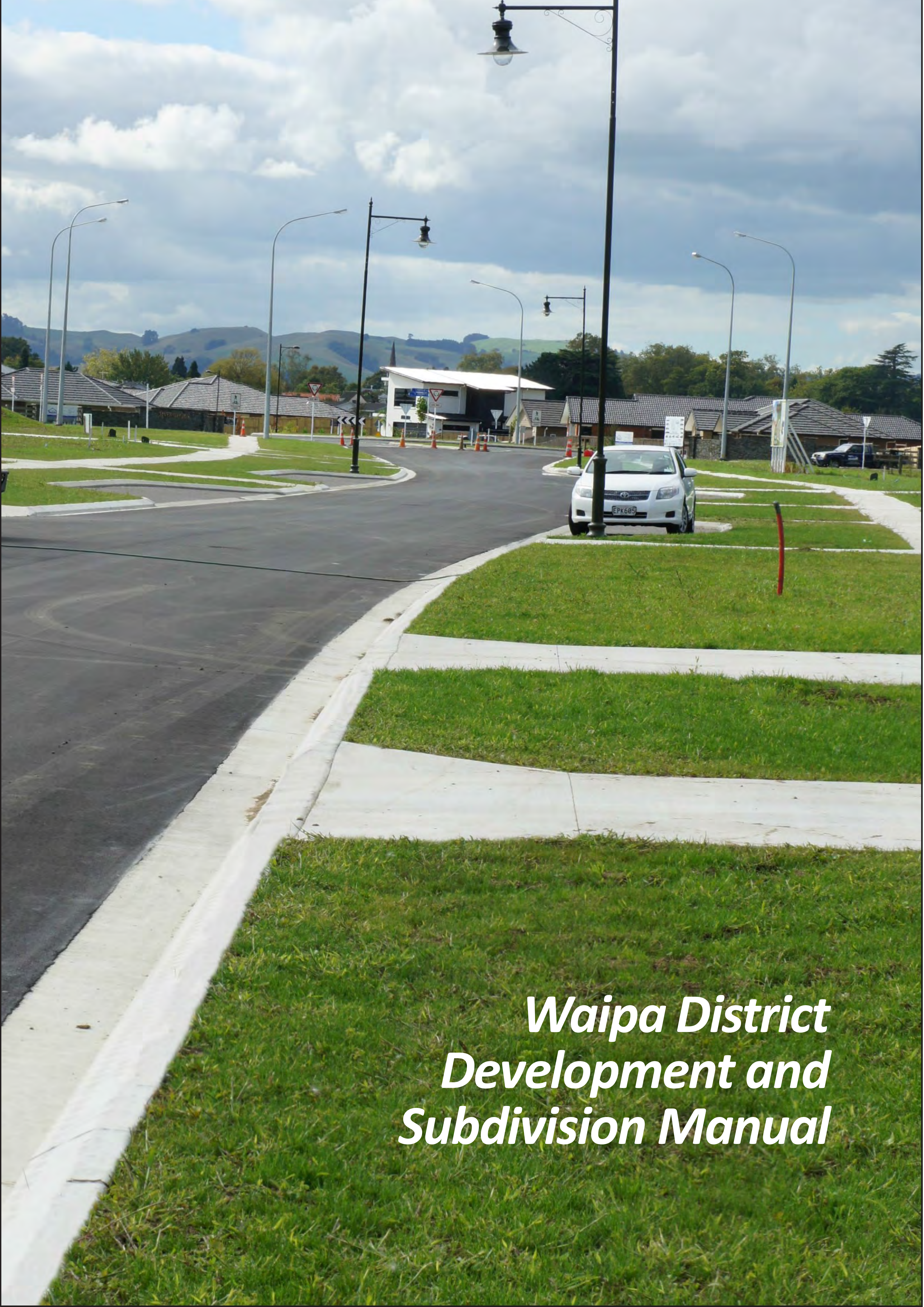


Waipa District Development and Subdivision Manual

How to Use the Manual

Please note that Waipa District Council has no controls over the way your electronic device prints the electronic version of the Manual and cannot guarantee that it will be consistent with the published version of the Manual.

Version Control

Version	Date	Updated By	Section / Page # and Details
1.0	November 2012	Administrator	Document approved by Council.
2.0	August 2013	Development Engineer	Whole document updated to reflect OFI forms received.
2.1	September 2013	Development Engineer	Whole document updated
2.2	August 2014	Development Engineer	Whole document updated to reflect feedback from internal review.
2.3	December 2014	Development Engineer	Whole document approved by Asset Managers
2.4	January 2015	Administrator	Whole document renumbered and formatted.
2.5	May 2015	Administrator	Document approved by Council.

Table of Contents

Part 1: Introduction

1.1 This Waipa District Development and Subdivision Manual (the Manual), is part of a new integrated approach to development and subdivision within the Waipa District (the District).

1.2 The Manual is part of a suite of documents that will assist to deliver the future of residential, industrial, commercial, and rural developments and subdivisions that implement directions in the Waipa 2050 project. The Manual, together with the Waipa District Plan (the District Plan), seeks to retain the features that make the District desirable and introduces measures that will assist the District to accommodate additional growth in residential, industrial and commercial activity.

1.3 These new elements include the staging of new growth areas that are coordinated with appropriate provision of infrastructure, the requirement for a low impact design approach to infrastructure, the provision for areas of compact housing within town centres, and the requirement for an enhanced level of amenity through higher levels of urban design, particularly in the commercial centres of the District.

1.4 The basis of this Manual is the Hamilton City Council Development Manual (Hamilton Manual). Any future changes to the Hamilton Manual will be evaluated by Waipa District Council (Council) and changes made to ensure consistency between documents.

Part 2: General Information

2.1 Introduction

2.1.1 This section outlines the background to the Manual, the contents of the Manual and in particular, the role of the Development Engineering department within the Integrated Development process.

2.1.2 It is intended that the Manual:

2.1.2.1 Create an infrastructure standard for development and subdivision for all, be it the Council building infrastructure or the developer building the infrastructure that is to be vested to Council.

2.1.2.2 Capture any changes in the service delivery strategies over time and record these as the new minimum standards for infrastructure.

2.1.2.3 Implement the desired infrastructure outcomes of the District Plan.

2.1.2.4 Provide the technical direction for the provision of low impact green engineering solutions.

2.1.3 The **minimum** standard can be achieved in a variety of ways and variations from those specified in the Manual can be assessed through the land use or subdivision consenting process.

2.2 Background to the Development and Subdivision Manual

2.2.1 The diagram below shows the vast number of inputs into the Manual.

Figure 1: Development and Subdivision Manual inputs

2.2.2 The diagram captures the range of inputs into the Manual that include:

2.2.2.1 District Plan initiatives that require a range of outcomes, including managing the location of growth and development in the District's towns and rural areas.

2.2.2.2 The requirements of the owners/operators of infrastructure to ensure well engineered and fit for purpose infrastructure is installed that can be properly integrated into existing systems.

2.2.3 To ensure the Manual can function as a genuine living document, it is administered pursuant to the Local Government Act 2002 (LGA). Reviews and updates of the Manual will be authorised by resolution of Council.

2.3 Structure of this Manual

2.3.1 The Manual comprises four volumes as follows:

(a) Volume 1: Development & Subdivision Processes

(b) Volume 2: Design Guide

(c) Volume 3: Technical Specifications

(d) Volume 4: Quality Systems

2.3.2 These volumes are described in more detail in the following sections.

2.3.3 The Manual provides standards for all infrastructure, including some infrastructure on private property that will not be vested to Council such as right of ways. The Manual recognises that Council and other network operators will become the owners of the roading and other infrastructure that are created in the development and subdivision process. Council and other network operators will assume responsibility for on-going maintenance of these systems. To that end, it is important that there is confidence that the systems are designed and constructed in a manner that ensures that they are fit for purpose at the time of transfer of ownership.

2.3.4 Volume 1: Development and Subdivision processes

2.3.4.1 The primary purpose of this volume is to describe the context in which the Manual has been compiled, how it should be used, and the relationships between various stakeholder interests involved in the processes. It is intended to provide the critical connections between Council's resource management objectives for land development in the District with the requirements of infrastructure owners/operators to provide fit for purpose and reliable levels of services to residents of the District. It provides information and explanation on policy settings and strategies from a resource management and asset management perspective to assist users to deliver the intended service delivery outcomes for land development within the District.

2.3.4.2 This volume of the Manual also provides guidance on the delivery of amenity value outcomes in support of the District Plan and is mandatory to meet the requirements of engineering conditions relating to landscaping.

2.3.5 Volume 2: Design guide

2.3.5.1 Volume 2 represents a means of compliance. It sets out design criteria for the construction of roading and key infrastructure services.

2.3.5.2 The design guides in Volume 2 set out the **minimum** standards required for infrastructure and other activities including earthworks and amenity value features such as tree planting. The Developer may produce an alternative design, but in that case, must be able to demonstrate that the design meets the relevant District Plan requirements.

2.3.5.3 The design guides in Volume 2 also apply in the case of any redevelopment or improvement works that are to be carried out by or for Council. They are to be used for any design that is carried out for Council internally or by an external design consultant.

2.3.6 Volume 3: Technical specifications

2.3.6.1 Volume 3 is effectively the "Manual's engine" and comprises fully detailed technical specifications for all roading and infrastructure services that may be constructed as part of a subdivision or Council construction contract. The specifications set **minimum** best practice requirements and are mandatory.

2.3.6.2 These specifications have been developed to ensure that:

(a) The roading and infrastructure services perform to the level of service required.

(b) The roading and infrastructure services are durable and will continue to operate in a satisfactory manner with **minimum** maintenance for the appropriate economic life.

(c) Maintenance of the roading and infrastructure services can be carried out in an efficient manner without the need for any special tools or materials that are unique to a certain subdivision.

2.3.6.3 The specifications apply both to works carried out by or for Council and to works carried out as part of a subdivision development.

2.3.7 Volume 4: Quality systems

2.3.7.1 Prior to Council signing off the subdivision to allow titles to be issued for the new lots Council must be satisfied that the construction works have all been completed satisfactorily. This requirement is also essential prior to Council assuming ownership and maintenance responsibilities for the roading and infrastructure services.

2.3.7.2 Volume 4 comprises a series of processes and checklists which must be completed by the Developer or their representative, and submitted to Council during construction and prior to the time of application for S224(c) Resource Management Act 1991 (RMA) certificate sign-off.

2.3.7.3 Council will undertake an audit role, from time to time during construction, to ensure that the checklists are correctly completed, that the requested tests have been completed, and that the necessary results have been achieved. Council is not responsible for supervision of the works as they progress.

2.3.7.4 The checklists and processes in Volume 4 are mandatory for all subdivision developments.

2.4 Using the Manual

2.4.1 The following section outlines the parties in the development and subdivision process, the roles that they have, in addition to any other matters that are required to be given regard to as part of the development and subdivision process.

2.4.2 The key parties in the statutory development and subdivision process are outlined below:

2.4.2.1 Waipa District Council referred to as “Council”, and associated parties as follows:

(a) Network operators; and

(b) Specialist technical advisors.

2.4.2.2 The applicant for the development and subdivision referred to as “Developer”, and associated parties as follows:

(a) Developer’s representative (i.e. the party nominated to represent the developer in the relationship with Council);

(b) Person engaged by the Developer to undertake the role of "Engineer", responsible for certifying the quality and compliance of the development works;

(c) Specialist technical advisors such as planning, design, architects, engineering and survey consultants; and

(d) Contractor(s) who carry out the construction works.

2.4.3 An approval for subdivision is effectively an "agreement" between Council as Territorial Local Authority and the Developer as the applicant for the subdivision. Under this "agreement", the Developer designs and constructs roading and infrastructure services which then becomes an asset of Council when completed (some infrastructure such as private right of ways do not become Council's assets). For its part, Council will issue the certificate(s) that are required before "titles" will be issued for the separate lots that are created, thus allowing the Developer to sell title to those lots.

2.4.4 The applicant shall ensure that all requirements of Council set out in the following documents are understood and complied with:

(a) The Operative and Proposed District Plan.

(b) This Manual.

(c) The conditions attached to the Subdivision and/or Land Use Consent.

(d) The approved engineering design plans.

2.4.5 The Developer shall appoint a representative to oversee the required compliances. The engagement of a Developer's representative and delegation of any responsibilities does not absolve the Developer from their responsibilities to Council that are established under the resource consent.

2.5 Council Role within the Development and Subdivision Process

2.5.1 Within Council, there are certain responsibilities in respect of the building and resource management processes as follows:

2.5.1.1 ***Planning and Regulatory***

(a) The Planning team within Council provides a range of resource management services in accordance with statutory obligations set out in the RMA.

(b) The Building Control team issues formal approval confirming that the proposed building work, based on the plans and documentation provided, complies with the New Zealand Building Code, Building Act 2004, and Building Regulations.

2.5.1.2 ***Service Delivery***

(a) This group within Council owns and manages a number of infrastructure assets including water, wastewater, stormwater, local road networks, parks and reserves and community facilities.

2.5.1.3 ***Development Engineering***

(a) This department provides a single point of communication on behalf of the Service Delivery owners to help facilitate seamless development engineering services and outcomes.

2.5.2 Specifically these groups look after the following matters:

2.5.2.1 ***Planning and Regulatory (Planning and Building Control teams)***

(a) Manages the resource consent process;

(b) Provides strategic and policy guidance;

(c) Processes and issues subdivision and landuse consents;

(d) Monitors and enforces conditions on landuse and subdivision consents;

(e) Coordinates the engineering design clearance process;

(f) Manages the 223 Certification process;

(g) Manages the 224(c) Certification process;

(h) Manages the issue of other subdivision certificates if required; and

(i) Manages the post-consent processes (the collection {and refund} of any bonds to be held) if required.

2.5.2.2 ***Service Delivery (Asset Management)***

(a) Advises the planning, building and development engineering teams on appropriate engineering and reserve requirements as part of the consent application process;

(b) Audits the engineering and landscape plans;

(c) Audits the physical work; and

(d) Advises the planning team of the issue of the practical completion certificate as part of the 224(c) certification process.

2.5.2.3 ***Development Engineering***

(a) Enforces the standards within the Manual as the "owners" of the Manual on behalf of Council;

(b) Administers this Manual, and acts as agent for Council's various service delivery units in respect of the setting of resource consent conditions for infrastructure and the subsequent acceptance of infrastructural assets; and

(c) Provides solutions acceptable to the asset owners, where there can be conflicts between the desire for project certainty, changing best practice needs for infrastructure, timing and the availability of capital.

2.6 Other Statutory Requirements

2.6.1 The provisions of these volumes shall be read subject to any applicable statutes, regulation, and bylaws, including the following and their amendments:

2.6.1.1 *Council bylaws*

- Traffic and Stock Droving Bylaw 2012
- Trade Waste Bylaw 2011
- Wastewater Drainage Bylaw 2011
- Cemeteries Bylaw 2007
- Fire Control Bylaw 2011
- Refuse Collection and Disposal Bylaw 2007
- Maungatautari Scenic Reserve Bylaw 2007
- Control of Signs and Sale of Goods Bylaw 2007
- Public Places Bylaw 2007
- Land Drainage and Stormwater Bylaw 2008
- Water Supply Bylaw 2013
- Public Places Liquor Control Bylaw 2008
- Dog Control Bylaw 2009
- Speed Limits Bylaw 2012

2.6.1.2 *New Zealand legislation*

- Resource Management Act 1991
- Local Government Act 1974
- Local Government Act 2002
- Health and Safety in Employment Act 1992 and associated regulations
- Electricity Regulations 1997, handbook to the electricity regulations
- Electricity Act 1992
- Soil Conservation and River Control Act 1941
- Land Transfer Act 1952
- Unit Titles Act 2010
- Cadastral Survey Act 2002
- Property Law Act 1952
- Utilities Access Act 2012

2.6.1.3 *New Zealand standards*

- NZS 1260:2009 - PVC-U Pipes and Fittings for Drain Waste and Vent Applications
- NZS 3104:2003 + A1 & 2 – Specification for Concrete Production
- NZS 3109:1997 + A1 & 2 – Concrete Construction
- NZS 3114:1987 – Specification for concrete surface finishes
- NZS 3116:2002 + A1 – Concrete Segmental and flagstone paving

- NZS 3122:2009 + A1 – Specification for Portland and blended cements
- NZS 3602:2003 – Timber and wood-based products for use in building
- NZS 3910:2003 – Conditions of Contract for Building and Civil Engineering Construction
- NZS 4121:2001 - Design for Access and Mobility – Buildings and Associated Facilities
- NZS 4402:1986 – Methods of Testing Soils for Civil Engineering Purposes
- NZS 4404:2010 – Land Development and Subdivision Infrastructure
- NZS 4407:1991 – Methods of Testing Road Aggregates
- NZS 4431:1989 + A1 – Code of Practice for Earth Fill for Residential Development
- NZS 4442:1988 – Welded Steel Pipes and Fittings for Water Sewage and Medium Pressure Gas
- NZS 5414:1977 – Specification for the construction of Traffic Signs
- SNZ/PAS 4509:2008 – New Zealand Fire Service fire fighting water supplies Code of Practice
- AS/NZS 1158 – Lighting for roads and public places [set]
- AS/NZS 1170 – Structural Design Actions [set]
- AS/NZS 1254:2010 – PVC-u pipes and fittings for stormwater and surface water applications
- AS/NZS 1477:2006 – PVC pipes and fittings for pressure applications
- AS/NZS 2032:2006 + A1 – Installation of PVC pipe systems
- AS/NZS 2033:2008 + A1 & A2 – Installation of Polyethylene pipe systems
- AS/NZS 2053.1:2001 – Conduits and fittings for electrical installations
- AS/NZS 2280:2004 + A1 – Ductile Iron pipes and fittings
- AS/NZS 2312:2002 – Guide to Protection of Structural Steel against atmospheric corrosion by use of protective coatings
- AS/NZS 2566.1:1998 + Supplement 1 - Buried Flexible Pipelines – Structural Design
- AS/NZS 2566.2:2002 – Buried Flexible Pipelines – Installation
- AS/NZS 2638.1:2011 – Gate valves for waterworks purposes – Metal Seated
- AS/NZS 2638.2:2011 – Gate valves for waterworks purposes – Resilient Seated
- AS/NZS 2845.1:2010 – Water supply – Backflow prevention devices – Materials, design and performance requirements
- AS/NZS 3000:2007 – Electrical Installations
- AS/NZS 3725:2007 – Design for installation of buried concrete pipes
- AS/NZS 3845:1999 – Road safety barrier systems
- AS/NZS 4058:2007 – Precast Concrete Pipes (pressure and non-pressure)
- AS/NZS 4087:2011 – Metallic flanges for waterworks purposes

