ T/7	Permeability of Filter Fabrics
TNZ T/8	Roadmarking Print Applicator Testing
TNZ T/10	Skid Resistance Deficiency Investigation and Treatment Selection

6.17 Quality Assurance, Inspection during Construction, as Built Record and Compliance Reporting

To provide Council with the confidence that the roading systems within any subdivision have been constructed to the specified standards, the developer shall ensure that at all times quality assurance records are maintained. At the end of construction these records are to be provided to the Gisborne District Council along with certification from an appropriately qualified professional that all inspections and test results have met the standards specified in the Engineering Code of Practice.

The attached table, and Section 7 of this Code of Practice, lists the quality assurance information, as built records and reporting that Gisborne District Council considers would be the minimum documentation required for submission to the Council for Compliance.

For roading works, in all cases inspections on site shall be carried out by a person with a good knowledge of road design theory and construction practice, who shall have reasonable liaison with the design engineer for being inspected.

The appropriately qualified professional will be required to certify the accuracy of all inspection records and test results that are submitted to Council for Compliance.

Council reserves the right to, and shall be granted access upon 24 hours written notice, to independently inspect the works. Where work or material is found to be unsuitable it shall be removed and replaced to the satisfaction of Council prior to further work being carried out. The cost of the independent inspection shall in this case be charged to the Developer.

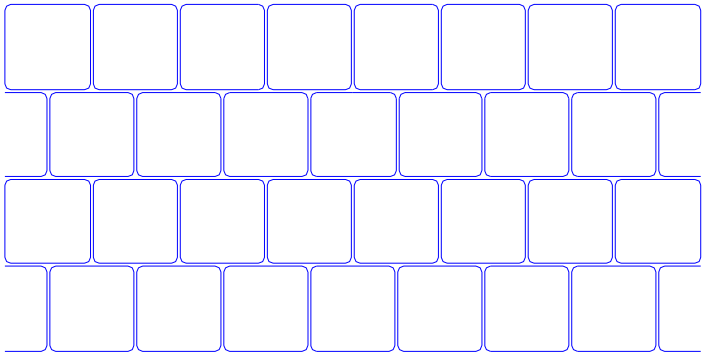
6.18 General Requirements for Private Developer

6.18.1 Resource Consents

- The developer shall be responsible for obtaining regional or district Resource Consents from the Council.

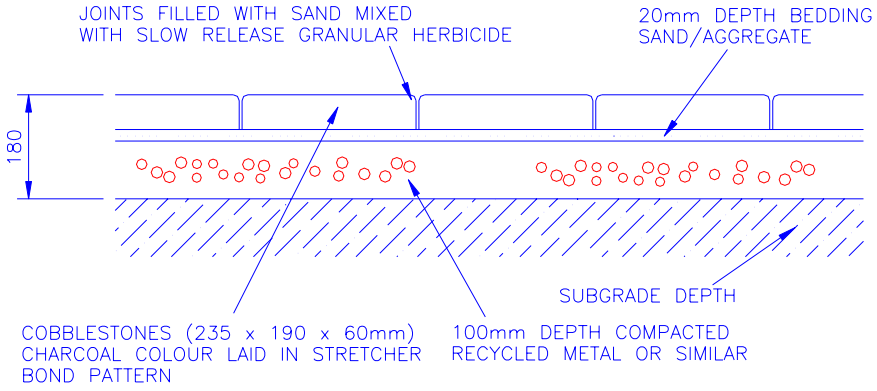
6.18.2 As Built Plans

On completion of the works, as-built plans must be provided, in accordance with the standards set out in Section 7 of this Code of Practice.