- AS/NZS 4130:2009 – Polyethylene (PE) pipes for pressure applications
- AS/NZS 4158:2003 – Thermal-bonded polymeric coatings on valves and fittings for water industry purposes
- AS/NZS 4441:2008 – Oriented PVC (PVC-o) pipes for pressure applications
- AS/NZS 4671:2001 + A1 – Steel reinforcing materials
- AS/NZS 4676:2000 – Structural Design requirements for Services Utility Poles
- AS/NZS 4677:2010 – Steel Service Utility Poles
- AS/NZS 4701:2000 – Requirements for domestic electrical appliances and equipment for reconditioning or parts recycling
- AS/NZS 4765:2007 – Modified PVC (PVC-m) pipes for pressure applications
- AS-NZS 5000.2:2006 – Electric cables – Polymeric insulated for working voltages up to and including 450/750 V
- AS/NZS 5065:2005 + A1 – Polyethylene and Polypropylene pipes and fittings for drainage and sewerage applications
- AS/NZS 670598 – Luminaires for Road and Street Lighting
- AS 1111.1:2000 – ISO metric hexagon commercial bolts and screws
- AS 1112.1:2000 – ISO metric hexagon nuts – Style 1 – Product grades A and B
- AS 1141.32:1995 – Australian Weak Particles Test
- AS 1579:2001 – Ace-welded steel pipes and fittings for water and wastewater
- AS 1628:1999 – Water supply – metallic gate, globe and non-return valves
- AS 1646:2007 – Elastomeric seals for waterworks purposes
- AS 1741:1991 – Vitrified Clay Pipes and Fittings with Flexible Joints
- AS 1744:1975 – Forms of letters and numerals for road signs
- AS 2129:2000 – Flanges for pipes, valves and fittings
- AS 3996:2006 – Requirements for access covers and grates
- AS 4794:2001 – Non-return valves – swing check and tilting disc
- NZS/BS 970.1:1991 + A1 – Specification for wrought steels for mechanical and allied engineering purposes
- BS 381C:1996 – Specification for colours for identification, coding and special purposes
- BS 499–1:2009 – Welding terms and symbols. Glossary for welding, brazing and thermal cutting
- BS 499–2C:1999 – Welding terms and symbols. European arc welding symbols in chart form
- BS 2971:1991 – Specification for class II arc welding of carbon steel pipework for carrying fluids

- BS 4607–1:1984 + A2:2010 – Non-metallic conduits and fittings for electrical installations. Specifications for fittings and components of insulating materials
- BS 7626-1:2011 – mechanical vibration and shock. Experimental determination of mechanical mobility. Basic terms and definitions and transducer specifications
- BS EN 295 – Vitrified clay pipes and fittings and pipe joints for drains and sewers
- BS EN 60998-1:2004 – Connecting devices for low-voltage circuits for household and similar purposes. General requirements

2.6.1.4 ***New Zealand Regulation and Code of Practices'***

- National Code of Practice for Utilities Access to the Transport Corridors 2011
- NZTA Code of Practice for Temporary Traffic Management 2012
- Code of Practice for Electrical Safe Distances NECP34:2001

2.6.2 The **minimum** separation distances between buildings, structures and earthworks outlined in the New Zealand Code of Practice for Electrical Safe Distances NZECP34:2001 for overhead power lines shall be maintained at all times.

2.7 Requirements of Authorities Other Than Council

2.7.1 In addition to Council, bodies or persons that may require to be consulted in respect of any proposed development or subdivision of land, particularly at *the concept plan or scheme plan* stage include, but may not be limited to:

- NZ Transport Agency
- The Waikato Regional Council
- The New Zealand Police (Traffic Safety Section)
- Heritage New Zealand
- The New Zealand Fire Service
- Network Utility Operators
- Tangata Whenua
- Waikato River Authority
- Ministry of Health - Drinking-water Standards for New Zealand 2005 (Revised 2008)

2.8 Manual Control

2.8.1 The Manual is a controlled document for quality management purposes.

2.8.2 The Manual is available externally in read-only format on Council's website and/or in hard-copy format. Hard copies can be purchased at a cost to be advised by submitting a completed order form to:

Waipa District Council
Development Engineering
Private Bag 2402
Te Awamutu 3840

2.8.3 All controlled hard copy Manuals are numbered and are issued to, and recorded as being held by, a single person/position title who is deemed to be responsible for future maintenance of the document.

2.8.4 Any holder of a hard copy of the Manual may allow copies of volumes, or all of the Manual to be copied, provided each page is clearly marked "uncontrolled copy".

2.8.5 Manual revision procedures

2.8.5.1 To ensure the Manual can function as a live document, it is administered pursuant to the Local Government Act 2002. Reviews and updates are authorised by resolution of Council.

2.8.6 Suggesting improvements

2.8.6.1 Any user of the Manual has the ability to submit an "Opportunity for Improvement" form (OFI) to Council where they feel that there is something in the Manual that could be improved (see OFI below). All OFI's will be considered annually by Council at the time of document review. The Manual will either be revised, or the OFI originator advised that no action will be taken, and the reasons why.

2.8.6.2 For a copy of the OFI form please call the Development Engineering department on 0800 924 723 or refer to the end of the Manual.

2.8.6.3 The following flowchart outlines the standard OFI/amendment/update procedures.

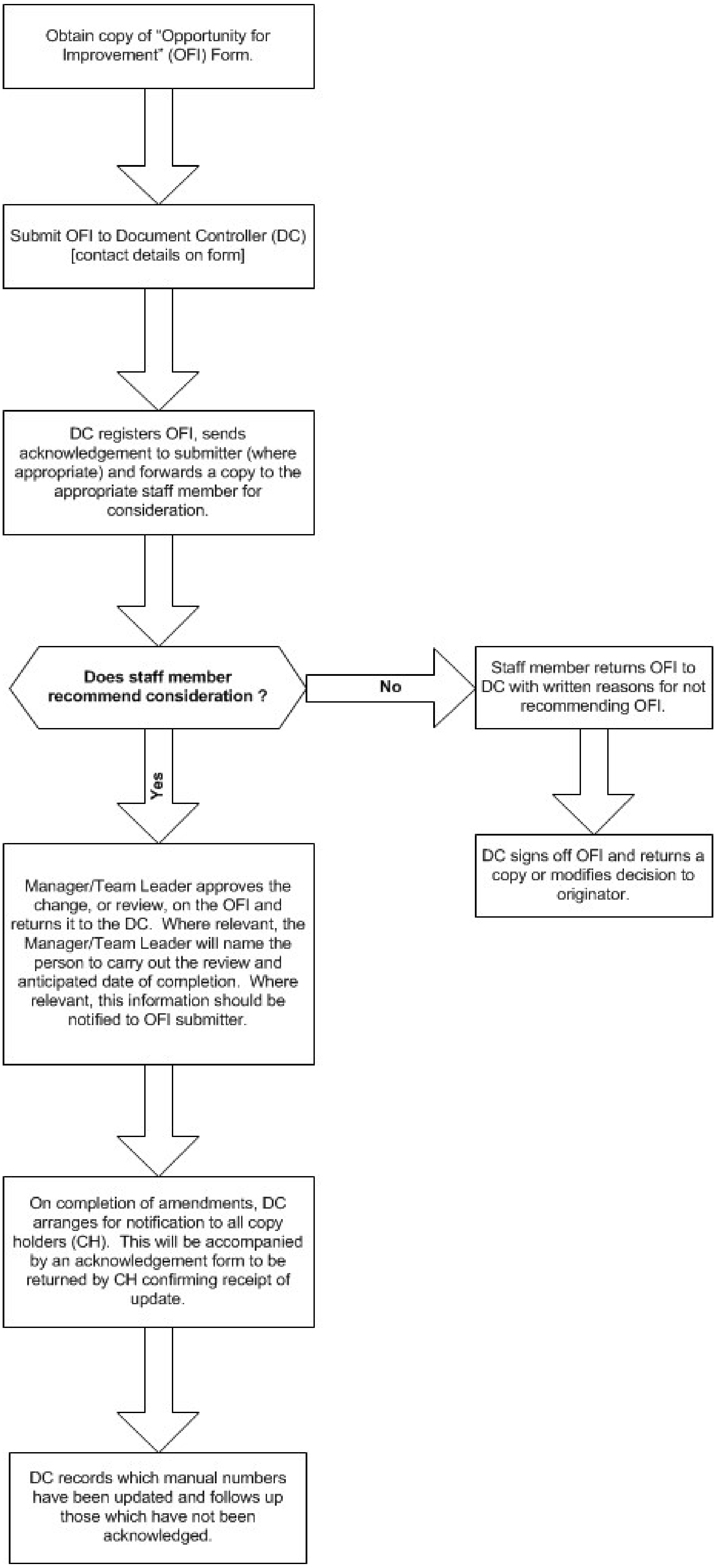


Figure 2: General OFI/amendment update procedure

2.9 The Manual with Reference to Land Development Engineering Standards elsewhere in the Waikato Region

2.9.1 There has been, and there continues to be, close collaboration between Council and the other councils in the Waikato Region. This collaboration recognises the fact that a significant portion of the region functions as a single market in land development. This is particularly the case at the sub-regional level (Waipa, Hamilton City, Waikato, Matamata-Piako, Otorohanga, Waitomo and Hauraki districts), where many land developers, contractors, resource management practitioners, engineers, surveyors and other professionals often provide their services to the market on a district basis.

2.9.2 Interpretation

2.9.2.1 In this Manual, unless inconsistent with the context, the following shall apply:

(a) ***Applicant/Consent Holder*** means the person or company that submits the fully completed application to Council for the purposes of receiving Council's consent to subdivide or develop land.

(b) ***Asset Manager/Activity Manager*** means:

(i) The person employed by Council who is responsible for managing the delivery of an activity to the community; and

(ii) The person employed by Council who is responsible for the management of Council owned infrastructural assets utilised to deliver the activity respectively.

(c) ***Contractor*** means the company/person engaged to undertake the physical works.

(i) In the case of industrial and urban land development, the Contractor shall be responsible to the Developer.

(ii) In the case of works constructed by Council, the Contractor's responsibility shall be defined by the general Conditions of Contract for the works.

(d) ***Council*** means Waipa District Council, or an authorised representative of the Waipa District Council.

(e) ***Developer*** means the company or person who has been granted or holds resource consent for the development.

(f) ***Developer's Representative*** means the person or persons appointed by the Developer to represent them.

(g) ***Engineer*** has a different meaning depending on the party relationships involved in the works:

(i) Where the work is being carried out as part of a subdivision or development, Engineer (or Surveyor) means a person suitably qualified and experienced to carry out the subdivision and development works and holds the necessary professional indemnity insurance cover for the area of practice to the level required by Council.

(ii) Where the work is being carried out as a direct contract to Council, then Engineer has the meaning as set out in NZS 3910:2003 – Conditions of Contract for Building and Civil Engineering Construction.

(h) ***Geotechnical Engineer*** means a person who has professional experience in soils engineering and a Professional Indemnity Insurance Policy acceptable to Council.

(i) ***Means of Compliance*** means a method by which the requirements of the Waipa District Plan may be complied with. It implies that there may be other methods which may meet the requirement, but which may be subject to specific consideration or approval.

(j) ***New Zealand Transport Agency Specifications*** where the New Zealand Transport Agency (NZTA) Specifications are referred to in the Manual and the Specification is not dated, then the NZTA Specifications that become current three (3) calendar months prior to the date of the commencement of on-site construction of the development shall be used. All references to either the basis of payment or maintenance period contained within the NZTA Specifications are deleted.

(k) ***Owner*** means the owner of the land being subdivided or developed.

(l) ***Resource Consent*** has the same meaning as in the Resource Management Act 1991.

(m) ***The Works*** shall generally be defined as the works for which this specification is being used and shall have the definition of “Contract Works” as defined in NZS 3910:2003.

(n) ***Waipa District Plan*** meaning either the Operative and/or Proposed Plan as applicable.

2.9.3 Abbreviations

2.9.3.1 ***DC (Document Controller)*** within the Development Engineering Department.

2.9.3.2 ***LESD*** means Landscaping of Engineering Stormwater Devices.

2.9.3.3 ***LGA*** means the Local Government Act 2002.

2.9.3.4 ***NZTA*** means New Zealand Transport Agency (NZTA).

2.9.3.5 ***P & R*** means Parks and Reserves team of Council.

2.9.3.6 ***RMA*** means the Resource Management Act 1991.

2.9.3.7 ***The Manual*** means the Waipa District Development & Subdivision Manual.

2.9.3.8 ***Waipa 2050*** means Waipa District Growth Strategy 2050.

Waipa
DISTRICT COUNCIL

Volume 1

SUBDIVISION AND LAND USE PROCESSES

Table of Contents

Part 1: Planning

1.1 Information to Users

1.1.1 This volume is intended to guide prospective developers, applicants and their agents in understanding:

1.1.1.1 The integrated development and subdivision approach within Waipa District.

1.1.1.2 The requirements of Council for the management of physical works to meet conditions of consent.

1.1.1.3 The responsibilities of the two parties, recognising that land development and subdivision is an agreement between Council and the Applicant.

1.1.2 Any Applicant should also refer to Council's application forms and information sheets for the information requirements for applications, assessment of environmental effects, consultation, etc.

1.2 Integrated Development and Subdivision

1.2.1 The District Plan is requiring a new approach to future development and subdivision - known as integrated development and subdivision. This is a process that takes place primarily within resource consent applications to ensure a holistic approach is followed. It does not replace any statutory steps within the resource consent process. It does, however, contribute to the resource consent application meeting the strategic requirements of Council.

1.2.2 Integrated development and subdivision requires a holistic (multi-disciplinary and collaborative) approach and it necessitates:

1.2.2.1 Working within the opportunities and constraints of a site, and its neighbourhood in a low impact manner.

1.2.2.2 An emphasis on design to achieve:

(a) Connectivity for a variety of transport modes within a development as well as the neighbourhood;

(b) Safe places and neighbourhoods;

(c) Sustainable use of resources;

(d) Energy efficient living; and

(e) Open space, which provides for the protection of existing features and a range of accessible park sizes.

1.2.3 Key steps

1.2.3.1 The following key steps list outline the processes that are needed to be followed to achieve integrated development and subdivision within the Waipa District.

1.2.3.2 For ease of understanding, the key steps, and associated diagram (Figure 3: Integrated development) have been developed in a linear fashion; however, it is acknowledged that most development rarely happens in this straightforward way. Therefore reviewing all the elements of the integrated development process, and consulting with Council is recommended at the earliest stages of considering a project.

1.2.3.3 The key steps are:

(a) Strategic context;

(b) Project feasibility;

(c) The Development and Subdivision Manual;

(d) Servicing constraints;

(e) Site suitability;

(f) The District Plan;

(g) Preparation of application;

(h) Site and neighbourhood analysis tool;

(i) Consultation;

(j) Development principles;

(k) Finalise application;

(l) Subdivision and/or landuse processing; and

(m) Monitoring.

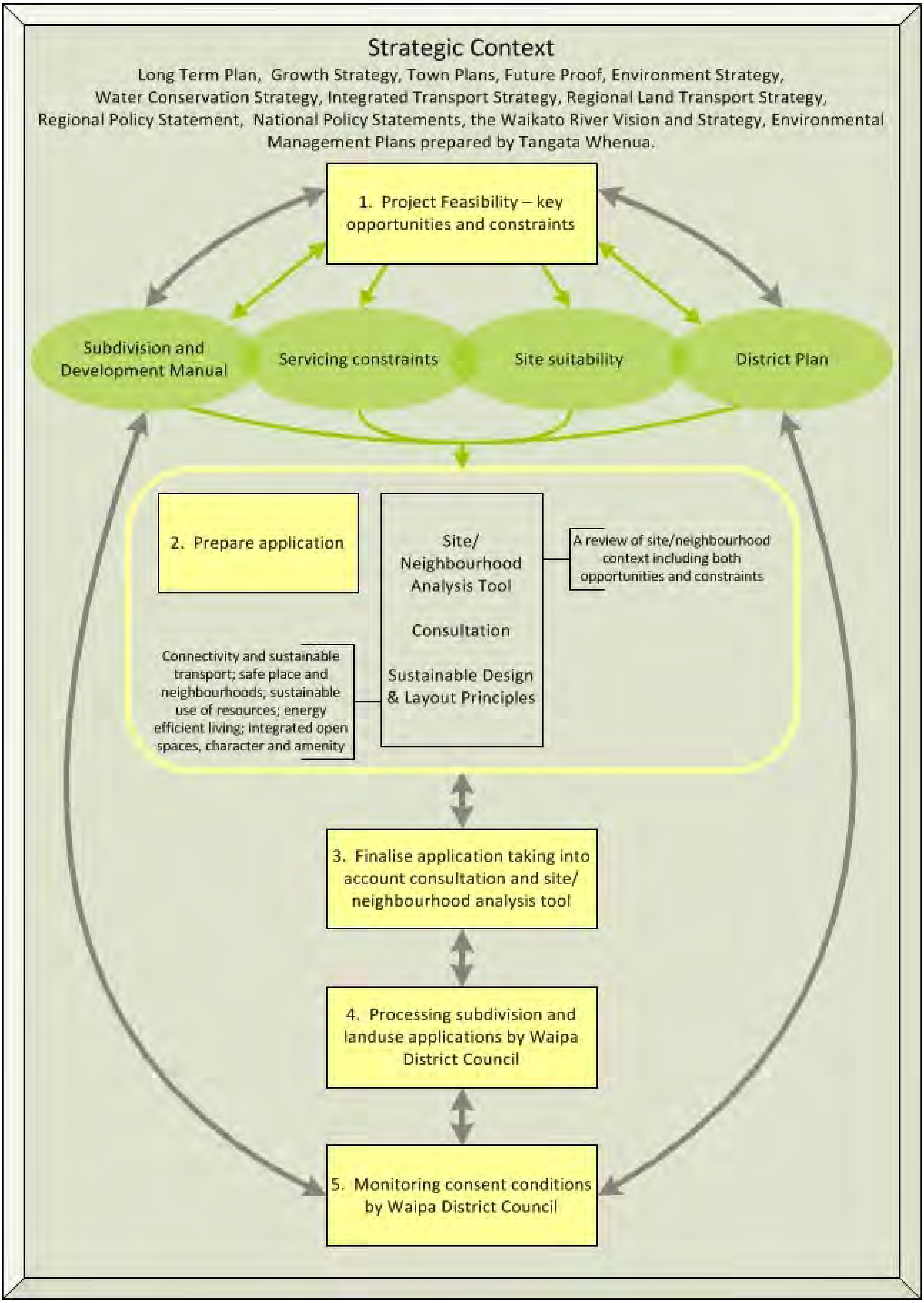


Figure 3: Integrated development

1.3 Strategic Context

1.3.1 National Policy Statements

1.3.1.1 National Policy Statements (NPS) are instruments available under the RMA to help councils decide how competing national benefits and local costs should be balanced. Applicants should ensure that their applications give regard to any NPS that may be relevant to their application.