STRETCHER BOND PATTERN

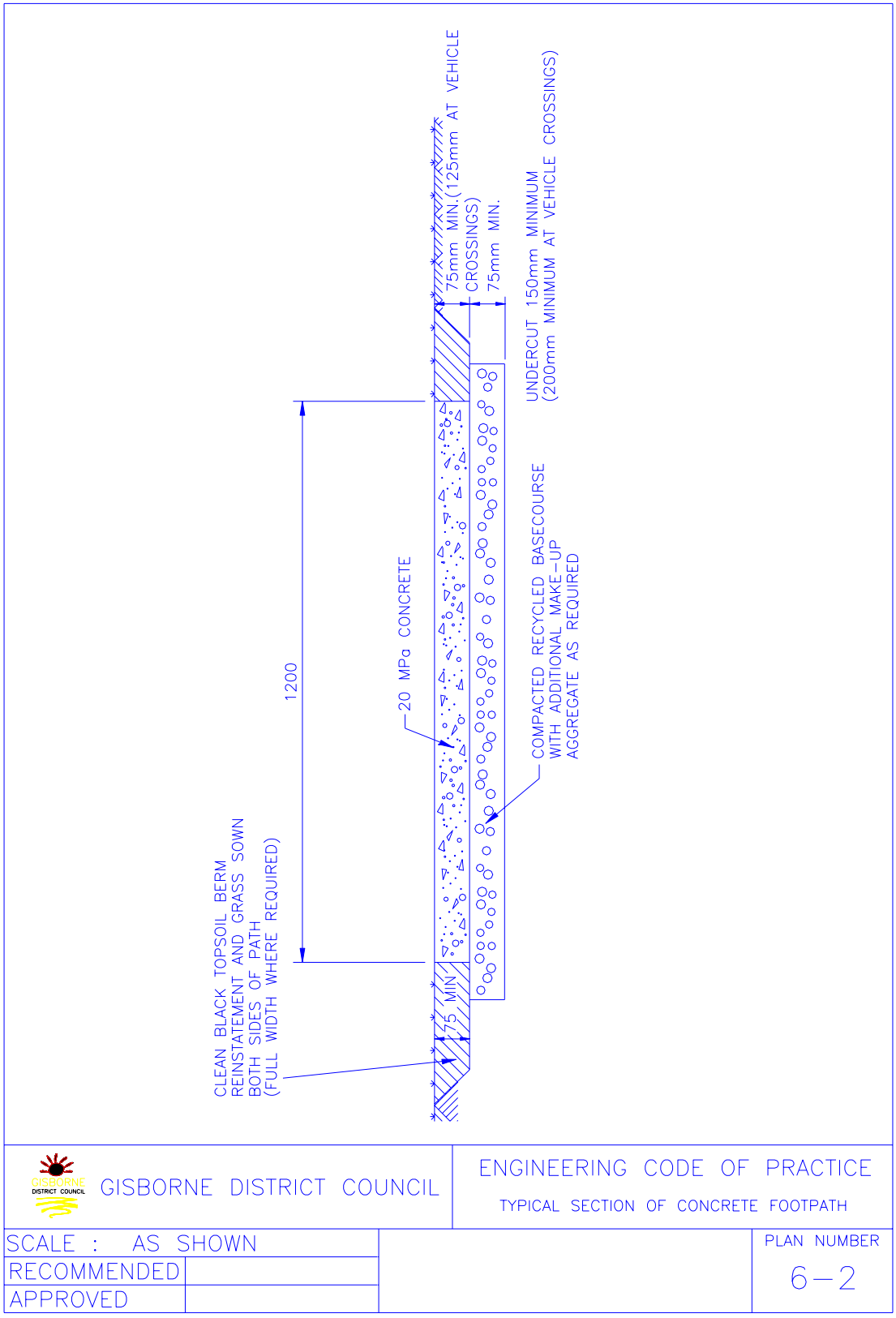
SCALE 1:20

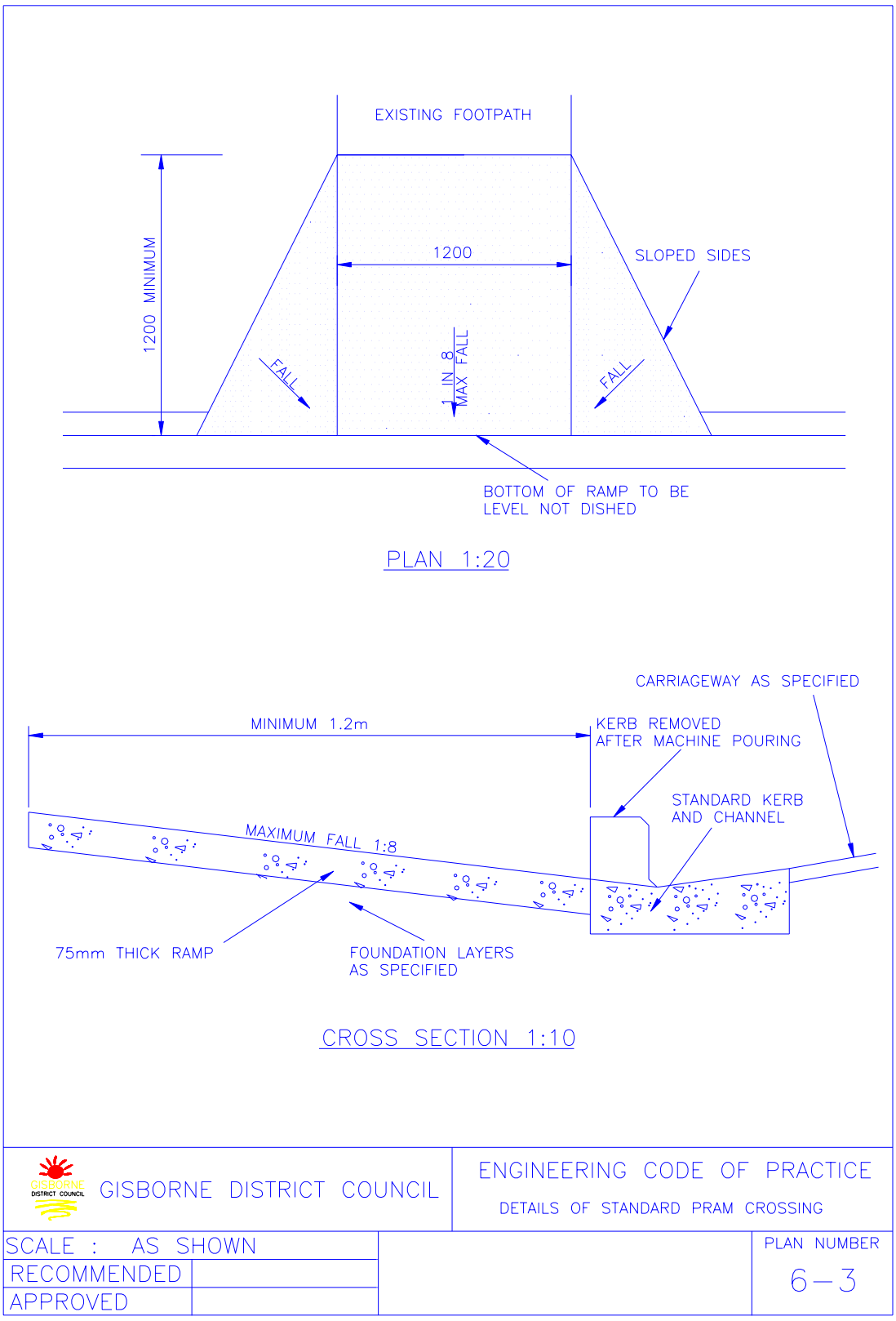


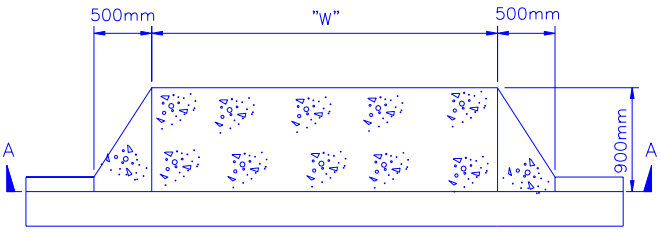
COBBLESTONE FOOTPATH DETAIL

SCALE 1:10

GISBORNE DISTRICT COUNCIL	ENGINEERING CODE OF PRACTICE CONCRETE PAVER FOOTPATH DETAILS	
SCALE : AS SHOWN		PLAN NUMBER
RECOMMENDED		6 – 1
APPROVED		

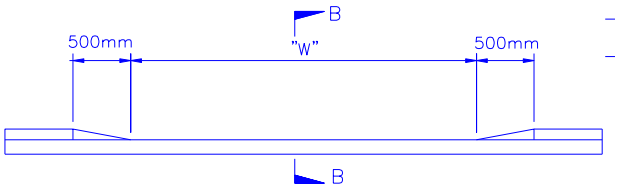

75mm MIN.(125mm AT VEHICLE CROSSINGS)
75mm MIN.
UNDERCUT 150mm MINIMUM
(200mm MINIMUM AT VEHICLE CROSSINGS)
20 MPa CONCRETE
COMPACTED RECYCLED BASECOURSE
WITH ADDITIONAL MAKE-UP
AGGREGATE AS REQUIRED
1200
75 MIN
CLEAN BLACK TOPSOIL BERM
REINSTATEMENT AND GRASS SOWN
BOTH SIDES OF PATH
(FULL WIDTH WHERE REQUIRED)
GISBORNE DISTRICT COUNCIL
ENGINEERING CODE OF PRACTICE
TYPICAL SECTION OF CONCRETE FOOTPATH
SCALE : AS SHOWN
RECOMMENDED
APPROVED
PLAN NUMBER
6-2


EXISTING FOOTPATH
1200 MINIMUM
1200
SLOPED SIDES
FALL
1 IN 8
MAX FALL
FALL
BOTTOM OF RAMP TO BE
LEVEL NOT DISHED
PLAN 1:20
CARRIAGEWAY AS SPECIFIED
MINIMUM 1.2m
KERB REMOVED
AFTER MACHINE POURING
STANDARD KERB
AND CHANNEL
MAXIMUM FALL 1:8
75mm THICK RAMP
FOUNDATION LAYERS
AS SPECIFIED
CROSS SECTION 1:10
GISBORNE DISTRICT COUNCIL
ENGINEERING CODE OF PRACTICE
DETAILS OF STANDARD PRAM CROSSING
SCALE : AS SHOWN
RECOMMENDED
APPROVED
PLAN NUMBER
6–3



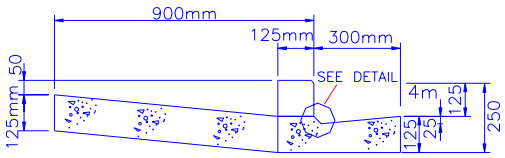
PLAN OF VEHICLE DISH CROSSING

NOTE:
- FOR COMMERCIAL CROSSINGS
- APRON THICKNESS 150mm
- D12 REINFORCING BAR AT 250mm CENTRES BOTH WAYS OR 644 HRC MESH
- REINFORCING 50mm COVER FROM BASE
- MINIMUM CONCRETE COMPRESSIVE STRENGTH TO BE 20MPa AT 25 DAYS