1.3.2 Regional Policy Framework

1.3.2.1 The Waikato Regional Council is responsible for the Regional Policy Statement (RPS), the Regional Land Transport Strategy (RLTS), and the Waikato Regional Plan. The Proposed RPS contains direction on development and subdivision in the region. It seeks to promote a planned and co-ordinated approach to future development, and contains specific requirements that need to be given effect to both through the preparation of district plans and the processing of resource consents. The Waikato Regional Plan contains consent requirements related to air and water discharges, water take, and earthworks that may be applicable to the proposed development and subdivision.

1.3.2.2 Another key component of the regional planning framework is the Waikato River Vision and Strategy and the Waipa River Accord. The Waikato River Vision and Strategy requires a proactive approach to be taken to restoring the values of the Waikato River. The Waikato River Vision and Strategy form part of the Proposed RPS and is to be implemented through regional plans, district plans, and any (not mandatory) Waikato-Tainui environmental plans. Council must have regard to the Waikato-Tainui environmental plan when considering an application for resource consent under section 104 of the Resource Management Act, where the consent authority considers the Waikato-Tainui environmental plan relevant and reasonably necessary to determine the application.

1.3.2.3 The District Plan has anticipated the strategy, however, future changes to the District Plan may be required as part of the Joint Management Agreements that form part of the Treaty Settlement process.

1.3.3 The challenges

1.3.3.1 Future development and subdivision in the Waipa District will occur in a context full of opportunities and challenges. Council has undertaken a strategic planning project called 'Waipa 2050'. The project provides strategic direction on how future challenges can be met in a proactive way, while protecting what is special about the District. Key concerns identified as part of the Waipa 2050 project include:

(a) Protecting the unique character and heritage of the district;

(b) Providing local jobs;

(c) Providing infrastructure to service the growing population;

(d) Retaining and supporting the rural and equine economy;

(e) Retaining the landscapes, biodiversity and rivers; and

(f) Implementing and providing for the Waikato River Vision and Strategy and the Waipa River Accord.

1.3.4 Resolving the challenges: strategic planning

1.3.4.1 A number of strategic planning documents seek to provide guidance on how the District can resolve these challenges in a proactive way. A growth management approach has been developed in the Waipa 2050 District Growth Strategy 2009 and is consistent with the regional framework of the Future Proof Growth Strategy and Implementation Plan 2009. These documents collectively allocate future staged growth within the Waipa District and the Waikato Region.

1.3.4.2 Further direction on the vision and outcomes contained in Waipa 2050 is provided through:

(a) Town Concept Plans developed collaboratively with local communities in Cambridge, Te Awamutu and Kihikihi, Pirongia and Ohaupo, which provide a 'blueprint' for responding to future growth demands in a manner that respects existing character. This is achieved by identifying gateways, views, and vistas, indicating the location of future land uses; and street, cycle, and walkway connections. Direction is also given to the character of public spaces such as streets, and to the design of main streets.

(b) The Waipa Integrated Transport Strategy identifies the transport outcomes for the District, and the contribution that the district makes to regional transport outcomes. An important element of the strategy is the promotion of walking and cycling as an alternative transport option to the motor vehicle.

(c) The Four Waters Strategy outlines the steps that are to be taken to improve the District's water conservation methods.

1.3.4.3 Many of these directions are embedded into the District Plan as outcomes sought as part of the development, subdivision, and building processes. Some of the identified outcomes require support from other agencies, for example bus services, which are funded by the Waikato Regional Council.

1.3.5 Resolving the challenges: funding

1.3.5.1 Council funding cycle has a direct impact on where and when growth and development can occur within the District. Council's Long Term Plan (10-Year Plan) guides Council's planning and decision-making on a ten-year cycle, and also allocates future spending. This funding is refined every year through the Annual Plan process. Any development or subdivision that depends on significant spending, for example the installation of water treatment works, must be aware of these funding cycles.

1.3.5.2 Collectively these documents influence many matters, including the future location of subdivision and development and the funding of a wide range of infrastructure. This strategic context is part of the District Plan, in particular the Strategic Policy Framework section of the District Plan, that directly guides development and subdivision and forms one of the basis on which all development is regulated and consented.

1.4 Project Feasibility; Development and Subdivision Manual, District Plan, Servicing Constraints, Site Suitability

1.4.1 The feasibility of a development or subdivision project is dependent on a range of factors including:

(a) The objectives, policies and rules in the Waikato Regional Plan;

(b) The objectives, policies and rules in the Waipa District Plan;

(c) The **minimum** standards within this Manual;

(d) Any servicing constraints that are applicable to the site; being either; the ability to connect into existing systems, constraints within the existing systems themselves, or the timing of funding and installation of significant pieces of infrastructure, to support future growth. Council's asset managers will be able to advise of any known constraints;

(e) The requirement for reserves; and

(f) The suitability of the site itself to physically allow the type of development (giving regard to such matters as soils on the site, natural hazards – flooding, erosion, slope, areas of fill etc.).

1.4.2 When all these matters have been examined, and the proposal continues to exhibit potential, the next steps in the process are to undertake a site and neighbourhood analysis and start the design process by applying the sustainable design and layout principles. It is noted that some elements of this may have been undertaken in the above process. These two steps will form the integral elements of any consent and will contribute to the project meeting the objectives, policies, and rules of the District Plan and the requirements of this Manual.

Excerpt from Proposed Waipa District Plan

1.5 Prepare Application

1.5.1 Site and neighbourhood analysis tool

1.5.1.1 In order to design a subdivision or development that has the qualities outlined in the development principles, a comprehensive analysis of the site and its surroundings is necessary. This is best undertaken prior to designing the layout. The site and neighbourhood analysis tool encourages a detailed examination of all elements of the site and adjacent neighbourhood, and builds the basis for understanding the constraints and opportunities of the site, in light of the development proposed. This will enable the development to take advantage of the natural and historical features of the site and relate well to its context. A pictorial summary of the elements to capture in the analysis are contained below (Figure 4: Site analysis and Figure 5: Wider area analysis). It is noted, however, that this is a guide only to the elements that may be studied.

CASE STUDY – Site Analysis

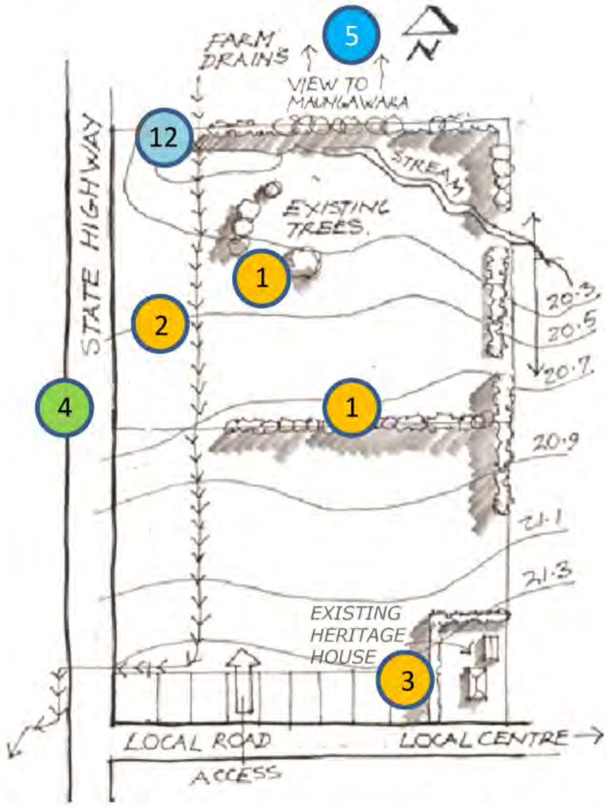


Figure 4 – (For the wider context and location refer to Figure 5 - site shown shaded)

Design Criteria derived from a contextual analysis:

1 Try to retain existing trees and parts of shelter belt.

2 Retain farm drain / water race (i.e. existing farm drain could form the basis of a swale network for managing stormwater on site).

3 Incorporate existing heritage house into new subdivision – the setting of the house needs to be respected.

4 Access site off the local road. The location of this access will need to be set back from the junction with the State Highway.

5 Provide views to significant landscape elements beyond the site from within the subdivision i.e. Maungawaka. Consider laying out streets in North–South direction to maintain views.

6 Enable easy access for new residents to dairy and local centre.

7 Provide pedestrian / cyclist link from the State Highway through the site, to give access to bus stops and a short cut for cyclists going to/from school.

8 Provide road link to existing cul-de-sac head in south east corner.

9 Provide a road to the eastern boundary to enable connection to residentially zoned land to east.

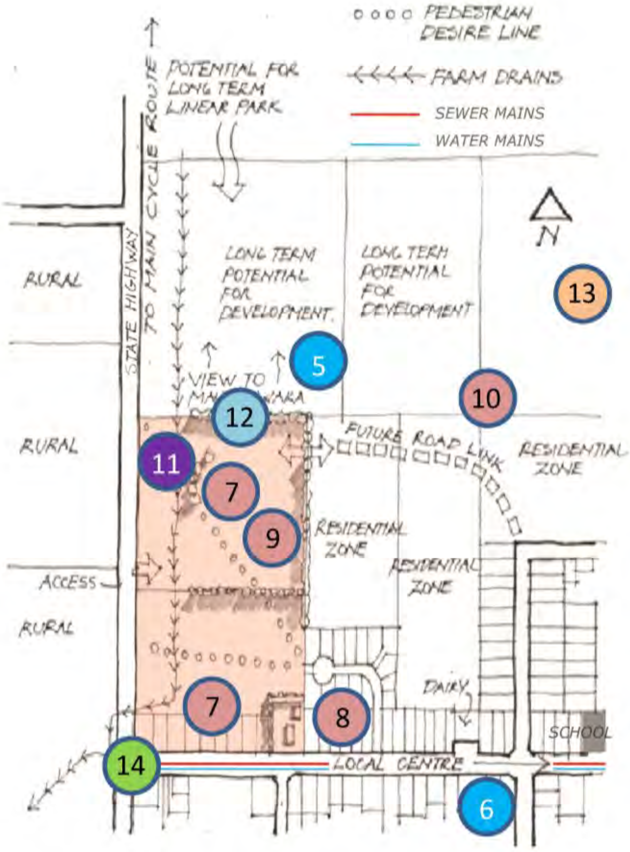
10 Allow for potential long term road connections to land to the north.

Figure 4: Site analysis

Excerpt from Proposed Waipa District Plan

CASE STUDY – wider area analysis

Note: this page to be read in conjunction with previous drawing



11 Local reserve required on site (get advice from Waipa District Council). Locate reserve to enable future extension to the north.

12 Stormwater detention pond and revegetated stream near the northern boundary, due to topography and amenity benefits. Use stormwater run-off for irrigation via underground storage.

13 Consult with tangata whenua regarding the existing archaeological site.

14 Consideration needs to be given to the requirement to upgrade intersections to cater for an increased traffic flow.

Adopted with permission from Selwyn District Council from the Design Guide for residential subdivision in the urban living zones – September 2009

Figure 5: Wider area analysis

1.5.1.2 When this information has been gathered, it will contribute towards the design and layout of the development. Resource consents submitted to Council will need to demonstrate how the site analysis tool has been taken into account in the development or subdivision. Another key element to consider as part of the design process, are the sustainable design and layout principles that are contained within the District Plan and are outlined below.

1.5.2 Sustainable design and layout principles

1.5.2.1 This integrated approach requires new ways of designing developments. Council has summarised this approach in the following set of design and layout principles.

1.5.2.2 ***Connectivity and sustainable transport:***

(a) Use of grid patterns or similar layouts to maximise connectivity and minimise movement times.

(b) Road and access way designs that are safe and reflect the key existing characteristics of places such as road widths, berm widths and trees.

(c) Provide for road connections to existing areas of development and future growth areas that support the road hierarchy.

(d) Provide for pedestrian and cycle routes and links within developments and to existing and future growth areas.

(e) Existing transport networks at the time of upgrade are retrofitted with cycling and walking opportunities.

(f) Provision for future bus routes and stops.

1.5.2.3 ***Safe places and neighbourhoods:***

(a) Passive supervision of parking areas and public spaces such as reserves and walkways.

(b) Reserve areas with street frontages.

(c) Block and lot layouts that ensure future dwellings have street frontage.

(d) Safe and accessible routes to school, shops and community facilities that are attractive and safe.

(e) Consideration of lighting and how it affects safety.

(f) Building designs which provide for easily identifiable access and egress points.

1.5.2.4 ***Sustainable use of resources:***

(a) Utility systems and networks that have regard to the sustainability of the 'life cycle' of the utility including materials selection, on-going energy and maintenance costs and renewal cycles.

(b) Sustainable drainage strategies including minimising impermeable surfaces, soak pits, swales, retention ponds.

(c) Water conservation methods such as rain harvesting/water tanks.

(d) Retention of natural landforms by minimising earthworks.

1.5.2.5 ***Energy efficient living:***

(a) Sites that are orientated to maximise passive solar gain from the north.

Excerpt from Proposed Waipa District Plan

(b) Provision for local and neighbour centres.

(c) A mix of housing densities including compact and low density.

(d) Average walking time of 5-10 minutes to local amenities, including shops, kindergartens and as far as achievable primary schools.

1.5.2.6 ***Open space***, which provides for:

(a) Protection of natural waterways, existing areas of significant vegetation including mature trees.

(b) Maintaining vistas to existing natural landforms.

(c) Reinforcement of the ecological corridors identified on the planning maps.

(d) A range of park sizes which are highly accessible and have street frontages.

1.5.2.7 ***Development that maintains or enhances character and amenity:***

(a) Implements the Town Concept Plans 2010.

(b) Avoids reverse sensitivity effects.

Advice Note: The Town Concept Plans outline key elements of existing character and amenity. Ways in which the principles can be achieved are described and illustrated within the Town Concept Plans including strategic road connections, cycle and pedestrian routes and locations as well as the proposed location of local and neighbourhood centres. Conceptual layouts for future growth areas are also provided.

1.5.3 Consultation

1.5.3.1 Dependant on the nature of the project and its consistency with the District Plan, it may be necessary to undertake consultation with parties that are potentially affected by the proposal. Those affected by the proposal are not just limited to the owners or occupiers of neighbouring sites and may include statutory bodies such as the Waikato Regional Council, the Waikato River Authority, Tangata Whenua, Historic Places Trust, etc.

1.5.3.2 The advice of Council planning staff should be sought in the earliest instance as to those parties that may be potentially affected by the proposal. The proposal may require modification based on the outcomes from consultation.

1.5.4 Finalising application/s for lodgement

1.5.4.1 It is expected that the finalising of an application will be an interactive process between the Applicant and Council, and again, may involve meeting with relevant Council staff, prior to lodgement.

1.5.4.2 If the above steps have been followed, the processing of an application should be quite straightforward. However, if an application does have to be publicly notified this is a longer, more complex process.

1.6 Monitoring

1.6.1 The monitoring of the implementation of consent conditions ensures that Council is getting it right, not just by the Applicant implementing their conditions, but also that the projects on the ground will be working together to collectively produce the outcomes anticipated by the District Plan.

1.6.2 Council looks forward to a productive relationship with its development community as we work together on integrated development and subdivision proposals.

1.7 Compliance with Consent Conditions

1.7.1 Financial contributions/development contributions

1.7.1.1 Council may levy financial and/or development contributions on any development or subdivision in the Waipa district.

1.7.1.2 Financial contributions, where applicable, are payments in land and/or cash that are assessed in accordance with Council's District Plan. They are based on adverse environmental or resource management effects and can include contributions towards the cost of infrastructure, in the absence of an alternative compensation mechanism such as development contributions. Financial contributions, where applicable, are quantified in resource or building consent conditions, including the settlement/payment timetable.

1.7.1.3 Development contributions, where applicable, are payments in land and/or case that are assessed for each relevant service/activity in accordance with Council's development contribution policy. They are based on the increased demand placed on Council owned infrastructure by any development. Development contribution settlement and payment requirements are quantified in accordance with the Development Contribution Policy. For most developments the required development contributions will be advised in a Development Contribution Notice accompanying a resource or building consent. These notices may be reviewed periodically in accordance with the development contributions policy.

1.7.1.4 The Development Contribution Policy also provides for development agreements to be used to set out the basis for quantifying the arrangements for assessing and paying financial and/or development contributions for extended timeframes and/or multi-faceted developments.

1.8 223 Certification (refer Section 223 of the Resource Management Act 1991)

1.8.1 The Applicant shall submit a Section 223 survey plan to the Planning and Regulatory Department for approval. Council will consider this plan and ensure that it is accurate and complies with the requirements of the District Plan and Resource Consent approval and conditions. This plan must be prepared by a Licensed Cadastral Surveyor using Land Online e-survey.

1.9 Road Names & Numbering

1.9.1 Road Names

1.9.1.1 Council has a statutory responsibility for naming and renaming roads within the District, including road types. Where Council receives a request to name a road and the proposed name is listed in the Approved Road Name Register and the location is appropriate, then the request will be referred to Council for a decision. Names not listed in the register must go through a consultation process and supporting rationale for the proposed name must be submitted. The Applicant shall submit proposed road names with the Resource Consent application, if possible. Proposed names must not be shown on any plans or figures until Council approval has been obtained. Road names must be submitted to Council prior to 223 Certification and approved by Council prior to 224 Certification. Copies of Council's Road Naming Policy and Register are available from Council.

1.9.2 Road Numbering

1.9.2.1 Council has a statutory responsibility under the Local Government Act, for allocating urban and rural property numbers. Council numbers in accordance with the national standard, AS/NZS 4819:2011, to ensure consistency and control within the District. Due to the Amalgamation of Te Awamutu and Cambridge Borough Councils in 1989, two numbering systems are used in the Waipa District. Te Awamutu, Kihikihi and Pirongia are numbered by measurement, as are all rural areas; Cambridge, Karapiro and Ohaupo urban are numbered sequentially. From time to time, Council has to take corrective action where mistakes and/or errors in numbering are identified.

1.10 224(c) Certification

1.10.1 Council will issue the 224(c) Certificate when it is satisfied that all Resource Consent conditions have been met and that all development contributions and/or financial contributions have been paid.

1.10.2 The 224(c) Certification is provided for under Section 224(c) of the RMA and is required by the District Land Registrar before the issue of titles for the newly created lots can proceed.

1.10.3 Requirements for 224(c) Application

1.10.3.1 The Applicant may apply for a 224(c) Certificate when:

(a) All works required to be carried out as conditions of the consent, are completed, or when Council considers a stage of "Practical Completion" (as defined below) is acceptable.

(b) In exceptional circumstances, Council may accept a bond proposal to cover the costs of completing work, however, a bond cannot be for the completion of essential work services or non-resource management reasons.

(c) All of the relevant quality checklists from Volume 4 have been submitted at the appropriate times during the course of the works, complete with all test certificates, all duly completed, and signed by the Engineer.

1.10.3.2 When applying for a 224(c) Certificate, the Applicant must submit the as-built plans and data information set out in each of the technical specifications of Volume 3, Parts 3, 4, 5, and 6 (roading, stormwater, wastewater and water supply infrastructure).

1.11 Completion & Practical Completion

1.11.1 "Practical Completion" is reached when Council is satisfied that the construction has progressed to a point where all weather access is available to each and every lot created and all essential infrastructure services are available for each and every lot.

1.11.2 Works that may remain to be completed at Practical Completion include:

(a) Final road surfacing;

(b) Topsoil and grassing of berms;

(c) Landscaping;

(d) Erection of signs; and

(e) Defects liability on all works.

1.11.3 "Completion" is when all works are fully complete and all defects that have arisen during the Defects Liability period have been corrected.

1.11.4 The Applicant shall not be liable for fair wear and tear during the defects liability period. Wear and tear generally means damage caused from normal and lawful use of the completed construction works.

1.12 Defects Liability Period

1.12.1 Works carried out during the subdivision development may be subject to a Defects Liability period of up to 12 months at the discretion of Council's relevant asset manager. The Defects Liability period shall commence from the date of issue of the 224(c) Certificate.

1.12.2 Any works that are completed after the date of the issue of the 224(c) Certificate may or will be subject to an extension of the Defects Liability period for 3 months following the completion of those delayed works.

1.12.3 Special conditions for Defects Liability apply to landscape works. Please refer to Volume 3, Part 7.

1.13 Bonds

1.13.1 In the event that the Applicant has proposed a bond and Council has accepted a bond process as part of the development or subdivision consent, this will be in strict accordance with Council's Bond Policy.

1.13.2 Upon request, Council's Planning and Regulatory and Development Engineering staff are able to advise of the instances when the application of this Policy would be acceptable.

Part 2: Physical Works Management

2.1 Developer's Responsibility

2.1.1 The Developer shall ultimately be responsible for all requirements and processes.

2.1.2 The Developer shall appoint a suitably qualified representative for:

(a) Interpreting the requirements of the Resource Consent.

(b) Submitting engineering plans and liaising with Council's staff throughout the engineering plan clearance procedure.

(c) Overseeing the physical works and certifying that the work has been completed to the required standards.

2.1.3 The Developer shall ensure competent professional expertise is engaged for the following work:

(a) Geotechnical investigation and reporting.

(b) Design of road works.

(c) Design of complex traffic facilities.

(d) Design and supervision of complex structures.

(e) Design of water supply.

(f) Design of stormwater disposal.

(g) Design of wastewater disposal.

(h) Design and installation of wastewater pumps.

(i) Design of landscaping.

(j) Supervising the construction of all works.

(k) Quality assurance and compliance monitoring.

2.2 Engineering Plans & Physical Works

2.2.1 Where a Resource Consent Application requires engineering design plans to be submitted for audit, it is the responsibility of the Developer to ensure this requirement is satisfied.

2.2.2 Figure standards

2.2.2.1 ***Size***

(a) Figures shall be A3 size and using the following scales:

(i)	Plan & Longitudinal Section	- Horizontal 1:1000, 1:500, 1:250
`		- Vertical 1:100, 1:50
(ii)	Cross Sections	- 1:100, 1:50

(b) In all cases, the plan size must be appropriate for the level of detail shown.

(c) In particular, use of 1:1000 scale is to be confined to site plans, and roading and water layout plans.

2.2.2.2 ***Number of sets of figures***

(a) Three hard copy sets of engineering plans shall be submitted to the Planning Guidance Manager to be audited by various units of Council.

2.2.2.3 ***Content of figures***

(a) *Locality Plan*

(i) Showing information sufficient to locate the subject site relative to existing features such as roads, already developed land, etc. All levels shall be in terms of Moturiki Datum.

(b) *Staging Plan*

(i) Where the development is likely to be constructed in stages, a plan showing the pattern and chronology of the land development shall be submitted. The staging should have been decided as part of the resource consent application process.

(c) *Earthworks and Silt Control*

(i) Plan View.

(ii) Original contours.

(iii) Final contours.

(iv) Overland drainage pattern.

(v) Cuts and fills.

(vi) Provisions for control of silt transportation.

(vii) Inclusion of any other “required” consents, e.g. WRC. or Land Use consent for earthworks.

(d) *Roading Plans*

(i) Plan View.

(ii) Horizontal alignment of kerb and channel including traffic facilities.

(iii) Horizontal alignment of road centre line.

(iv) Horizontal alignment of footpaths.

(v) Horizontal alignment of cycleway.

(vi) Location of vehicle crossings where known.

(vii) Location of catch pits, leads and manholes.

(viii) Location, type and colour of street light columns (may be separate plan).

(ix) Location of landscaping areas and street trees.

(x) Location of any reserve.

(e) *Roading Longitudinal Sections*

(i) Existing ground levels at minimum of 15m intervals.

(ii) Proposed final centreline levels.

(iii) Cuts and fill.

(iv) Grades.

(v) Vertical curve information.

(vi) Location of catch pits.

(vii) Location of intersecting roads.

(f) *Cross Sections*

(i) Proposed road.

(ii) Existing ground contour extending at least 3m into adjacent land.

(g) *Road Marking and Signage*

(i) Location and types of signage.

(ii) Location and alignment of all road markings.

(h) *Landscaping*

(i) Areas and species to be planted.

(ii) List of species.

(iii) Details and location of any hard landscaping.

(iv) Details on planting specifications.

(v) Maintenance schedule for weeding and replacement planting during Defects Liability Period.

Advice Notes:

1. Non-compliance in respect of landscape maintenance during the defaults maintenance period (12 months for landscaping) will be rectified by Council with the cost to be paid by the applicant prior to the release of the landscape maintenance bond.
2. Landscape maintenance performance will be monitored in accordance with Checklist 7.1 (Volume 4).

(i) *Detail Figures*

(i) Include figures of all standard details to be used in the physical works, such as kerb and channel profile, cobblestone laying patterns, typical cross section showing footpath, berms, kerb and channel, subsoil drainage, pavement layers and location of all services.

(j) *Stormwater*

(i) Plan View.

(ii) Horizontal alignment of all pipelines relative to property boundaries or kerb lines as appropriate.

(iii) Location of all manholes.

(iv) Location of all structures (including wetland/retention/sedimentation ponds).

(v) Location of any open drain.

(vi) Position of all property connections and the depth at the property boundary.

(vii) Secondary flow paths.

(viii) Site plan showing property boundaries, final contours (maximum 1m interval), and catchment and sub-catchment boundaries used in stormwater flow calculations together with label annotations providing a link to the stormwater runoff calculations. It is recommended the stormwater drainage system is shown on this figure as well.

(ix) Construction plan details for stormwater control structures; plan view to include contours at 0.5m interval and elevation view to show normal, discharge and overflow water levels.

(k) *Longitudinal Sections*

(i) Existing ground levels.

(ii) Proposed ground levels.

(iii) Manhole diameters, depths and lid levels.

(iv) Pipe depths, inverts, length and grade.

(v) Pipe type size and class.

(vi) Existing and proposed pipelines, cables, and ducts crossing the alignment.

(vii) Invert levels of all pipelines connecting to a manhole.

(l) *Wastewater*

(i) Plan view.

(ii) Horizontal alignment of all pipelines relative to property boundaries or kerb lines as appropriate.

(iii) Location of all manholes.

(iv) Location of all structures (including pump stations).

(v) Position of all property connections.

(vi) Show finished land level contours (not greater than 1m intervals – include RL labels on contours).

(m) *Longitudinal Sections*

(i) Existing ground levels.

(ii) Proposed ground levels.

(iii) Manhole diameters, depths and lid levels.

(iv) Pipe depths, inverts, lengths and grade.

(v) Pipe type size and class.

(vi) Existing and proposed pipelines, cables, and ducts crossing the alignment.

(vii) Invert levels of all pipelines connecting to a manhole.

(n) *Pump Station (including Rising Main and Overflow)*

(i) Show all relevant details to enable the design to be audited and the structure constructed.

(ii) Construction figure of pump station structure.

(iii) Rising main plan and longitudinal section (see Wastewater).

(iv) Water and electrical services to the pump station.

(v) Show the provision for pump station overflow in both plan and elevation views.

(o) *Water*

(i) Plan view.

(ii) Horizontal alignment of all pipelines relative to face of kerb (or boundary as appropriate).

(iii) Location of all valves.

(iv) Location of all hydrants and building sites to be provided with fire protection.

(v) Pipe type size and class.

(vi) Position of all property connections and the depth at the property boundary.

(vii) Location of all flushing valves.

(viii) Pipe depths where it is planned for the pipeline to be at a different depth to that specified in this Manual, Council's Development Manual. Long sections are required for pipelines of 250 NB and larger. The long section shall show existing and proposed pipelines, cables, and ducts crossing the alignment.

(ix) Long sections are required for pipelines of 250 NB and larger. The long section shall show existing and proposed pipelines, cables, and ducts crossing the alignment.

2.2.3 Supporting Documentation

2.2.3.1 *Geotechnical information*

(a) Where required by Council, a report from a professional advisor experienced in geotechnical matters (and having a policy of Professional Indemnity Insurance acceptable to Council), detailing the ground conditions and an opinion on the suitability of the land for the purpose proposed, shall be obtained.

2.2.3.2 *Roading*

(a) Road pavement design calculations including results of preliminary soil testing.

2.2.3.3 *Stormwater drainage*

(a) Detailed catchment runoff calculations showing the formula input factors used in the calculations for each sub-catchment.

(b) Detailed pipeline flow capacity analysis.

(c) For stormwater control devices, detailed analysis demonstrating the design performance in respect of stormwater quantity and quality as appropriate. Detailed design of overland flow paths, channels and capacities.

2.2.3.4 ***Wastewater***

(a) Wastewater flow estimates supported by the estimates of population equivalents for each catchment together with catchment boundaries and catchment areas.

(b) Pipe flow calculations showing pipe capacity and flow velocity for average dry weather flow, peak daily flow and peak wet weather flow.

(c) Pump station calculations justifying the selection of wet well size, pump selection and rising main hydraulics.

(d) Calculations for capacity Emergency Storage Chamber.

(e) A video inspection and report is required where a private drain is to become part of the public network and in the opinion of the Manager, Water Services, the condition of the line is doubtful.

2.2.3.5 ***Water***

(a) Fire flow calculations.

2.2.3.6 ***Structural information***

(a) Calculations and manufacturer's specifications as and where required.

2.3 Engineering Works

2.3.1 Engineering plan acceptance

2.3.1.1 Submitted engineering plans are audited against the requirements of the resource consent engineering conditions, and the standards set in this Manual. The process for engineering plan acceptance is set out in the flow chart below.

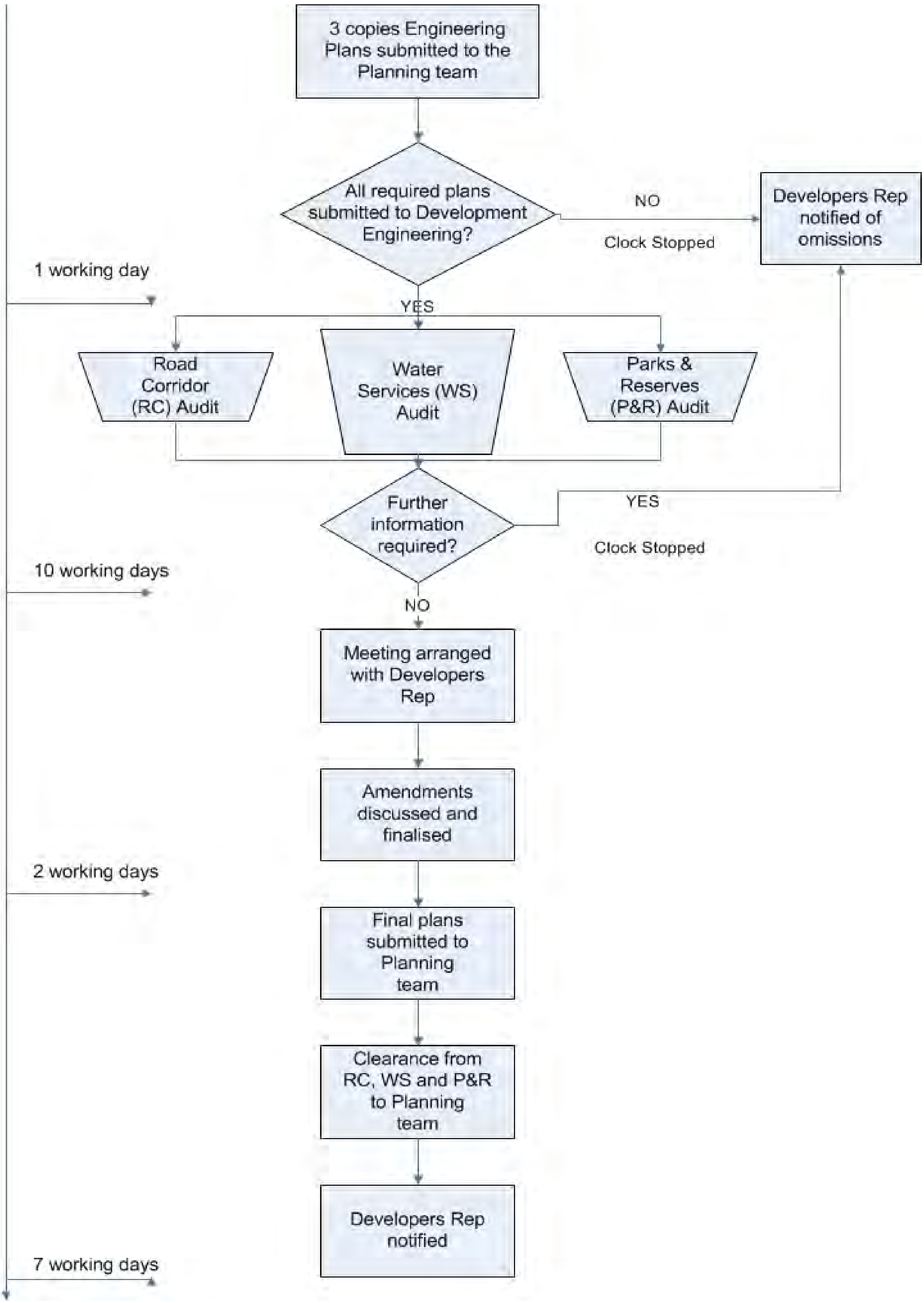


Figure 6: Engineering plan acceptance process

Advice Note: The times specified above are Waipa District Council targets for provision of the service. They do not include any time expended whilst further information requests are being considered by other parties.

2.3.2 Final accepted plans

2.3.2.1 After the notification, the Developer or their Representative shall submit a further four complete sets of accepted plans for stamping and signing on behalf of Council. These copies will be returned to the Developer's Representative after signing. One complete copy of the stamped and signed plans shall be available on site at all times.

2.3.3 Changes to accepted plans

2.3.3.1 The accepted plans may only be amended after satisfactory consultation with the department/s in Council directly involved with the proposed changes.

2.3.3.2 In all cases the changes must be documented and the amendments shown on the accepted plans.

2.3.3.3 The process for dealing with changes to accepted plans is shown in the following flowchart.

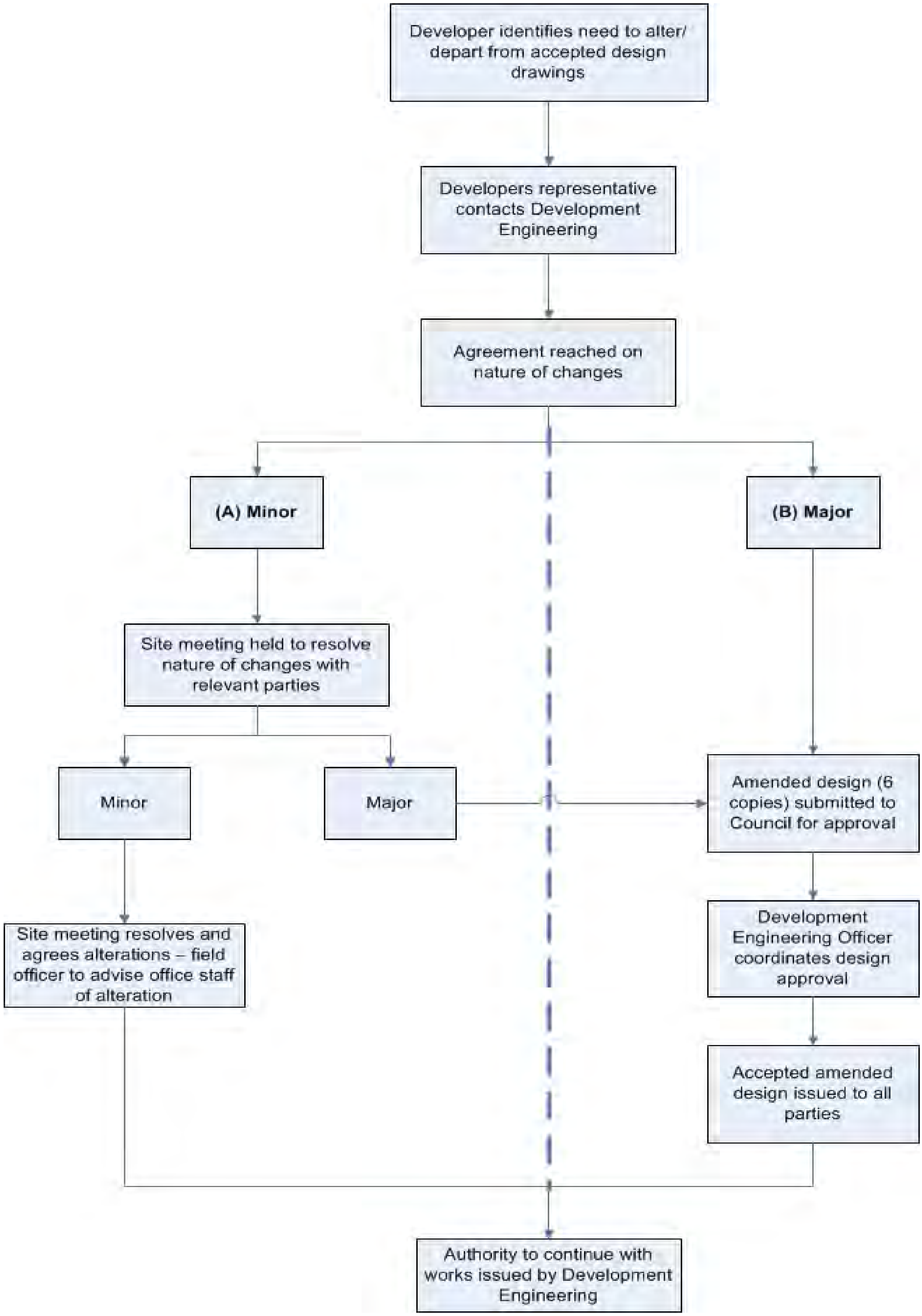


Figure 7: Procedure to amend accepted engineering drawings

2.3.4 Commencement of work

2.3.4.1 No engineering works shall commence on any subdivision or development until all approvals, and acceptances (engineering resource consent and others) have been obtained, and a pre-construction meeting has been held with Council. Where construction proceeds in stages, a separate pre-construction meeting shall be held for each stage.