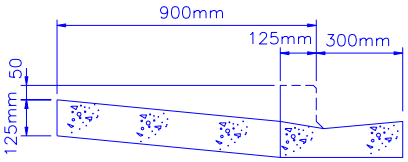


SECTION A–A

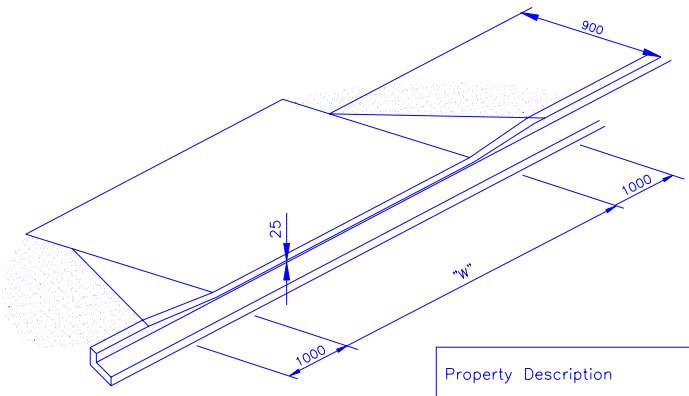
NOTE: NO LIP CROSSING REQUIRED:
- IN CENTRAL BUSINESS DISTRICT. (C.B.D.)
- IN SUBURBAN SHOPPING PRECINCTS OR OTHER HIGH PEDESTRIAN TRAFFIC AREAS
- WHERE CHANNEL GRADIENT IS SUFFICIENT TO PREVENT SILTING OF THE CROSSING INVERT.



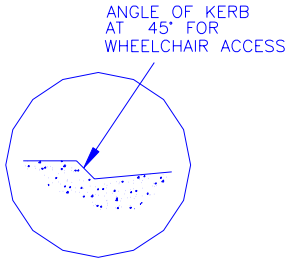
SECTION B–B STANDARD CROSSING



SECTION B–B NO LIP CROSSING



MINIMUM STANDARDS FOR VEHICLE CROSSINGS ONTO URBAN ROADS



DETAIL

Property Description	Width "W"	Concrete Depth "D"	HRC
Residential 1–3 Dwellings	3m	100mm	No
4–6 Dwellings	4m	125mm	No
7+ Dwellings	6m	150mm	1 Layer 665
Light Commercial (not requiring specific design)	4m	150mm	1 Layer 665
Industrial (not requiring specific design)	6m	150mm	1 Layer 665

GISBORNE DISTRICT COUNCIL

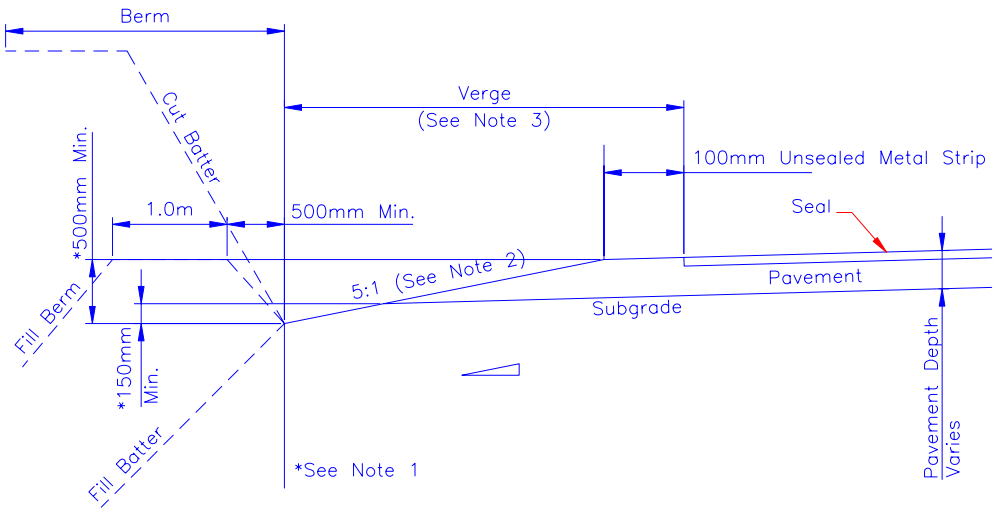
ENGINEERING CODE OF PRACTICE
VEHICLE ACCESS CROSSINGS

SCALE : NOT TO SCALE

RECOMMENDED

APPROVED

PLAN NUMBER
6–4



TYPICAL CROSS SECTION GUIDELINES FOR VERGES ON RURAL ROADS

NOTES

1.) *Adopt whichever provides the greater depth:
(A) 500mm below the seal edge, or
(B) 150mm below the pavement/subgrade interface.

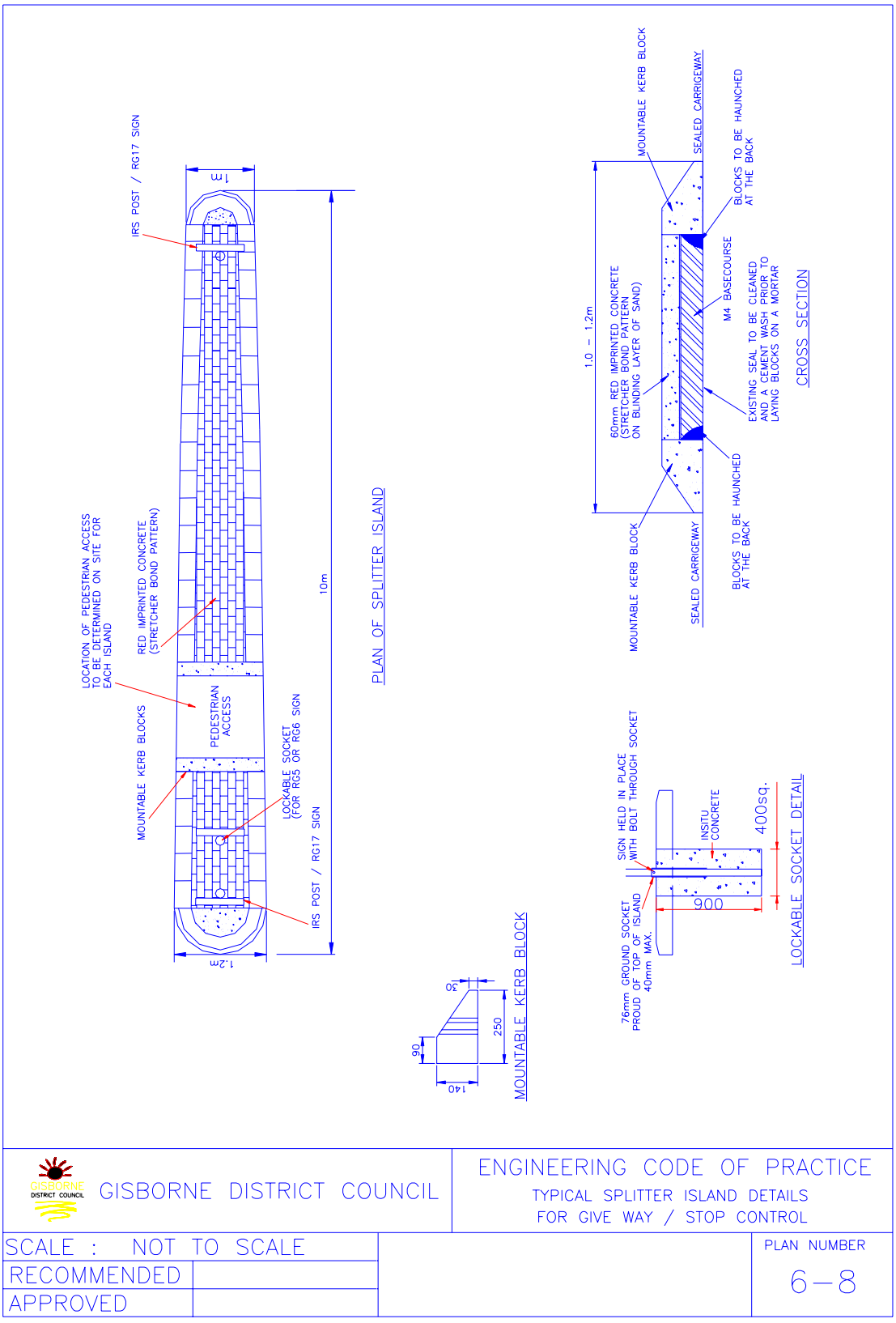
2.) 5:1 Side slopes may be narrowed to an absolute minimum of 4:1 in constrained locations. 6:1 side slopes are required within 3.0m of topside of curves.