2.3.4.2 Confirmation of these approvals and notification of intention to commence shall be supplied to Council on the form provided in Volume 4, Part 9, Appendix 1 of this Manual. The Developer shall be responsible for arranging the pre-construction meeting.

2.3.5 Auditing of engineering works

2.3.5.1 Auditing of engineering works is detailed in Volume 4 Quality Systems. Council reserves the right to enter the work site at any time for auditing, inspecting or checking purposes.

2.3.6 Quality of work

2.3.6.1 The Developer is responsible for ensuring that the engineering works constructed by contractors are carried out according to the accepted plans and best work practices.

2.3.6.2 The Developer shall be responsible for satisfactory completion of the Quality System Checklists as detailed in Volume 4 of this Manual. A copy of the checklists will be issued with the final accepted plans. Where the Quality System Checklists require the presence of a Council representative, then the Developer shall make such arrangements as required. At least 24 hours' notice should be given.

2.3.6.3 Copies of completed checklists shall be forwarded to Council as the works progress.

2.3.7 CCTV post construction inspections

2.3.7.1 Once the road surface is to finished level and prior to any road surfacing, the Developer shall arrange for all public stormwater and sewer mains to be inspected by CCTV. The Developer will provide a DVD and defects report to Council. The filming shall be done travelling upstream with a trickle of water flowing downstream to allow hollows and steps to be easily seen. All defects are to be fixed to the satisfaction of Council at the Developers cost. Where faults are found and repaired, Council may instruct the developer to re-film those lengths to ensure there are no further problems.

2.3.8 "Stop-work" notices

2.3.8.1 Any person or persons carrying out `on site' works as part of any Council approved development project shall cease such work, or part thereof, immediately upon receipt of a written stop-work notice specifying restrictions and issued by Council or an authorised agent.

2.3.8.2 The Developer shall have the right to appeal to Council's Manager Planning & Regulatory to override or amend such stop-work notice. A copy of Council's Manager Planning &

Regulatory's written decision shall be recorded on Council's resource consent or project file. Work may recommence when Council advises in writing.

2.3.9 Emergencies

2.3.9.1 If a situation is observed that is likely to endanger the safety and/or the security of the public, public or private property, or the operation of any public facility, the Developer will be instructed to undertake remedial action to alleviate the danger and secure the site. Any such work or supply of materials will be at the Developer's expense.

2.3.10 Public protection

2.3.10.1 The Developer shall take all reasonable measures to protect the public from the adverse effects of the work. Particular attention should be paid to the erection and maintenance of temporary fencing, especially in areas of potential ponding. Signs shall be erected warning of danger within the site area. These protection measures should be shown in the approved Health and Safety Plan.

2.3.11 On-site testing

2.3.11.1 Any work that requires testing in the presence of a Council officer shall be pre-tested and proved satisfactory by the Developer's Representative prior to the witnessed testing.

2.3.11.2 If the work does not meet the standard, then a fee will be charged for the second and any subsequent visit to re-measure or re-test the work.

2.3.11.3 Specific testing regimes are set out in Volume 4 of this Manual. Subsequent work dependent on a satisfactory test result shall not be undertaken until compliance has been demonstrated, and approved by Council as required.

2.3.12 Standard audits

2.3.12.1 The following are milestones that the Developer or Developer's Representative must notify to Council to enable any audit to be carried out if required:

(a) Commencement of work.

(b) Prepared earthworks and subsoil drainage prior to filling.

(c) Completed earthworks and prepared subgrade.

(d) Commencement of stormwater reticulation.

(e) Commencement of wastewater reticulation.

(f) Commencement of water reticulation.

(g) Finished base course.

(h) Prior to commencement of carriageway surfacing.

2.3.12.2 Audits will be carried out within one working day of notification if possible. Work shall not proceed until the audit has been satisfactorily completed. When work has been interrupted or delayed, the Manager Development Engineering shall be notified before it is recommenced.

2.3.13 Preservation of natural features

2.3.13.1 As a condition of granting Resource Consent, Council may require the Developer to make provision for the preservation of natural landscape, trees, areas of trees or bush, buildings or sites of historic, archaeological or other significance, and wildlife habitats. It should be noted that where preparatory work is agreed to prior to the Resource Consent being granted, such approval cannot be taken to authorise the destruction of any of the features referred to in this section.

2.3.13.2 Every effort shall be made by the Developer to ensure that the development or subdivision is in harmony with and complements the existing and surrounding landscape, including the blending of landforms and the preservation, where appropriate, of existing natural vegetation and other features.

2.3.14 Connection to existing services

2.3.14.1 Connection of new stormwater, wastewater, and water supply reticulation to existing systems shall be undertaken by Council at the Developer's cost. In some circumstances, but subject to specific approval of Council and with supervision by Council, the Developer may undertake the connection directly.

2.3.14.2 The Developer shall apply to Council for specific approval at least ten working days before the connection is to be made. The new services must be tested and shown to meet all requirements prior to the connection being made.

2.4 Works Completion and Clearance (as part of 224(c) Certification)

2.4.1 Works clearance

2.4.1.1 The Developer shall apply for the 224(c) Certificate only when satisfied the work is finished to the required standard. This includes the submission of the complete and accurate as-built details. Refer also Clause's 1.10 to 1.13 of this Volume.

2.4.2 Quality Systems manual (Volume 4)

2.4.2.1 The Quality Checklists included in Volume 4 of this Manual must be completed and submitted at the time of construction. Works clearance will not be considered until all certifications and quality assurance exercises are complete and as-built plans are received.

2.4.2.2 The Developer shall also submit completed producer statement forms, as set out in Volume 4, Part 9, Appendix 4 of this Manual.

2.4.3 As-built plans

2.4.3.1 *General*

(a) Upon completion of construction, copies of "As-Built" plans showing details as constructed and certified as correct by the Developer, shall be submitted to Council. Separate plans are required for roading, earthworks (finished contours), wastewater, stormwater and water supply. Detailed as-built requirements are listed in the relevant Technical Specifications in Volume 3 of this Manual.

2.4.3.2 *As-built plan format*

(a) The standard symbols to be used on all figures are shown in Figure 8: Standard symbols.

Advice Note: Line colour is to be in black only.

2.4.4 Areas of filling

2.4.4.1 The areas of filling shall be shown by depth contours depth of fill in the form of lines joining all points of equal fill depth or by contours showing original ground levels and finished ground levels.

2.4.5 Landscape works

2.4.5.1 Where development or subdivision includes landscaping or reserves to be vested in or managed by Council, an as-built plan of the landscaping works shall be provided to Council showing the following details:

(a) Location, extent and types of materials.

(b) Name and location (measured position in the berm) of street trees.

(c) Names, grades, number, planting density of traffic island planting.

2.4.6 Other utility services

2.4.6.1 In applying for works completion, the Developer shall submit the appropriate checklists from all other utility network operators confirming that they have received the required as-built information.

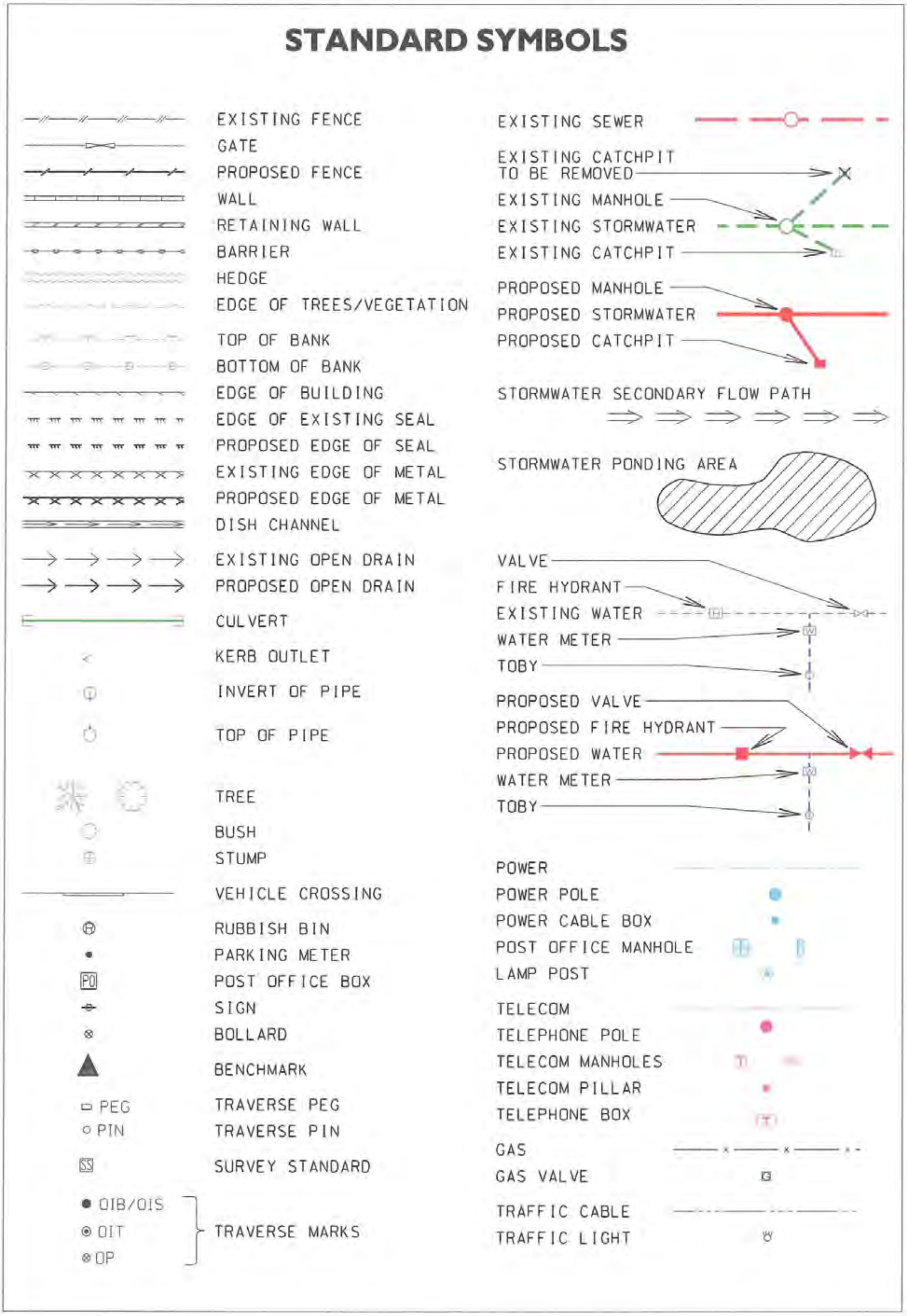


Figure 8: Standard symbols

Waipa
DISTRICT COUNCIL

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DESIGN GUIDE

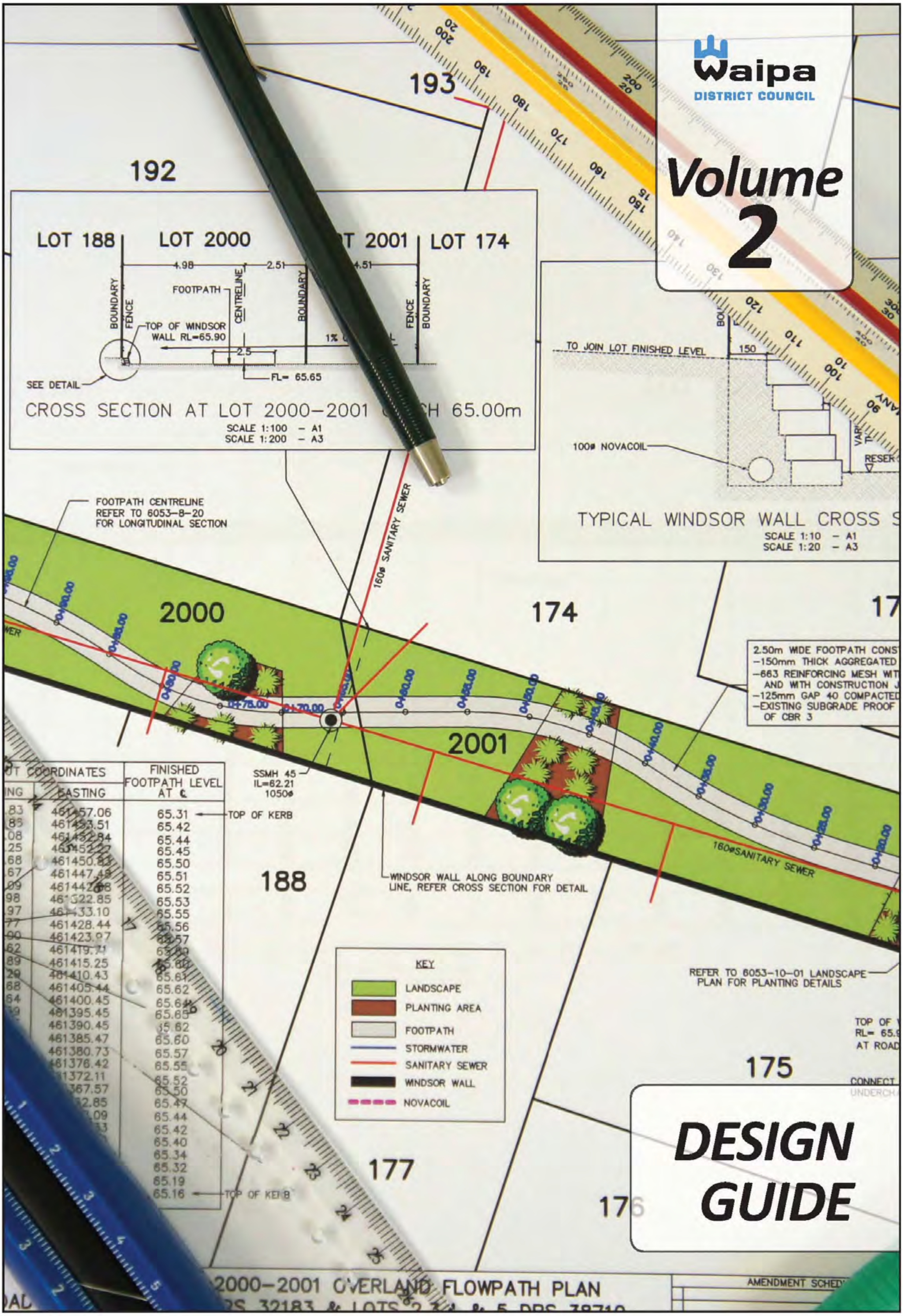


Table of Contents

Part 1: General

1.1 Introduction

1.1.1 This Design Guide sets out the standards that are required to meet the rules as set out in the District Plan. It represents a "means of compliance" with the District Plan and is the basis for all roading and infrastructure services work undertaken by or for Council.

1.1.2 It is acknowledged that the performance standard rules in the District Plan may be achieved by adopting different design methods. If a Developer proposes to vary from these Design Guides then the onus is on the Developer to prove that the performance standard rules are met.

1.1.3 In many cases, the standards set out in the Design Guide tend to provide an interpretation in numerical terms of the performance criteria in the District Plan.

1.1.4 The format of the Design Guide is carried through into Volume 3: Technical Specifications of this Manual. Thus, Roadworks is Part 3 in each Volume. Every effort has been made to separate matters relating to design from matters relating to construction.

1.1.5 While the two volumes are companion documents, each can stand-alone.

1.1.6 Any enquiry concerning interpretation of any matter in this Design Guide should be referred to Council's Planning & Regulatory Department.

1.2 Existing Underground Services

1.2.1 The Developer shall arrange for the searching of records to determine the existence and position of pipes, cables and other utilities on or about the site of the proposed works. The position or relocation of such utilities shall be taken into account when designing the works. Utilities shall include any permanent reference marks as defined in the Regulations made under the Cadastral Survey Act.

1.3 Survey Benchmarks

1.3.1 The Developer shall provide for the extension of the District's survey benchmark network to ensure that there is at least one benchmark within 500m of any point measured by road centreline. The benchmark must comprise a brass or stainless steel pin set into a substantial block of concrete (kerb and channel is suitable). The top of the brass or stainless steel pin shall be accurately levelled (±5mm) in relation to Moturiki Datum by a Licenced Cadastral Surveyor. A figure showing the location of the benchmark and its reduced level shall be supplied to Council's Development Engineering Department.

1.4 Health & Safety & Temporary Traffic Management

1.4.1 The Developer shall give consideration during the design phase to how the project will be constructed, so as to ensure that all aspects of the Health & Safety in Employment Act 1992, and amendments, are fully complied with. The Developer shall also consider, and include all necessary information on how the work will be carried out in order that it will minimise the impact on the existing road network. All work on the road network shall be carried out in accordance with the NZTA Code of Practice for Temporary Traffic Management (latest version).

Part 2: Earthworks and Land Stability

2.1 Introduction

2.1.1 This section of the Manual sets out the basic design requirements for earthworks that are to be carried out as part of any development. Some construction information is included for completeness. Detailed information on construction standards is set out in Volume 3 Standard Technical Specifications of this Manual.

2.2 Standards

2.2.1 The following NZ Standards shall be read concurrently with and apply to this part of the Design Guide:

(a) NZS 4402:1986 - Methods of Testing Soils for Civil Engineering Purposes.

(b) NZS 4431:1989 + A1 – Code of Practice for Earth Fill for Residential Development.

2.3 Scope

2.3.1 This part of the Manual sets out the requirements for the design of earthworks or preparation for foundations, or both, including:

(a) The excavation and filling of land to form new contours.

(b) The assessment and protection of slope stability.

(c) The suitability of both natural and filled ground for the founding of roads, buildings, services and other works.

2.3.2 Because of the wide range of soil types, physical conditions and environmental factors applying in different areas of the district, it is not often possible to lay down precise requirements which will be applicable in all cases. The criteria set out in this section will be subject to the judgement of the Developer or Geotechnical Engineer.

2.4 General

2.4.1 Earthmoving activities are subject to both Regional and District Council approvals. Resource consents shall be obtained before commencement of site work. The District Plan anticipates that low impact design principles will be used and earthworks minimised in any development or subdivision.

2.4.2 Choice of final landform is dependent on many factors which may be specific to the site. These include:

(a) Relationship with surrounding landscape;

(b) Extent of earthworks and development;

(c) Roading pattern;

(d) Preservation of natural features;

(e) Ground stability; and

(f) Damage by flood or other natural occurrences such as erosion by sea, river, or surface water run-off.

2.4.3 The intent is that every lot created for the purpose of housing a building or structure shall contain a safe building platform suitable for the erection of the building or structure anticipated on the site.

2.4.4 All resource consent applications development or subdivision where land stability needs to be addressed to ensure that the requirements of Council are met, shall be accompanied by a Statement of Suitability for Development (see Volume 4 of this Manual) relevant to the site. Council may request that a more detailed geotechnical report be undertaken to prove the suitability of the site for its intended purpose after evaluating the engineer's statement.

2.5 Technical Responsibilities

2.5.1 Where any urban land subdivision involves carrying out bulk earthworks, the assessment of slope stability, or the detailed evaluation of the suitability of natural ground for the foundations of buildings, streets, services or other works, then a Civil Geotechnical Engineer shall be appointed by the Developer to carry out the following functions:

(a) Prior to detailed planning of any development, to undertake a site inspection and such investigations of subsurface conditions as may be required.

(b) To review the figures and specifications defining the earthworks proposed, and submit a written report to the Engineer on foundation and stability aspects and any proposed departures from this Manual and associated standards.

2.5.2 Preliminary site evaluation

2.5.3 Prior to any detailed planning or design, the Developer or geotechnical engineer, as applicable, shall undertake a preliminary evaluation of the general nature and character of the site in sufficient detail to determine the likely requirements for earthworks or the need for further investigations into the suitability of foundation conditions, or both, and the stability of the natural ground. The preliminary evaluations should be carried out in the context of the total surroundings of the site. In simple cases, a visual appraisal may be sufficient. In other cases, depending on the nature of the project, its locality, the scale of development proposed and individual site characteristics, particular attention may need to be given to the following matters which should be considered prior to preparing a scheme of subdivision.

2.5.3.1 *Drainage*

(a) It is important to identify the existing natural drainage pattern of any area and to locate natural springs or seepage.

(b) Where any natural drainage paths are interfered with or altered by earthworks, appropriate measures should be taken to ensure that sufficient adequate alternative drainage facilities are provided.

> Advice Note: Sub-soil drainage on private property may be subject to approval under the Building Act 1991. Building Consents should be obtained before commencement of site work.

2.5.3.2 ***Slope stability***

(a) Some natural slopes exist in a state of marginal stability and relatively minor works such as trenching, excavation for streets or building platforms, removal of scrub and vegetation, or the erection of buildings, can lead to failure. Signs of instability include cracked or hummocky surfaces, crescent shaped depressions, crooked fences, trees or power poles leaning uphill or downhill, uneven surfaces, swamps or wet ground in elevated positions, plants such as rushes growing on a slope or water seeping from the ground.

2.5.3.3 ***Foundation stability***

(a) A study of the general topography of the site and its surroundings may indicate areas which have previously been built up as a result of natural ground movement or by the deliberate placing of fill material. Unless such fill has been placed and compacted under proper control, long-term differential settlement could occur causing damage to superimposed structures, roads, services or other subdivision works.

2.5.3.4 ***Specialist services***

(a) Where a soils report is required, then prior to or at the time of applying for resource consent, the Developer shall submit to Council a written report from a geotechnical engineer setting out the particulars of any investigations carried out. The report should include details of contours, natural features and modifications proposed thereto, and include a statement from the geotechnical engineer as to the suitability of the land for development or subdivision, with details of any special conditions that should be imposed. A suitable format for this report is included as Checklist 2.1 in Volume 4 Quality Systems of this Manual.

2.6 Planning and Design

2.6.1 Landform

2.6.1.1 The final choice of landform should represent the most desirable compromise between taking account of the factors referred to in Clause 2.5 above and the preservation of natural features and the natural quality of the landscape including the retention of natural watercourses.

2.6.1.2 The choice of a suitable landform is dependent on many factors which may be specific to a particular site. In general, unnecessary earthworks should be avoided but considerations which may justify the carrying out of earth-works include:

(a) Minimising the possibility of damage to property occurring through ground movement in the form of slips, subsidence, creep, erosion, or settlement.

(b) Minimising the possibility of damage to property occurring through flooding, or surface water run-off.

(c) The development of a more desirable roading pattern with improved accessibility to and within the site and the creation of a better sense of orientation and identity for the area as a whole.

(d) Efficient overall land utilisation including the quality of individual sites and amenity areas around buildings, the economics of providing engineering services, and the standard of roading and on-site vehicular access.

(e) The need to create suitably graded areas for playing fields and other community facilities.

(f) The enhancement of the general environmental character of the area by softening the landscape or by artificially creating or emphasising landforms of visual significance, particularly on flat sites or on areas devoid of landscape features.

(g) The safety of the site by incorporating CPTED (Crime Prevention through Environmental Design) principles. Refer Volume 2 Part 7: Street Landscaping, Clause 7.2.2 for details.

2.6.2 Soils investigations

2.6.2.1 Where appropriate the general nature and shape of the ground should be studied and particular note taken of:

(a) The geological nature and distribution of soils;

(b) Existing and proposed drainage conditions and the likely effects on ground water;

(c) The previous history of ground movements in similar soils in the area;

(d) The performance of comparable cuts and fills (if any) in adjacent areas; and

(e) The existence of peat soils including consistency, depth, and extent.

2.6.2.2 Soil data should be obtained for areas which are intended to:

(a) Form insitu bases for fills;

(b) Yield material for construction of fills; and

(c) Be exposed as permanent batters.

2.6.2.3 Sufficient borings, probing, or open cuts should be made to:

(a) Classify the soil strata by field and visual methods;

(b) Evaluate the likely extent and variation in depths of the principal soil types; and

(c) Establish the natural ground water levels.

2.6.2.4 The soil information thus obtained should form the basis for:

(a) Further sampling and testing which may be required on representative soil types; and

(b) Relating subsequent soil test properties to relevant strata over the site.

2.6.2.5 The appropriate test data for different areas shall be determined by the geotechnical engineer.

2.6.3 Stability criteria

2.6.3.1 ***Settlement***

(a) The most important factor in ensuring satisfactory performance of stable fills is the limiting of post-construction differential settlements. The design and construction of fills should be such that these settlements are kept within acceptable limits.

2.6.3.2 ***Bearing capacity***

(a) The strength of the ground resisting general shear failure (and resulting gross deformation) under the footings of a house is a local phenomenon distinct from settlement. Fill constructed to minimise settlement in accordance with this Manual will have adequate shear strength.

2.6.3.3 ***Shrinkage of peat soils***

(a) Where peat soils are present in the area of the subdivision then special provisions shall be made to limit drainage of the peat which would lead to shrinkage.

2.6.3.4 ***Slope stability***

(a) In most cases, it is unnecessary or impracticable to measure quantitatively the factor of safety of a slope against shear failure. Maximum slopes of cuts and fills may be determined by the Geotechnical Engineer from experience and from observation of slopes in the vicinity which have a long-standing history of stability, are of similar height to the proposed slope, and are of apparently similar geological formation.

(b) Where necessary or where a precedent is not available, a special soils engineering investigation should be carried out by the Geotechnical Engineer to determine acceptable limits to cut and fill slopes. In assessing slope stability, account should be taken of possible future changes in ground water level or other conditions.

Part 3: Road Work

3.1 Introduction

3.1.1 This Manual provides standards for one means of compliance in terms of engineering design and construction.

3.1.2 Other means of compliance will be considered in engineering design but must be supported by detailed design philosophy and calculations.

3.2 Road Classification

3.2.1 There are three road design categories for District roads, as follows:

(a) Arterial roads (Major & Minor).

(b) Collector roads.

(c) Local roads.

3.2.2 Table 1: Road Classification, below, outlines a hierarchy of roads in accordance with the degree of access that each road offers to adjacent land and the proportion of through traffic it carries. The table also defines the classifications in relation to traffic function and provides some of the geometric and structural standards for the classifications. The design requirements of the District Plan were also included as part of Table 1: Road Classification.

3.2.3 Major and minor arterial roads will only occasionally be part of a subdivision. Standards for their design but will be defined by the Manager Road Corridor on a case-by-case basis.

Table 1: Road Classification

Type & Description	Road Reserve Width (m)	Carriage-way Width (m)	Lane Width (m)	Cycleway Width	Street Parking Widths	Kerb/Edging Type	Front Berm, Street Tree, Swale, Lighting Recessed Parking and Bus Stops	Footpath Width (m)	Back Berm / Utility Corridor [1(ii)]
STRATEGIC ROADS									
State Highway is NZTA Responsibility									
Arterial: Major and Minor	Specific Design	Specific Design	Specific Design	2 @ 1.5m	Specific Design	Barrier (Urban Only)	Specific Design	Specific Design	Specific Design
DISTRICT ROADS									
Residential Zones									
Collector	25m	15m	2 @ 3.5m	Both sides @1.5m	1 park per lot @ 2.5m wide	Barrier	Both Sides	2 @ 1.5m	Both Sides @ 2.1m min
Local: Through Road	21m	11m	2 @ 3m	Shared Environment	1 park per lot @ 2.5m	Barrier	Both Sides	2 @ 1.5m	Both Sides @ 2.1m

Excerpt from Proposed Waipa District Plan

Excerpt from Proposed Waipa District Plan

Type & Description	Road Reserve Width (m)	Carriage-way Width (m)	Lane Width (m)	Cycleway Width	Street Parking Widths	Kerb/Edging Type	Front Berm, Street Tree, Swale, Lighting Recessed Parking and Bus Stops	Footpath Width (m)	Back Berm / Utility Corridor [1 (ii)]
					wide				min
Local: Cul-de-sac i) >150m in length ii) <149m in length	 21m 21m	 11m 11m	 2 @ 3m 2 @ 3m	 Shared Environment Shared Environment	 0.75 parks per lot @ 2.5m wide 0.75 parks per lot @ 2.5m wide	 Barrier Barrier or Mountable	 Both Sides One Side only	 2 @ 1.5m 1 @ 1.5m	 Both Sides @ 2.1m min Both Sides @ 2.1m min
Service Lanes (2) (Max. length 150m)	5.5m	3m	1 @ 3m One-way only	Shared Environment	Not Permitted	Mountable	Not Permitted	Not Required	One side @ 2.1m min.
Private ROW's i) 2 – 3 Lots ii) 4 – 6 Lots	 4m 6m	 3m 5m	 Single Lane Single Lane	 Not Applicable Not Applicable	 Not Permitted Not Permitted	 Barrier, Mountable or Flush As above	 Not Applicable Not Applicable	 Not Applicable Not Applicable	 Not Applicable Not Applicable
Industrial/Commercial Zones									
Collector	25m	13m	2 @ 4m	Shared with Footpath	2 @ 2.5m	Barrier	One side only	Both sides @ 2.5m	Both Sides @ 2.1m min
Local: Through Rd & Cul-de-sac:									
> 150m in length	24m	13m	2 @ 4m	Shared with 2.5m Footpath	2 @ 2.5m	Barrier	One side only	1 @ 2.5m & 1 @ 1.5m	Both Sides @ 2.1m min
< 149m in length	22m	13m	2 @ 4m	Shared with 2.5m Footpath	2 @ 2.5m	Barrier	One side only	1 @ 2.5m	Both Sides @ 2.1m min
Private ways	(ROW's and Service Lanes)								
2 – 3 Lots	7m	5m	Single Lane	Not Applicable	Not Permitted	Heavy Duty Barrier or Mountable	Not Applicable	Not Applicable	Not Applicable
4 – 6 Lots	9m	7m	Single Lane	Not Applicable	Not Permitted	Heavy Duty Barrier or Mountable	Not Applicable	Not Applicable	Not Applicable
Rural & Large Lot Residential Zones (swale both sides, tree planting – specific design, no lighting)									
Collector	20m	8m + 0.75m unsealed shoulder both sides	2 @ 3.5m + 0.5m sealed shoulder both sides	Not Applicable	Not Applicable	Not Applicable	Both Sides @ 3.7m min	Av. Lot size is $2500m^2$ – $5000m^2$ 1 @ 1.5m	Both Sides @ 0.8m min
Local	20m	7m + 0.75m	2 @ 3m + 0.5m	Not Applicable	Not Applicable	Not Applicable	Both Sides @ 3.7m	Av. Lot size is $2500m^2$	Both Sides @ 0.8m

Excerpt from Proposed Waipa District Plan

Type & Description	Road Reserve Width (m)	Carriage-way Width (m)	Lane Width (m)	Cycleway Width	Street Parking Widths	Kerb/Edging Type	Front Berm, Street Tree, Swale, Lighting Recessed Parking and Bus Stops	Footpath Width (m)	Back Berm / Utility Corridor [1 (ii)]
		unsealed shoulder both sides	sealed shoulder both sides				min	– 5000m² 1 @ 1.5m	min
Cul-de-sac:									
<20 Lots	18m	7m + 0.75m unsealed shoulder both sides	2 @ 3m + 0.5m sealed shoulder both sides	Not Applicable	Not Applicable	Not Applicable	Both Sides @ 3.7m min	Av. Lot size is 2500m² – 5000m² 1 @ 1.5m	One side @ 0.8m min
>20 Lots up to 200m max. length.	20m	7m + 0.75m unsealed shoulder both sides	As above	Not Applicable	Not Applicable	Not Applicable	Both Sides @ 3.7m min	Av. Lot size is 2500m² – 5000m² 1 @ 1.5m	Both Sides @ 0.8m min
Private ROW's (3)									
i) 2 - 3 Lots	6m	3m	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
ii) 4 - 6 Lots	9m	5m	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable

Further Requirements:

1. *All Urban Collector and Local Roads carrying <500 vehicle per day must incorporate traffic calming measures to ensure traffic speeds do not exceed 30kph.*
2. *An additional 0.6m for each additional trunk water main, sewer main or stormwater main, must be added to the minimum berm width on one side only.*
3. *All Residential Service Lanes must incorporate traffic calming measures to ensure traffic speeds do not exceed 20kph.*
4. *Service Lanes must connect at both ends to Local Roads only.*
5. *Minimum surface treatment for Private ROW's in the Rural and Large Lot Residential Zones must have an all-weather surface. Where existing dwellings are located within 25m of the ROW, mitigation of dust nuisance must be undertaken and submitted to Council. Dwellings located within 15m of the ROW, surface must be chip sealed in accordance with Council's standard.*
6. *Minimum cross fall to be 5% for all-weather surface.*

3.3 Road Network Guidelines

3.3.1 To improve the living environment, local roads providing property access should be designed to form a grid network which may attract external through traffic. Through their design and layout, local roads should encourage vehicle speeds appropriate to the environment, while providing convenience of access to residents and essential services.

3.3.2 In designing the layout of a road network to serve the land to be developed, the following issues must be considered:

(a) Zoning of the land.

(b) Likely usage of the land.

(c) Connections to existing roads/paths/cycle ways.

(d) Mitigation of adverse effects of traffic:

(i) Volume;

(ii) Speed;

(iii) Manoeuvrability;

(iv) Function;

(v) Parking; and

(vi) Safety.

(e) Linkages to other developments and amenities.

(f) Relationship to the concept for the total area.

(g) Recognition of the road hierarchy classification.

(h) Achievement of grid pattern layouts.

(i) Public transport requirements.

(j) Service corridors.

(k) Protection of unique features.

(l) Pedestrian needs.

(m) Cyclist needs.

(n) Landscaping and street tree provision.

(o) Needs of mobility or visually impaired persons.

3.3.3 T-junctions are preferred to cross intersections particularly for local roads. Acute-angle and Y-junctions are to be avoided. Multi-leg intersections may require control by roundabouts.

3.3.4 Intersections on curves, particularly on the inside of curves, other than large radius curves, should be avoided.

3.3.5 Generally, roads should intersect only with roads in the same class or those immediately above or below in classification.

3.3.6 Designed shared environments, pedestrian, cyclist and vehicular traffic is encouraged for low volume roads. However, in high volume roads, shared environments should be separated and areas of potential conflict between pedestrians, cyclists and vehicles should be designed to minimise safety risks.

3.3.7 The advantages of pedestrian walkways outside of road reserves should be considered to achieve good connectivity.

3.3.8 The District has a policy of increasing the popularity and safety of cycling. Road networks should provide a convenient and safe cycle access through a combination of on and off road facilities. See Clause 3.11 for further details.

3.3.9 All landscape planting design and implementation within the road reserve shall be as per Volume 2, Part 7 of this Manual.

3.4 Parking

3.4.1 General

3.4.1.1 Provision shall be made for the parking of vehicles on roads as specified in Table 1 Road Classification in Clause 3.2 above. The carriageway widths and design speeds specified in the table recognise that carriageway parking will occur. Alternative widths and layouts may be suitable which provide for parking in defined areas clear of the through traffic.

3.4.2 Carriageway parking

3.4.2.1 As the traffic function of a road becomes more important, it is necessary to provide more carriageway parking specifically for vehicle parking so that moving traffic is not impeded.

3.4.2.2 In residential zones, carriageway parking shall be as specified in Table 1 Road Classification. See Figure 22: DG 306 Parking space dimensions and locations for layout of on road parking areas.

3.4.2.3 Roads within Industrial Zones, because of the mixing of light vehicles with long, less manoeuvrable, heavy vehicles, shall provide parking width on each side of the carriageway to leave a clear line for moving traffic in each direction.

3.4.3 Indented parking

3.4.3.1 To facilitate a clear traffic pathway, indented parking bays and parking in the middle of cul-de-sac heads may be considered.

3.4.4 Mobility parking

3.4.4.1 Mobility parking spaces shall be designed according to NZS 4121:2001 Design for Access and Mobility – Buildings and Associated Facilities.

3.4.4.2 Mobility parking spacing are to be painted with blue anti-skid water-base (Damar paint supply colour to be confirmed with Council prior to marking).

(a) Guidelines for installation:

(i) The yellow mobility symbol should be marked on top of the blue. The symbol may be smaller if needed (i.e. to fit within the blue) depending on the space layout.

(ii) Blue marking to be 1.2 – 1.4m wide strip on both angle and parallel parks, extending beyond parked car/standard marked car park by 200-300mm, blue bordered by yellow.

(iii) Example photos shown below:

3.5 Road, Carriageway, and Formation Widths

3.5.1 Road width

3.5.1.1 The road width is to provide for:

(a) Carriageway.

(b) Parking.

(c) Cycling.

(d) Footpaths.

(e) Berms.

(f) Services.

(g) Traffic facilities.

(h) Landscaping.

(i) Road furniture.

3.5.1.2 Adequate width of road reserve is important and minimum widths are scheduled in Table 1 Road Classification of this Volume. Additional width is likely to be required where earthworks are extensive. A minimum clearance of 3m is desirable between the road reserve boundary and tops of cuttings or toes of embankments.

3.5.1.3 Preservation, or capitalisation of natural features or existing trees may dictate an irregular shaped road width. Certain carriageway and berm geometrics may require that the road width be increased.