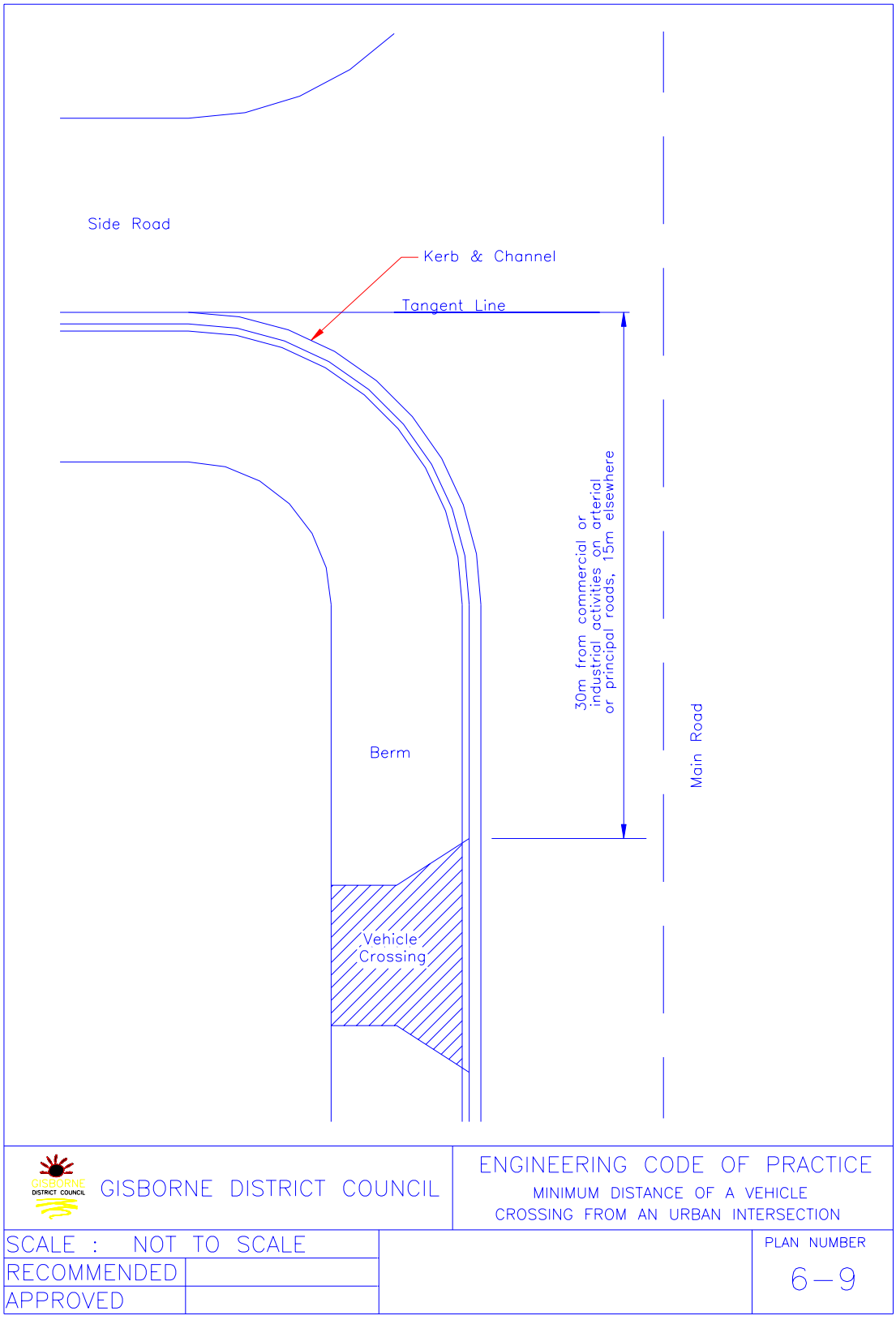
3.) The verge width is determined by the critical dimensions given in "Note 1" above.

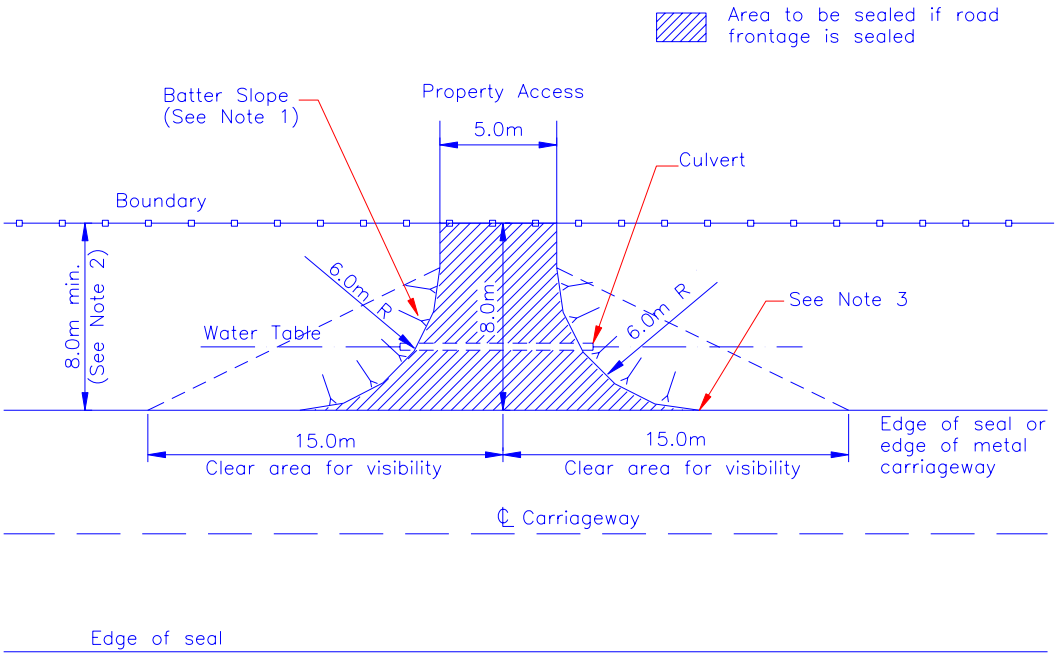
4.) See drawing 6–5 for typical cross section details

5.) Cut batter, Fill batter, Fill slopes are dependant on site soil stability criteria.

GISBORNE DISTRICT COUNCIL	ENGINEERING CODE OF PRACTICE CROSS SECTION GUIDELINES FOR VERGES ON RURAL ROADS	
SCALE : NOT TO SCALE		PLAN NUMBER
RECOMMENDED		6–6
APPROVED		


IRS POST / RG17 SIGN
1.3
10m
PLAN OF SPLITTER ISLAND
LOCATION OF PEDESTRIAN ACCESS TO BE DETERMINED ON SITE FOR EACH ISLAND
RED IMPRINTED CONCRETE (STRETCHER BOND PATTERN)
MOUNTABLE KERB BLOCKS
PEDESTRIAN ACCESS
LOCKABLE SOCKET (FOR RG5 OR RG6 SIGN
IRS POST / RG17 SIGN
1.2m
MOUNTABLE KERB BLOCK
SEALED CARRIGEWAY
BLOCKS TO BE HAUNCHED AT THE BACK
1.0 – 1.2m
60mm RED IMPRINTED CONCRETE (STRETCHER BOND PATTERN ON BLINDING LAYER OF SAND)
M4 BASECOURSE
EXISTING SEAL TO BE CLEANED AND A CEMENT WASH PRIOR TO LAYING BLOCKS ON A MORTAR
CROSS SECTION
MOUNTABLE KERB BLOCK
SEALED CARRIGEWAY
BLOCKS TO BE HAUNCHED AT THE BACK
30
250
90
140
MOUNTABLE KERB BLOCK
SIGN HELD IN PLACE WITH BOLT THROUGH SOCKET
INSITU CONCRETE
400sq.
900
76mm GROUND SOCKET PROUD OF TOP OF ISLAND 40mm MAX.
LOCKABLE SOCKET DETAIL
GISBORNE DISTRICT COUNCIL
ENGINEERING CODE OF PRACTICE
TYPICAL SPLITTER ISLAND DETAILS
FOR GIVE WAY / STOP CONTROL
SCALE : NOT TO SCALE
RECOMMENDED
APPROVED
PLAN NUMBER
6 – 8


Side Road
Kerb & Channel
Tangent Line
30m from commercial or industrial activities on arterial or principal roads, 15m elsewhere
Main Road
Berm
Vehicle Crossing
GISBORNE DISTRICT COUNCIL
ENGINEERING CODE OF PRACTICE
MINIMUM DISTANCE OF A VEHICLE CROSSING FROM AN URBAN INTERSECTION
SCALE : NOT TO SCALE
RECOMMENDED
APPROVED
PLAN NUMBER
6–9



NOTES:

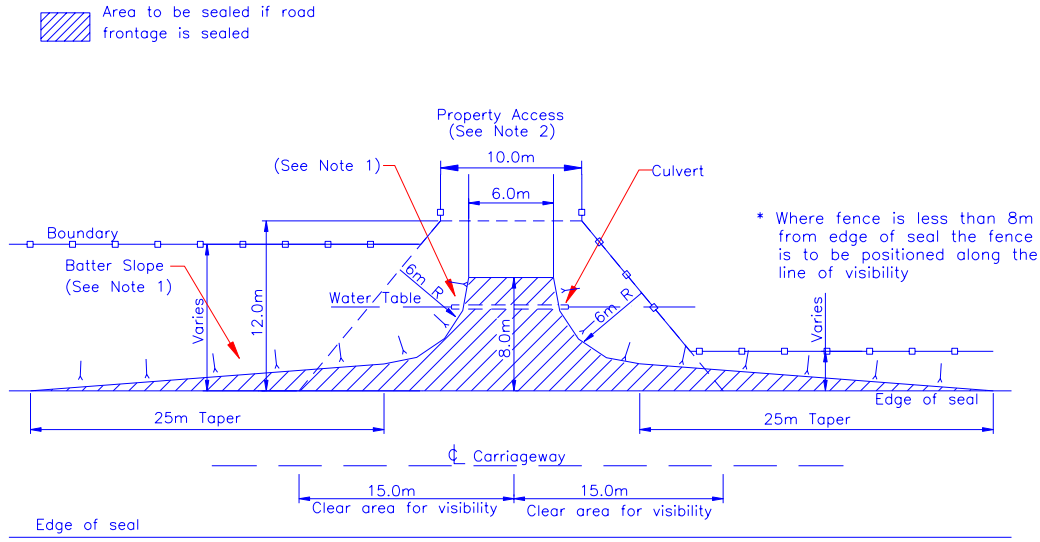
1.) Batter slopes not to be steeper than 1.5H : 1.0V

2.) If the road boundary fence is less than 8m from the edge of seal the fence is to be repositioned outside the area required for visibility, and the gate shall be positioned a minimum of 8m from the edge of seal

3.) Basecourse metal to be formed a minimum of 100mm wider than the seal area

4.) All dimensions in metres

GISBORNE DISTRICT COUNCIL	ENGINEERING CODE OF PRACTICE TYPE A VEHICLE CROSSING	
SCALE : NOT TO SCALE		PLAN NUMBER
RECOMMENDED		6–10
APPROVED		



NOTES:

1.) Basecourse metal to be built a minimum of 100mm wider than the seal area

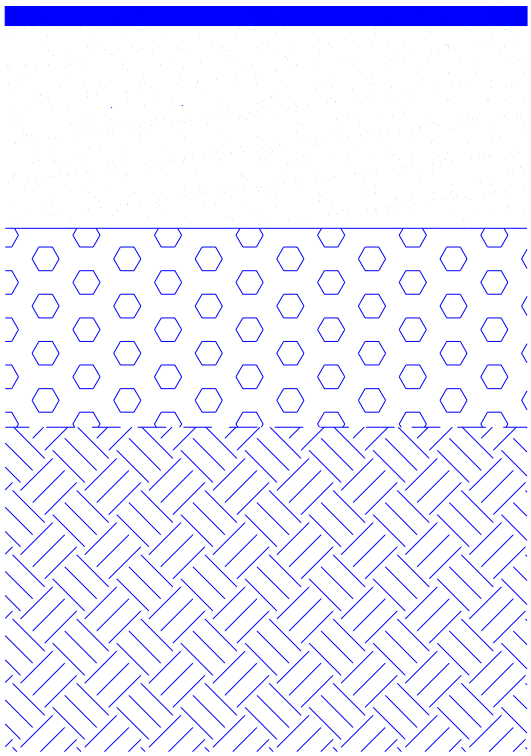
2.) Gate shall be no less than 12m from the edge of the seal of the road

3.) Batter slopes not to be steeper than 1.5H : 1.0V

4.) If the rural road is unsealed, the detail above will still apply except that sealing of the accessway is optional

5.) All dimensions in metres

GISBORNE DISTRICT COUNCIL	ENGINEERING CODE OF PRACTICE TYPE B VEHICLE CROSSING	
SCALE : NOT TO SCALE		PLAN NUMBER
RECOMMENDED		6–11
APPROVED		