3.5.1.4 Fences, if constructed, shall be placed on boundary lines unless written permission is received to do otherwise.

3.5.2 Carriageway width

3.5.2.1 Two lanes for moving traffic shall be provided on all roads except where a device is used for traffic control or there is a shared environment (as defined in Table 1 Road Classification).

3.5.2.2 The minimum lane widths for moving traffic are scheduled in Table 1 Road Classification. Where traffic function is dominant or there is significant cycle traffic on high volume collector roads, the lane widths should be increased and, in some cases, a marked cycle lane should be provided.

3.5.2.3 In residential areas, the carriageway may be split into separate one-way lanes for aesthetic or landscaping reasons or to suit ground levels on steep terrain. Adequate manoeuvrability and property access must be retained.

3.5.2.4 Carriageway widths shall be not less than those shown in Table 1 Road Classification.

3.5.2.5 For very low volume traffic roads narrower carriageway widths may be considered, based on actual vehicle and turning dimensions and shall be at the discretion of the Manager, Road Corridor.

3.5.2.6 Where topography or other considerations make carriageway and berm widths technically difficult and uneconomical, they may be reduced providing there is no loss of functionality and subject to approval from the Manager, Road Corridor.

3.5.3 Formation width

3.5.3.1 Formation width shall be sufficient to contain the functions described in Clause 3.5.1 above. Where topography permits, the formation width should extend beyond the road boundary by 500mm, with batters providing a smooth transition to the adjacent building lot grades.

3.5.3.2 Where structures retaining private lots (e.g. retaining walls) are required, these shall be fully located on the lot, not within the road reserve and shall be constructed such that a compliant vehicular access can be provided to each lot.

3.6 Road Geometry

3.6.1 Road alignment

3.6.1.1 Geometric design, including gradients, super elevation, and road widening shall be in accordance with Austroads standards.

3.6.1.2 Horizontal alignment of roads should be based on terrain and the design speed applicable to the road function.

3.6.1.3 Vertical alignment of roads should ensure that inclines can be negotiated during all weather conditions and sight distances are adequate for safety. The ideal gradient should be considered as a planning factor when selecting locations for shopping centres, service centres, footpaths, and cycleways.

3.6.2 Intersection spacing

3.6.2.1 The table below sets out minimum spacing between adjacent intersections on different categories of road. All distances are measured along the centreline of the major road between the centrelines of the intersecting roads.

Table 2: Intersection Spacing

	Local Roads	Collector or Arterial	Industrial
Same Side	60m	90m	200m
Opposite Sides	30m	45m	100m

3.6.2.2 In all cases, a right/left stagger is preferred. If crossroads are unavoidable, a roundabout is required for all but low volume roads.

3.6.3 Intersection alignments

3.6.3.1 The preferred angle of intersection shall be 90°. Kerb radii shall be in accordance with Austroads standards.

3.6.4 Grades at intersections

3.6.4.1 Gradients within 30m of intersections shall be:

(a) Local Roads - a maximum of 1 in 10 (10%), ideally less than 1 in 33 (<3%).

(b) Collector & Arterial Roads - less than 1 in 50 (2%).

3.6.5 Road marking and signing

3.6.5.1 The requirements of the NZTA Manual of Traffic Signs and Markings shall be met for priority intersections, as either “Give Way” or “Stop”.

3.6.6 Channelisation at intersections

3.6.6.1 All side roads carrying greater than 120 vehicles per day (15 dwellings), which have a direct access to a collector or arterial road (refer to Map 48 Road Hierarchy, in the District Plan) shall be channelised using either kerb extensions and/or a central throat island at the intersection with the collector or arterial road. Such treatments are to be designed and constructed in accordance with this Manual.

3.7 Visibility requirement

3.7.1 Driver sight distances need to be related to traffic function and vehicle speeds and the resulting visibility splays and envelopes may require the road boundary to be set back.

3.7.2 Tree planting shall not be placed in the visibility splay. Only road lighting columns and road signs shall be considered. More detail on requirements for planting within visibility splays is given in Volume 2, Part 7 of this Manual.

3.7.3 All visibility requirements shall be to Austroads standards.

3.7.4 Mid-block visibility requirement

3.7.4.1 Horizontal and vertical sight distances along a road shall be designed in accordance with Austroads standards.

3.7.4.2 The designer shall submit the criteria used in determining the visibility distances with the engineering plans.

3.7.4.3 The stopping sight distance measured round a curve shall be along a line 1.5m into the lane width from the inside kerb.

3.7.5 Intersections

3.7.5.1 Intersections shall be designed in accordance with Austroads standards.

3.7.5.2 Engineering plans must show:

(a) Design Speed.

(b) Design Vehicle.

(c) LV - Distance from limit lines to viewpoint.

(d) ASD - Approach Sight Distance.

(e) ESD - Entering Sight Distance.

(f) SISD - Safe Intersection Sight Distance.

(g) All radii.

3.7.6 Roundabouts

3.7.6.1 The size of a roundabout has a significant role in the performance for capacity, traffic safety and turning movements of vehicles.

3.7.6.2 Roundabouts shall be designed in accordance with Austroads standards.

3.7.6.3 The following minimum design criteria shall be applied.

Table 3: Roundabout Minimum Design Criteria

Road Type	Central Island Diameter	Circulating Width	LV Distance*
Local Road	16m including a 2m concrete collar	Single lane - 7m	5m
Collector Road Industrial	20m including a 2m concrete collar	Single lane - 7m Dual lane - 10.5m	9m
Arterial Road	24m including a 2m concrete collar	Single lane - 7m Dual lane - 10m	9m

(* LV Distance is defined as the minimum distance from limit lines to view point)

3.7.6.4 For a roundabout achievement of Austroads Criterion Visibility 3 is desirable. The minimum acceptable visibility will be Criterion 1 and 2 using LV distances as per Table 3.

3.7.6.5 Minimum criterion may be reduced where:

(a) Physical constraints such as a building/structure prevent practical implementation of minimum design criterion.

(b) Roundabouts can be shown to form a traffic control device as part of a Local Area traffic management scheme (mini Roundabouts).

3.7.6.6 Approval of any roundabout below minimum design criteria will be required from the Manager, Road Corridor.

3.7.6.7 The designer shall submit supporting evidence that the design will meet capacity, safety and turning movements of intended vehicles.

3.7.6.8 Traffic modelling shall show that the design can mitigate the effects of traffic generation from the development. Where applicable, consideration should be given for future network growth and development. This could include intersection modelling using software such as SIDRA.

3.7.6.9 For all roundabouts, a Road Safety Audit shall be completed by a qualified auditor to NZTA procedures. Any issues rated as serious must be rectified or mitigated, subject to Council's Manager Road Corridor's agreement, prior to submitting Engineering Plans. Items rated important will be evaluated and considered for inclusion with consent conditions.

3.7.6.10 Engineering Plans must show:

(a) The visibility splays for each approach of each roundabout, landscaping details, signage and road marking, and state the:

(i) Design Speed.

(ii) Design Vehicle.

(iii) LV Distance.

(iv) Central Island Diameter.

(v) Circulating Width.

(vi) Level of Service.

3.7.6.11 A copy of the Stage 3 Detailed Design Safety Audit and evidence of compliance with recommendations.

3.7.7 Gradients

3.7.7.1 ***Longitudinal gradient***

(a) Longitudinal gradient will depend on terrain. The following gradients should be used:

(i) Min gradient subject to evidence that 0.4% is unobtainable up to: 0.33% (1 in 300).

(ii) Min gradient: 0.40% (1 in 250).

(iii) Max gradient (on collector and industrial roads): 8.33% (1 in 12).

(iv) Max gradient (on residential roads): 12.50% (1 in 8).

3.7.7.2 ***Vertical curves***

(a) Vertical curves shall generally comply with the requirements of Austroads standards.

(b) For areas where the design speed is ≤ 50 Km/h, vertical curves shall have a minimum length of 20m, except where the grade change is ≤ 1% where the minimum vertical curve length is 10m.

3.7.7.3 ***Super-elevation***

(a) Super-elevation on rural roads shall be designed in accordance with Austroads standards.

(b) For urban local and collector roads, and curves in large lot residential subdivisions, super-elevation will not normally be required.

3.7.7.4 ***Cross fall***

(a) A normal cross fall is 3% is required.

(b) Single cross fall will be considered on carriageways up to 7m where normal cross fall is unobtainable.

3.7.8 Horizontal Curves

3.7.8.1 The minimum centreline radius for industrial roads, residential collector and Minor Arterial roads is 80m. The minimum centreline radius for local residential roads is 15m. Reverse curves are to be separated by an adequate length of straight road.

3.7.9 Extra widening

3.7.9.1 Where the centreline radius is less than 59m, extra widening may be applied to the carriageway in accordance with Austroads standards. In such cases, the minimum berm width shall not be reduced.

3.7.9.2 Where the centreline radius is greater than 60m, extra widening on curves is not required.

3.7.10 Cul-de-sac heads

3.7.10.1 Every cul-de-sac should be provided with a carriageway such that a 99 Percentile Design Truck (refer Figure 21: DG 305.3 99 percentile service truck tracking curve) may turn without reversing.

3.7.10.2 In urban environments, provision should also be made, near the end of a cul-de-sac, for three-point turning utilising insets in the kerb line or kerb crossings for the design single unit vehicle (see Figure 20: DG305.2 99.8 percentile car tracking curve). Such kerb crossings shall be specifically designed, such that:

(a) Outside radius turning circle -min. radius 6.3m.

(b) For simple bulbous head -min. radius 9m.

(c) For simple bulbous head in commercial/industrial rods -min radius 13m.

3.7.10.3 Off-carriageway parking may be provided in cul-de-sac heads (refer to Clause 3.4.3).

3.7.10.4 In rural environments, turning heads will be required at the end of all no-exit roads in accordance with Austroads standards.

3.7.11 Cross fall on berms in urban environments

(a)	Footpath cross fall	- ideally 1% to 2%.
(b)	Balance of grass berm cross fall	- typically 4%.

3.7.11.1 Localised footpath cross falls in the range of 2% to 3% may be permitted in exceptional circumstances where levels make the typical cross falls impractical. Localised grass berm cross falls may similarly range between 2% and 10%. Engineering figures should identify any variances from the typical cross falls. Berm cross fall shall be satisfactory for vehicle crossings.

3.8 Road Pavement

3.8.1 Flexible pavement design

3.8.1.1 Pavement design shall be undertaken by an engineer experienced in pavement design. Pavement design shall be in accordance with Austroads standards including the New Zealand supplement to Austroads.

3.8.1.2 Minimum factors to be included in the design are:

(a)	Design Period	- 25 years.
(b)	Annual HCV growth factor	- 3%.
(c)	Load factor ESA/HCV	- 0.6 local roads;
		- 0.7 collector roads; and
		- 0.9 arterial and industrial roads.
(d)	% HCV	- 9% all roads.

3.8.1.3 The designer shall provide a design report with the engineering figures, including the following information as a minimum:

(a) Results of soils investigations.

(b) Design assumptions and figures.

(c) Quality Assurance measures for construction.

3.8.2 CBR tests

3.8.2.1 All designs shall be based on soaked CBR’s.

3.8.2.2 Insitu CBR results used for compliance shall be the 10 percentile value of tests. To obtain the 10 percentile value, collate CBR test results from samples taken at the same level relative to the subgrade.

3.8.3 Subgrade compliance

3.8.3.1 The subgrade shall be tested for compliance with the CBR and other properties required by the applicable design method. Testing shall be in accordance with the Technical Specification (Volume 3, Part 3, Section 2 of this Manual).

3.8.3.2 Subgrade compliance shall be subject to approval by Council before construction of the next pavement layer.

3.8.4 Sub-base layer

3.8.4.1 Compaction to CBR ≥ 40.

3.8.4.2 Sub-base compliance shall be subject to approval by Council before construction of the next pavement layer.

3.8.5 Base course

3.8.5.1 Aggregate shall be NZTA M4 or GAP as specified in Volume 3 Technical Specification.

3.8.5.2 Basecourse shall be compacted to CBR ≥ 80.

3.8.5.3 The finished pavement shall be tested as set out in Volume 3, Part 3, Section 2, Clause 3.2.5 of the Technical Specifications. The results of the test will be considered in terms of compliance to the tables in 3.2.5 giving regard to the method of pavement design, time of year, uniformity of pavement deflection recording and proposed final surfacing. Bowl deflection results may be required to assist in the consideration.

3.8.6 Pavement layer construction

3.8.6.1 Pavement construction below the kerb and channel shall extend 500mm behind the kerb face.

3.8.7 Surface sealing

3.8.7.1 All carriageways must be surfaced with either a chip seal or asphaltic concrete. Interlocking block paving will be considered on a case by case basis.

3.8.7.2 Asphaltic concrete on first coat seal is mandatory on industrial roads, rotary intersections, urban arterial roads, all cul-de-sac turning circles and any other site subject to high turning movements. On cul-de-sac heads, asphalt shall be applied until the carriageway becomes a constant width.

3.8.8 Chip seal surfaces

3.8.8.1 A two coat chip seal comprising a first coat of Grade 3 wet locked with a second coat of Grade 5 is appropriate for most residential and rural roads but other chip seal designs will be considered. This must be followed by a second coat chip seal between 3 and 18 months later as part of the project cost.

3.8.9 Asphaltic concrete on first coat chip seal

3.8.9.1 An asphalt concrete layer must be applied over a waterproofing chip seal of Grade 4 or Grade 5 chip with a residual bitumen application of 1.0 litre/m^2.

3.8.9.2 As a minimum, NZTA M/10 specification Mix 10 is appropriate for residential applications but industrial and arterial sites should consider the use of SMA 10. Selection of an appropriate mix for arterial and industrial sites should be agreed with the Manager, Road Corridor.

3.8.9.3 Ramp asphalt to existing sealed surfaces (refer Figure 52: TS 319 A/C transition ramp / OGPA overlay details and Figure 53: TS 320 A/C overlay v-ramp detail). Minimum thickness for Mix 10 asphaltic concrete is 25mm.

> Advice Note: For both first and second coat chip seal, the bitumen application shall extend over the channel lip, but not by more than 25mm.

3.8.10 Concrete block paving

3.8.10.1 The road pavement may be surfaced with concrete block pavers.

3.8.10.2 The concrete blocks shall comply, and laying shall be in accordance with NZS 3116:2002 “Concrete Segmental and Flagstone Paving”. Pavers shall be 80mm thick Firth Holland pavers, or similar approved.

3.8.10.3 Pavements in NZS 3116:2002 titled “Light vehicular” are not acceptable.

3.8.10.4 On carriageways, pavers shall be laid in a herringbone pattern at 45° to the centreline, with the long zigzag parallel to the centreline. See Figure 49: TS 318A Paved flush threshold, Figure 50: TS 318B Paved raised pedestrian ramp, and Figure 51: TS 318C Concrete raised pedestrian ramp (Volume 3).

3.9 Road Drainage

3.9.1 Subsoil drains

3.9.1.1 Where topography dictates or soils are not free draining, subsoil drains will be required behind the kerb as follows:

(a) Minimum subsoil pipe size - 90mm.

(b) Minimum depth to pipe invert - 700mm (from top of kerb).

3.9.1.2 Refer to Technical Specification Figure 54: TS 321 Location of subgrade drainage (Volume 3).

3.9.2 Batter drains

3.9.2.1 Batter drains behind the boundary may be required to prevent water entering into or onto the berm. They must be constructed as for Clause 3.9.1 Subsoil drains above.

3.9.3 Drain outlet inverts

3.9.3.1 Subsoil and batter drain outlets shall be to catch pits, manholes or precast concrete culvert wing-walls or designed outlet structures.

3.9.3.2 Batter drain outlets may be to rock rip-rap channels or flumes to waterways.

3.9.4 Kerb and channel, vertical kerb & island kerb

3.9.4.1 For kerbs with radii tighter than the minimum specified in Table 3: Roundabout Minimum Design Criteria, or carriageway narrower than standard, "Heavy Duty Kerb and Channel" shall be used. Refer to Figure 44: TS 311 Cross section details associated kerb and channel reinstatement within existing pavement and Figure 46: TS 313 Median refuge island kerb details (Volume 3).

3.9.5 Catch pits

3.9.5.1 For developments where the stormwater connection is direct from each lot to stormwater drainage pipes, the following shall apply:

(a) Gross area drained (carriageway, berm & footpath) - maximum 900m².

(b) Area of carriageway - maximum 450m².

(c) Maximum spacing of catch pits - 100m.

(d) Maximum spacing of catch pits where private houses connect stormwater to kerb & channel - 60m.

3.9.5.2 Preferred location of catch pits are:

(a) At intersections, at the kerb line tangent point.

(b) Upstream of pram crossings.

(c) At changes of gradient on steep roads.

(d) Cul-de-sac heads.

3.9.5.3 A double catch pit will be required:

(a) At the lowest point in a sag vertical curve.

(b) At the ends of a cul-de-sac where water falls to the end.

(c) On all channels where the gradient is steeper than 5%.

(d) To have alternative type with bars perpendicular to the kerb.

3.9.5.4 Catch pits in swales will require a specific design.

3.9.5.5 Catch pits shall be of the type referred to in Figure 78: TS 349 Double sump catchpit design and Figure 79: TS 351 Vertical entry catchpit (Volume 3).

3.9.6 Dish channels

3.9.6.1 Refer to profile in Figure 41: TS 308 Kerb and channel profiles. For dish channels with footpaths or access ways, concrete is to be on subgrade with CBR not less than 7.

3.9.6.2 Where possible, the design should avoid a requirement for dish channels.

3.10 Footpaths

3.10.1 General

3.10.1.1 In general, all roads shall have a footpath on both sides.

3.10.1.2 In the following cases, consideration will be given to one path only:

(a) Where a short cul-de-sac has been deliberately designed to create a slow speed environment.

(b) On minor roads in industrial areas where it can be demonstrated that a second footpath is not justified.

3.10.1.3 In the case of a properly designed shared environment, i.e. where both vehicles and pedestrians have equal priority, a footpath will not be required.

3.10.1.4 In locations with high concentrations of pedestrians, e.g. shopping areas, outside schools and leading to schools, footpath widths require specific design in consultation with the Manager, Road Corridor and shall:

(a) Have a cross fall in accordance with Clause 3.7.11 Cross fall on berms in urban environments.

(b) Have a non-skid surface where footpath gradients are stepper than 8.33%.

(c) Not be depressed by vehicular crossings.

(d) In new subdivisions, generally be constructed in concrete.

(e) Be located centrally in the berm – Refer to Figure 13: DG 300 Cross section details typical berms (Version: May 2012).

3.10.1.5 RTS 14 "Guidelines for Facilities that Assist Blind and Visually Impaired Pedestrians" should be incorporated into new roading infrastructure as appropriate.