Surfacing – Typically Chip Seal or Asphalt Concrete

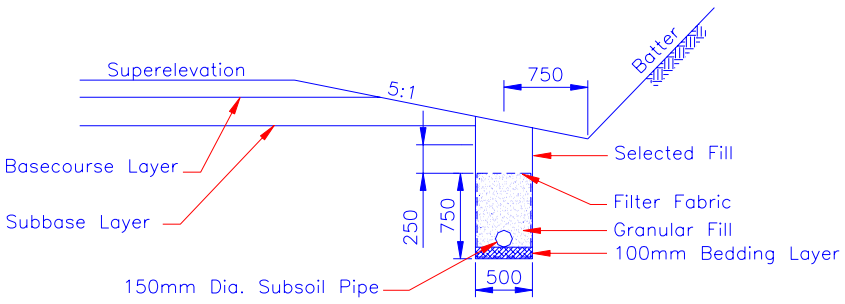
Basecourse – TNZ M\4 Specification

Subbase – Unbound Aggregate – Cement or Lime Stabilised Aggregate

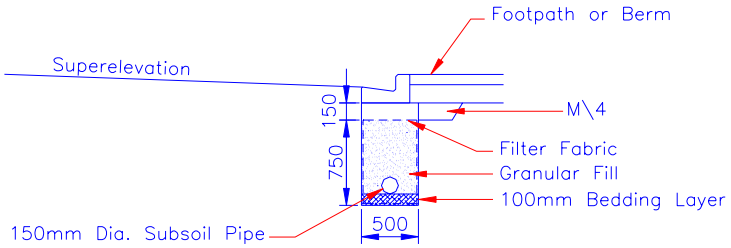
Geofabric or Geogrid Options

Subgrade – Pavement design normally based on CBR. Subgrade CBR can be improved by drainage

GISBORNE DISTRICT COUNCIL	ENGINEERING CODE OF PRACTICE TYPICAL FLEXIBLE PAVEMENT STRUCTURE
SCALE : NOT TO SCALE	PLAN NUMBER 6–12
RECOMMENDED	
APPROVED	



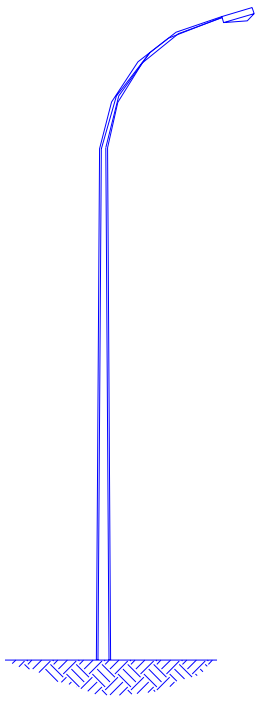
RURAL SURFACE WATER CHANNEL



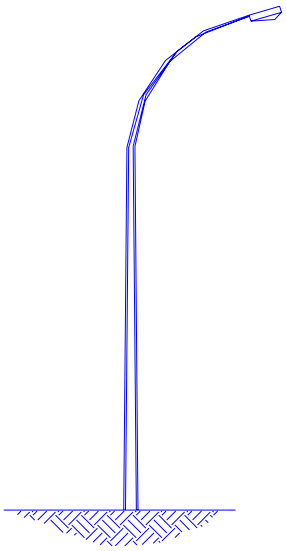
KERB & CHANNEL

NOTE: All subsoil drainage requires specific design, above details are examples

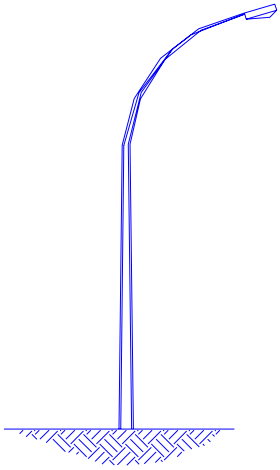
GISBORNE DISTRICT COUNCIL	ENGINEERING CODE OF PRACTICE TYPICAL SUBSOIL DRAINAGE DETAILS
SCALE : 1:50	PLAN NUMBER
RECOMMENDED	6–13
APPROVED	



INTERSECTION & ARTERIAL CONFIGURATION
11.2m Galvanised Steel Pole
150w Or 250w Lantern



PRINCIPAL CONFIGURATION
8.6m Oclyte
3.2m Extension Outreach
150w HPS Lantern



COLLECTOR & LOCAL ROAD CONFIGURATION
7.3m "Oclyte" column or equivalent
Standard curved Outreach
Lantern (Collector)–100w HPS
Lantern (Local Road)–70w HPS

TYPICAL STREET LIGHT POLE CONFIGURATIONS

Reference should be made to AS/NZS 1158.0 Parts 0,1.1 and 1.3

GISBORNE DISTRICT COUNCIL	ENGINEERING CODE OF PRACTICE TYPICAL STREET LIGHT CONFIGURATIONS
SCALE : NOT TO SCALE	PLAN NUMBER
RECOMMENDED	6–14
APPROVED	

Section 7
Contracts, QA, Inspection, As Built Record & Reporting

Contents

The Contents of this Section are as follows:

Section 7: Contracts, QA, Inspection, As Built Record & Reporting

7.1 Introduction

The previous sections of this Code of Practice have discussed the engineering standards that Council believes will provide acceptable solutions, but not necessarily the only solutions, for the engineering works associated with subdivision or land use projects in Gisborne. Council will require in the Consent Conditions that these projects are properly documented and certified by an appropriately qualified professional.

The following consents/agreements should be obtained by Consultant/Developer prior to construction:

1	Entry to private land	1.1	Entry agreement
2	Work on private land	2.1	Property owner Consent
		2.2	Easiment
3	Working within Road Reserve	3.1	GDC approval
		3.2	TNZ approval
4	Services consultation (under and above ground)	4.1	LINZ
		4.2	Telecom company
		4.3	Power company
		4.4	Gas company
		4.5	PacSat company
		4.6	GDC - Water - Sewer - Stormwater
5	Above Ground Features	5.1	Vegetation clearing Traffic regulation
6	Other	6.1	Historical places
		6.2	District plan and Regional Plans
		6.3	District Plan and Regional Resource consent

This section of the Code of Practice will outline Council's requirements in relation to Construction Conditions of Contract and Specifications, Engineering Drawing

Presentation, Quality Assurance and Inspection, As-Built Documentation and Quality Assurance Record.

7.2 Construction Conditions of Contract and Specifications

If Council is to be a party to a Construction Contract, or if the works involved will eventually become the responsibility of Council, the General Conditions of Contract for construction will be *NZS 3910 : 1987, Conditions of Contract for Building and Civil Engineering Construction.*

A number of Special Conditions of Contract will normally be required. The following list of Special Conditions is indicative only:

- Conditions of Tendering
- Type of Contract (e.g., Lump Sum or Measure and Value)
- Bonds
- Nomination of Engineer to the Contract
- Nomination of Engineer's Representative to the Contract
- Time Extensions
- Contract Period
- Liquidated Damages
- Insurance
- Health and Safety
- Protection of public, private properties and existing services
- Traffic Management
- Quality Plans
- Programming of Work

Other parts of a Construction Contract will include:

- The Schedule of Prices

- Basis of Payment
- Plant and Subcontractors Schedule
- Technical Specification

The Technical Specification will detail the works to be completed under the Contract, the Standards to be applied and the means by which Standards will be measured. Reference will be made to Standard Specifications (e.g. NZS and TNZ) and/or Material Specifications if required. Council recommends that the advice of a suitably qualified professional be obtained when preparing and administering a Construction Contract. All construction documentation, and the Quality Control of works, will need to be certified by an appropriately qualified professional.

7.3 Engineering Drawing Presentation

Drawings in support of land development and subdivision projects will be drawn on A1 or A2 Sheets (original size) at the following standard scales. The drawings will be of sufficient number and detail to adequately define the project.

- Road Plans 1:500, 1:250
- Utility Service Plans 1:500, 1:250
- Road Long Sections 1:500 or 1:250 with a distortion of 5 to 10 to vertical scales
- Service Long Sections 1:500 or 1:250 with a distortion of 5 to 10 to vertical scales
- Road Cross Sections 1:100 urban and rural

Detail drawings shall utilise appropriate scales selected from any of the above or at 1:100, 1:50, 1:20 or 1:10.

Draughting standards will comply with

NZS/AS 1100.401 (1984) Technical drawing, Supplement No.3 (Jan 1984) Engineering Survey and Engineering Survey Design-Sewerage and Water Supply

NZS/AS 1100.401 (1984) Technical drawing, Supplement No.4 (Jan 1984) Engineering Survey and Engineering Survey Design-Roads

7.4 Survey Standards

The following survey standards should be followed during the construction phase of a development.

- Survey Location of Control Points for Project

  These will be established by a Registered Surveyor from the national survey network for location, and for levels from the LINZI datum. Once project control points are established these will be regarded as 'absolute' in location and level accuracy for the purpose of control of location of features within the project.

  Setting Out Roading Works

  These will be set on a project by project basis. For roading works the final location will need to be within the tolerances set out below:

  Tolerances for setting out the work from the data supplied shall be:

  (a) Horizontal ± 10mm

  (b) Vertical ± 5mm

- Roading Construction

  Tolerances from lift pegs or other setting out points, which may include concrete kerb and channel or a fixed point of concrete kerbing, shall be as shown below. Reference shall also be made to the *Transit New Zealand Specification TNZ B/2 : 1991*.

  (a) Width Tolerances

Unconstrained (i.e., no K & C)	-20mm to + 100mm
Constrained by K & C	0mm to + 20mm

  (b) Vertical Tolerances

Kerb and Channel and footpaths	- 5mm to + 5mm

Setting Out for Underground Services

Pavement Layers	Between Pavement Centreline and Pavement Edge	
	Without Concrete Channel	**With Concrete Channel**
Sub-base course	- 25mm + 5mm	- 25mm + 5 mm
Basecourse	- 5 mm + 15 mm	varies see note 1
Note 1 : Tolerance – 5mm + 0mm	(I) at or close to the lip of channel -	
– 5mm +	(ii) at other locations on pavement 15mm	

These will be set on a project by project basis. For utility services setting out for services will need to be within the following tolerances.

Tolerances for setting out the work from the data supplied shall be:

(a) Horizontal ∀ 50mm

(b) Vertical ∀ 5mm

7.5 Quality Assurance and Testing

The Contractor/Developer and his/her advisors are responsible for providing Council with:

- Quality Assurance Record
- Test Records.

These must be provided for all engineering works associated with subdivision and land development, in accordance with this Code of Practice, and the Gisborne District Combined Regional Land and District Plan. The attached spreadsheets for water supply, stormwater and sanitary sewer works, and for roading works, list the quality assurance information and test records that Council considers would be the minimum documentation required for submission to Council for Compliance.

The specifications for the tests required for all aspects of the development are described in detail in Sections 3,4,5,and 6 of this Code of Practice.

7.6 As-Built Drawings

As shown on the attached spreadsheets, Council will require that as built drawings are submitted with the information required for Compliance.

- "As built" drawings of all engineering works will be drawn as discussed in Section 7.3

- Each drawing will be clearly stamped as 'as built' and signed by the appropriately qualified person so certifying the same. Council will retain a copy of all "as built" drawings. If Computer Aided Drawing ("*AutoCAD*") has been used, A1 paper "as built" copies and computer file copy will be supplied in all cases. The computer file must be compatible with GDC systems. Developers should confirm with GDC the software compatibility before supplying the computer file copy.

- Survey control and locations for "As-Builts" will be based on co-ordinated data (x, y and z) from permanent control points, in accordance with LINZ datum. All locations will be dimensioned and shown on the plans. The tolerances shall be:

(a) Horizontal ± 10mm

(b) Vertical ± 10mm

7.7 Compliance Report

The attached spreadsheets also describe the information that Council believes should be presented in the Compliance Report, which will be submitted to Council with the request for Subdivision Compliance. The Report will be signed by the appropriately qualified professional who has been responsible for the inspection of the works, and will certify the accuracy of the test results, including a copy of all the test results. This report will also summarise the QA and As Built information. If Council is not satisfied with the standard of information provided, ***Council will confirm in writing that more information is required***. This could delay the Compliance process.

7.8 Financial Reporting

Council is required to maintain an asset register of all services (stormwater, sanitary sewerage, water supply and roading assets) that are owned and maintained by Council. To assist them in this asset management work, Council may require, as a Condition of Consent, that the Developer supply details of the installation cost of fixed assets, such as pipelines (including valves and hydrants) manholes, and pump stations. These asset costs, which would include both design and construction costs, are likely to take the following form:

- ***Pipelines***

Cost per linear metre, including all valves, hydrants for principal and rider mains for water supply, and shallow manholes on stormwater and sanitary sewer pipelines.

Note: the costs associated with service connects are not included.

- ***Manholes***

The cost for each manhole > 1.0 metre deep (i.e. not shallow manholes).

- ***Pump Stations***

The cost for each pump station.

- ***Kerbs and Channel***

Cost per linear metre installed, including sumps and leads.

- ***Footpath***

Cost per square metre.

- ***Road Pavement***

Cost per square metre.

The asset cost information, which does not include land purchase costs, would need to be certified as correct by an appropriately qualified professional, and submitted in tabular form within the Compliance Report.

Quality Assurance and As-Built Schedule for Water Supply, Stormwater and Sanitary Sewer Works

Description of Activity	Quality Assurance Information	As-Built Drawing Information	Completion Report
Underground Pipework ❖ All pipework associated with water supply, stormwater and sanitary sewerage works to be owned by Gisborne District Council.	**Records Showing:** ❖ Pipe size (diameter, wall thickness), material, rating (for pressure pipe), gradient, class (for gravity pipe). ❖ Joint details including type (mechanical or fusion), rating or class, material and manufacturer. ❖ Photographs of pipework in the ground, including typical trench layout for all mains and rider mains, all pipe junctions, all changes of material. ❖ Co-ordinates (x, y and z to DOSLI datum) for top of pipe at start and end or change of material, size and/or rating / class, top of take off for lateral or service, top of pipe at change of direction. ❖ The results of pressure test and cleaning and disinfection as required for the different services.	**The "As-Built" plans will show:** ❖ Plan and long-section of all mains and rider-mains, showing pipe materials, manufacturer's name and date of manufacture, type and sizes, co-ordinated (x, y, z) position as show under QA information, location of all laterals and service connections.	The completion report will summarise the QA and As-Built information, and include supply certificate (with batch numbers) for all pipes supplied to the site. The report will also include certified records test information for the different services.
Water Supply fittings (Valves, Hydrants, Tobies)	**Records showing:** ❖ Type of Fitting, material, rating. ❖ Joint details including type (mechanical or electro-fusion), rating, material and manufacturer. ❖ Photographs of all fittings when connected in the ground, clearly showing the location. ❖ Co-ordinates (x, y and z to DOSLI datum) of the top of the pipe entering the toby, valve, hydrant or other fitting. ❖ Flow test information from each hydrant and service lateral and results of cleaning and disinfection as required for the different services.	**The "As-Built" plans will show:** ❖ On the plan and long section the location of all fittings will be clearly marked, including fitting type and size, material, manufacturer's name and date of manufacture, co-ordinated (x, y, z) position as shown under QA information.	The completion report will summarise the QA and As-Built information, and include supply certificate (with batch numbers) for all fittings supplied to the site, and certification of the welding equipment and personnel competing the pipe joints. The report also include certified records of all tests.

Description of Activity	Quality Assurance Information	As-Built Drawing Information	Completion Report
Manholes	**Records showing:** ❖ Type of manhole, material, dimensions (diameter, depth). ❖ Joint details with external pipework. ❖ Photographs of all completed manholes prior to backfilling from all directions showing all main pipes entering and leaving the manhole and internal detail including the floor. ❖ Co-ordinates (x, y and z to DOSLI datum) of the invert of the outlet pipe of the manhole and the finished lid level.	**The "As-Built" plans will show:** ❖ On the plan and long section the location of all manholes will be clearly marked including dimensions (diameter and floor level) and materials used for construction and co-ordinated (x, y, z) position as shown under QA information.	The completion report will summarise the QA and As-Built information.
Pump Stations and Special Services	**Records showing:** ❖ Details of all pumps and fittings including materials, ratings, joint details (mechanical or fusion) including material and manufacturer. ❖ Co-ordinates (x, y and z to DOSLI datum) of the floor of the building and the top of pipes as they enter and leave pumps and fittings, and in particular the invert levels of rising mains and wet wells. ❖ Photographs of the completed structure, including internal photographs of all pipes, pumps and fittings. ❖ Confirmation of the installed pump curves versus design requirements. ❖ Results of any pressure test and cleaning and disinfection as required for the different services.	**The "As-Built" plans will show:** ❖ On the plan and long section the (x, y, z) location of all pumps, fittings and pipework as shown on QA information. ❖ Building details showing all structures, entry / exit points, vehicle access points, water supply points, electrical fittings. ❖ The location of back up facilities for emergency power supply.	The completion report will summarise the QA and As-Built information and including certification for electrical works and supply certificates (with batch numbers) for all pumps / fittings supplied to the site. The report will also include certified records of test data as required from all pumps and pipelines, and provide copies of pump manuals and operational specifications.

Description of Activity	**Quality Assurance Information**	**As-Built Drawing Information**	**Completion Report**
Service Trenches	**Records showing:** ❖ Confirm the type of trench e.g. narrow trench detail as per pipe manufacturer's specifications or conventional trench. ❖ Trench width and depth and any special information such as high groundwater levels or details that could affect long-term performance such as extent of over-excavation and backfill, or poor foundation materials and methods used to provide stability such as geotextile/geogrid support. ❖ Backfill materials used and compaction records. ❖ Finished road pavement details when in roadway. ❖ Photographs of typical trench backfill showing the relative location of the different services laid within the trench and how these are arranged.		The completion report will summarise the QA and As-Built information.
Sampling and Testing of Concrete and Aggregate Materials	❖ A representative sample of sub-base and basecourse gravel for each 500m of roadway constructed and 500m of kerb and channel constructed, should be obtained and tested. ❖ The sampling of gravel and aggregates will be in accordance with NZS 4407. The gravels and aggregates will be sampled from the stockpiled material which shall not be added to or modified subsequent to the sampling. ❖ The sampling of concrete will be in accordance with NZS3112. ❖ The sampling of materials will only be undertaken by persons approved by an IANZ registered laboratory, or in accordance with IANZ Technical Note 15. ❖ All testing of materials will be carried out by a Laboratory able to provide IANZ endorsed test reports. Except for materials sampled at the site during the work all reports will be provided to the Certifying Engineer prior to the materials being incorporated into the work.	N/A	The Completion Report will summarise the QA information and include copies of **all** certified test results.

Description of Activity	Quality Assurance Information	As-Built Drawing Information	Completion Report
Service Trenches	❖ All underground service trenches will be constructed and inspected in accordance with the Council's *Specification for Service Maintenance Operations and New Service Installations Within Road Reserve*. Specific attention by the contractor needs to be given to the quality of any service trench reinstatement at the subgrade level in any new road pavement. The Californian Bearing Ratio (CBR) measured at the surface of the reinstated service trench at subgrade level will be greater than the average CBR value for the existing subgrade **in all cases**. The reinstatement of service trenches will need the approval of the Certifying Engineer before construction of the pavement layers is undertaken.	N/A	The Completion Report will summarise the QA information and include copies of **all** certified test results.
Footpaths and Kerb and Channel	❖ Survey setouts will be checked for subgrade levels and the top of basecourse levels. Alignment and levels will be checked at stringing time.	**The As-Built plans will show:** ❖ On the plan and long section the location of all kerb and channel and footpath and provide all RAMM data as required by Council.	The Completion Report will summarise the QA information and include copies of **all** certified test results.
Road Pavement Construction	❖ Survey setouts will be checked for width and vertical tolerance for finished subgrade, subbase and basecourse levels and final crossfall.	**The As-Built plans will show:** ❖ On the plan and long section the location of the carriageway, shoulder, berm and drainage channel and provide all RAMM data as required by Council.	The Completion Report will summarise the QA information and include copies of **all** certified test results.

Description of Activity	Quality Assurance Information	As-Built Drawing Information	Completion Report
Traffic Signs and Road Marking	❖ All pavement marking shall be in accordance with TNZ P/12 and carried out using equipment **currently** certified to TNZ E/3. The Contractor must provide evidence of this through an approved quality system such as Certification to NZ Roadmarkers Federation's Quality Assurance programme (QAP) or ISO 9002 Certification. ❖ Traffic signs will be manufactured and installed in accordance with the Manual of Traffic Signs and Markings - Parts 1 and 2 under an approved Quality System: - NZS 9001 : 1994 or NZS 9002 : 1994; *or* - Transit New Zealand Quality Standard TQSI : 1995. ❖ All permanent traffic signs, frames and fittings shall be obtained from a manufacturer that has in place a quality assurance system that has been certified by Joint Accreditation System Australia and New Zealand (JAS_ANZ) accredited agency.	**The As-Built plans will show:** ❖ On the plans the location of all road marking and traffic signs.	The Completion Report will summarise the QA information and include copies of **all** certified test results.
Road surfacing	❖ The testing of road sealing including sealing chip, finder composition and application rate and asphaltic concrete thickness and temperature will carried out in accordance with the *Transit New Zealand Specifications*, referred to in Section 6.8 of this Code of Practice.	RAMM records as required by Council.	The Completion Report will summarise the QA information and include copies of **all** certified test results.
Road Lighting	❖ The Quality Assurance information will identify the make, model and date of manufacture of all lighting components.	**The As-Built plans will show:** ❖ On the plans the location by street lights. ❖ RAMM records as required by Council.	The Completion Report will summarise the QA information and include copies of **all** certified test results.