3.10.2 Footpath widths

(a)	Arterial Roads	- Specific Design.
(b)	Collector and Local Roads	- 1.5m.
(c)	Collector Industrial Roads	- Refer Table 1.
(d)	Shared use cycleway footpaths	- 2.5m min (3m preferred).

3.10.3 Concrete footpaths

(a) Minimum depth of concrete on 25mm compacted fine granular material

(b) Minimum concrete thickness - 100mm.

(c) Subgrade CBR - Minimum 7.

3.10.3.1 Subgrade preparation shall extend 200mm beyond the edges of footpath.

3.10.4 Asphalt surfaced footpaths

(a) Minimum depth asphalt - 25mm Mix 10.

(b) Minimum depth base course - 75mm GAP 20.

(c) Subgrade CBR - Minimum 7.

3.10.5 Paved footpaths

(a) 50mm Firth Holland Pavers or approved equivalent.

(b) Minimum depth of base course as per manufacturers requirements.

(c) Subgrade CBR as per manufacturers requirements.

3.10.6 Pram-wheelchair crossings

3.10.6.1 Pram crossings shall be provided at all intersections. Refer to Figure 42: TS 309 Crossing details and Figure 45: TS 312 Splitter island paved pedestrian cutdown details (Volume 3).

(a) Maximum gradient - 8.33%.

3.10.6.2 The lip of the crossing shall be flush with the invert of the channel.

3.10.6.3 NZTA Pedestrian Planning and Design Guide shall be used to assess sites for future road crossing facilities.

3.10.7 Facilities for vision impaired pedestrians

3.10.7.1 Tactile pavers shall be installed in accordance with RTS14 Guidelines for the Blind and Vision Impaired Pedestrians. Yellow tactiles shall be used at all crossings except in urban upgrades where there are both other facilities available to assist the partially sighted, and the yellow colour is inappropriate to the streetscape environment.

3.10.7.2 Tactile pavers are required at the following locations:

(a) Crossing points across Arterial or Collector Roads, including pedestrian throat islands, refuge islands and median islands.

(b) Other points where significant numbers of pedestrians cross an access way or side road.

(c) Railway crossings.

(d) Other highly pedestrianised areas.

3.11 Cycle Traffic

3.11.1 Provision for cyclists on and off the carriageway shall be subject to scheme plan approvals and designed in consultation with the Manager, Road Corridor.

3.11.2 Provision for cyclists on the carriageway should be in line with "engineering best practise" and generally in accordance with Austroads publications. The minimum width of on road cycle lanes is 1.5m. Refer to Table 1: Road Classification.

3.11.3 Paths designed for use by cyclists, either exclusively or shared with pedestrians, shall be in accordance with Austroads publications. The minimum width of shared use paths is 2.5m. Refer to Table 1: Road Classification.

3.12 Vehicle Crossings

3.12.1 Vehicle crossings shall be provided where vehicles are crossing the kerb and berm.

3.12.2 Vehicle crossings shall be provided as part of the subdivision development for private ways and to lots with road frontage less than 5m in width or where site constraints restrict choice in crossing location. Refer to Volume 3 Technical Specification for details of widths and construction standards.

3.12.3 Crossings shall be designed so that the footpath has priority through the crossing. In particular:

3.12.3.1 Vehicle crossings shall not interfere with the profile of the footpath or the berm except that minor filling may be permitted between the property boundary and the footpath. No retaining walls or structures are permitted to encroach onto the berm and no lowering of the berm is permitted.

3.12.3.2 The crossing must allow a laden 90 percentile car to negotiate the crossing without bottoming or scraping. To achieve this the following guidelines should be adhered to:

(a) The algebraic difference in grade changes must not exceed 1 in 8.

(b) Where the total of a series of grade changes exceeds 1 in 8, allow a minimum of 3m of intermediate grade between changes of grade. If these guidelines cannot be achieved, Council's Regulatory Engineer must be consulted.

3.12.3.3 Urban vehicle crossings shall be constructed to the property boundary. No coloured, stamp patterned, exposed aggregate or cobble stones surfaces will be permitted between property boundary and kerb.

3.12.3.4 Vehicle crossings in rural areas shall be surfaced to the same material as the adjoining road.

3.12.3.5 For commercial crossings in urban areas of moderate to high pedestrian use, it is required that the priority of the footpath over the crossing be provided. A pavement marked pedestrian crossing may be appropriate.

3.12.3.6 Construction details in Urban Areas are included in Volume 3, Part 3 and in the following figures: Figure 37: TS 306 Vehicle crossings with kerbed roads, Figure 38: TS 307.1 Entranceways without kerb or kerb and channel and for rural zones: Residential < 2 ha, Figure 39: TS 307.2 Entranceways without kerb or kerb and channel and for rural zones: Light commercial 2 ha – 20 ha, Figure 40: TS 307.3 Entranceways without kerb or kerb and channel and for rural zones: Heavy commercial > 20 ha, Figure 42: TS 309 Crossing details, and Figure 43: TS 310 Cross section details for vehicle crossings and depressed kerb and channel of this Manual.

3.12.3.7 Construction details in Rural Areas are included in Volume 3, Part 3 and Figure 38: TS 307.1 Entranceways without kerb or kerb and channel and for rural zones: Residential < 2 ha, Figure 39: TS 307.2 Entranceways without kerb or kerb and channel and for rural zones: Light commercial 2 ha – 20 ha, Figure 40: TS 307.3 Entranceways without kerb or kerb and channel and for rural zones: Heavy commercial > 20 ha and Figure 43: TS 310 Cross section details for vehicle crossings and depressed kerb and channel of this Manual.

3.12.3.8 The vehicle crossing standards apply to the full width of the berm (between the kerb and road boundary).

3.12.3.9 When constructing a new vehicle crossing, if an existing footpath exists, the footpath is to be cut out and reconstructed to the vehicle crossing standard.

3.12.3.10 Where the existing kerb and channel is cracked, the kerb and channel is to be removed and incorporated into the vehicle crossing construction works.

3.12.3.11 Chip seal surface shall only be used in the rural zone and the large lot residential zone. Concrete will be permitted where a kerb is present.

3.12.3.12 Sub-grade and sub-base preparation is to extend 200mm beyond the edges of the crossing.

3.12.3.13 Surface joints to be sealed as required in Volume 3, Part 3, Clause 3.6.3.4.

3.12.4 For properties at intersections, the vehicle crossing should be off the minor road rather than the major road.

3.12.5 Access driveways shall be formed and maintained so as to adequately control stormwater and prevent materials such as mud, stones, chip, gravel or stock effluent being carried out onto a public road.

3.12.6 Vehicular entrances onto State Highways will require New Zealand Transport Agency approval. In the event that a vehicular entrance is approved the siting and design of the vehicle crossing will be part of the approval.

3.12.7 Visibility at vehicle crossings

3.12.7.1 Refer to RTS 6 “Guidelines for Visibility at Driveways”.

3.12.7.2 Visibility shall be in accordance with Table 4: Vehicle Crossing Visibility.

3.12.7.3 The minimum sight distances recommended in Table 4 are stopping distances for vehicles on the frontage road. They should be measured along the centre of the appropriate lane as indicated by the lines AC and BD in Figure 9: Lines of clear sight. For practical purposes, A and B can be taken as opposite the centre of the driveway.

3.12.7.4 There should be lines of clear sight from driver's eye height to driver's eye height, i.e. 1.15m above ground level, along the lines detailed in the paragraphs below.

Table 4: Vehicle Crossing Visibility

Driveway Classification	Operating speed (km/h)* on Frontage Road	Minimum sight distance (m)** (AC & BD in Fig.9)		
		Frontage road classification		
		Local	Collector	Arterial & State Highway
Low Volume Driveways Up to 200 vehicle movements per day.	40	30	35	70
	50	40	45	90
	60	55	65	115
	70	85	85	140
	80	105	105	175
	90	130	130	210
	100	160	160	250
	110	190	190	290
	120	230	230	330
High Volume Driveways More than 200 vehicle movements per day.	40	30	70	70
	50	40	90	90
	60	55	115	115
	70	85	140	140
	80	105	175	175
	90	130	210	210
	100	160	250	250
	110	190	290	290
	120	230	330	330

* Operating speed = 85th percentile speed on frontage road. This can be taken as the speed limit plus 15% if survey data is not available.

** Distances are based on the Minimum Gap Sight Distance tables in Austroads, Intersections at Grade [1] assuming reaction times of 1.5 seconds on local roads with operating speeds up 60 km/h and 2.0 seconds for all other speeds and all collector and arterial roads.

3.12.7.5 The following lines of sight are recommended:

(a) *Local roads*

(i) For all driveways on local roads, there should be lines of clear sight between vehicles at or within the sight distance of the driveway and vehicles on the road opposite the driveway.

(ii) This is shown by the lines AC and BD in Figure 9: Lines of clear sight.

(b) *Collector roads*

(i) Low volume driveways.

(ii) The required lines of clear sight are as for driveways on local roads, i.e. lines AC and BD in Figure 9: Lines of clear sight.

(c) *High volume driveways*

(i) In addition to the above, there should be clear visibility between vehicle waiting to leave the driveway and vehicles on the frontage road. That is, at a point, 5m into the driveway from the centre of the lane nearest the driveway to a vehicle at the sight distance along the road from the driveway. The 5m offset is the minimum recommended distance to allow intervisibility between drivers and allow adequate clearance from the front of the vehicle at the driveway and the edge of the traffic lane. The additional lines of clear sight are shown by the lines CE and DE in Figure 9: Lines of clear sight.

(ii) If parking is in demand near these driveways, then it may be impractical to fully insist on these lines of clear sight. It is accepted therefore that for these driveways, parked vehicles may obstruct these lines of sight but there should be no permanent obstructions to these site lines.

3.12.7.6 ***Arterial roads***

(a) *Urban Areas*

(i) For low volume driveways on arterial roads in urban areas the same conditions as for high volume driveways on Collector Roads are recommended.

(b) *Rural Areas*

(i) For low volume driveways in rural areas and for all high volume driveways on Arterial Roads even parked vehicles should not obstruct the required lines of sight between vehicles at the driveway and vehicles on the frontage road. The recommended lines of clear site are therefore as shown by lines EC and ED in Figure 9: Lines of clear sight with no exemption for parked vehicles.

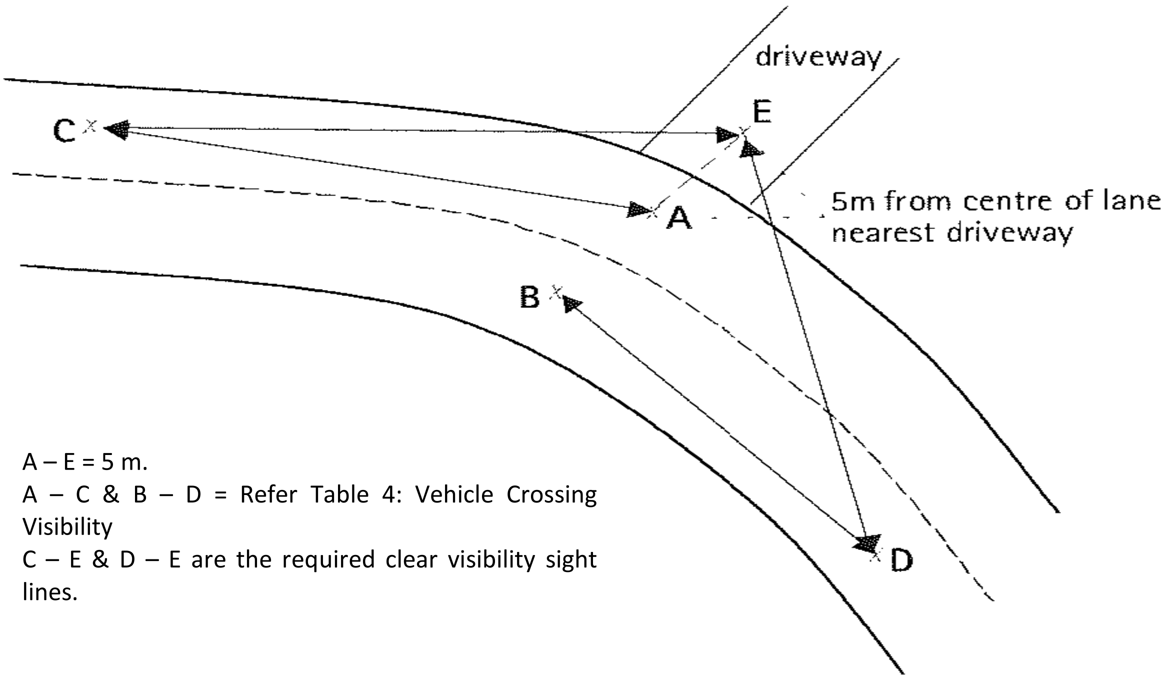


Figure 9: Lines of clear sight

3.12.8 Access way separation from intersections and other access ways

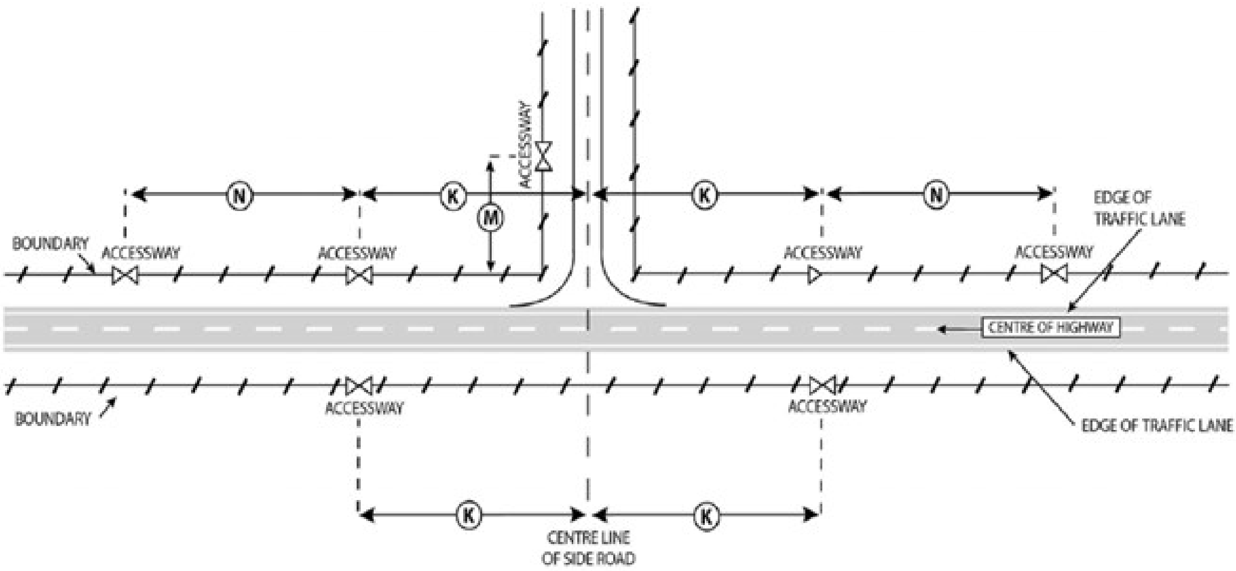


Figure 10: Separation Between Vehicle Crossings

3.12.8.1 The minimum distance of a vehicle entrance from an intersection or other entrance shall be as follows, where the values for K, M and N are included in the table below.

Table 5: Vehicle Crossing separation distances as shown in Figure 10: Separation Between Vehicle Crossings above

Posted Speed limit (km/h)	Minimum Distance (m) K =	Minimum Distance (m) M =	Minimum Distance (m) N =
40	30	20	For 60km/h:

Posted Speed limit (km/h)	Minimum Distance (m) K =	Minimum Distance (m) M =	Minimum Distance (m) N =
50	30	20	less than 4m or more than 11m
60	30	20	
70	100	45	40
80	100	45	100
90	200	60	200
100	200	60	200

Advice Notes:

1. Varying separation distances for lower speed areas is to provide for the possibility of on street parking (e.g. as close as practicable or at least 5m space and 1.25m clearance between edges of crossings.
2. New vehicle access ways shall be located a minimum of 30m from a railway level crossing.

3.12.9 Seal widening near driveways on rural roads

3.12.9.1 On rural roads without kerbs, additional seal widening near driveways allows more room for manoeuvring and through vehicles to avoid conflicts. These may be required on arterial roads with a speed limit of 70 km/h or more.

3.12.9.2 Widening design shall be in accordance with Figure 11: Low volume driveways frequently used by heavy vehicles and Figure 12: High volume driveways frequently used by heavy vehicles.

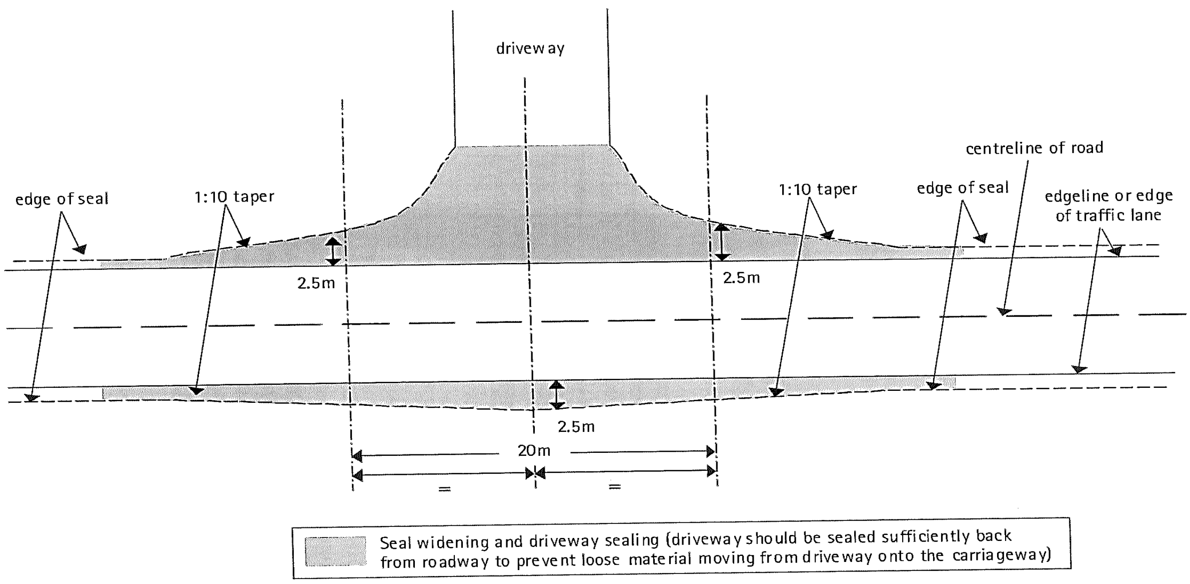


Figure 11: Low volume driveways frequently used by heavy vehicles

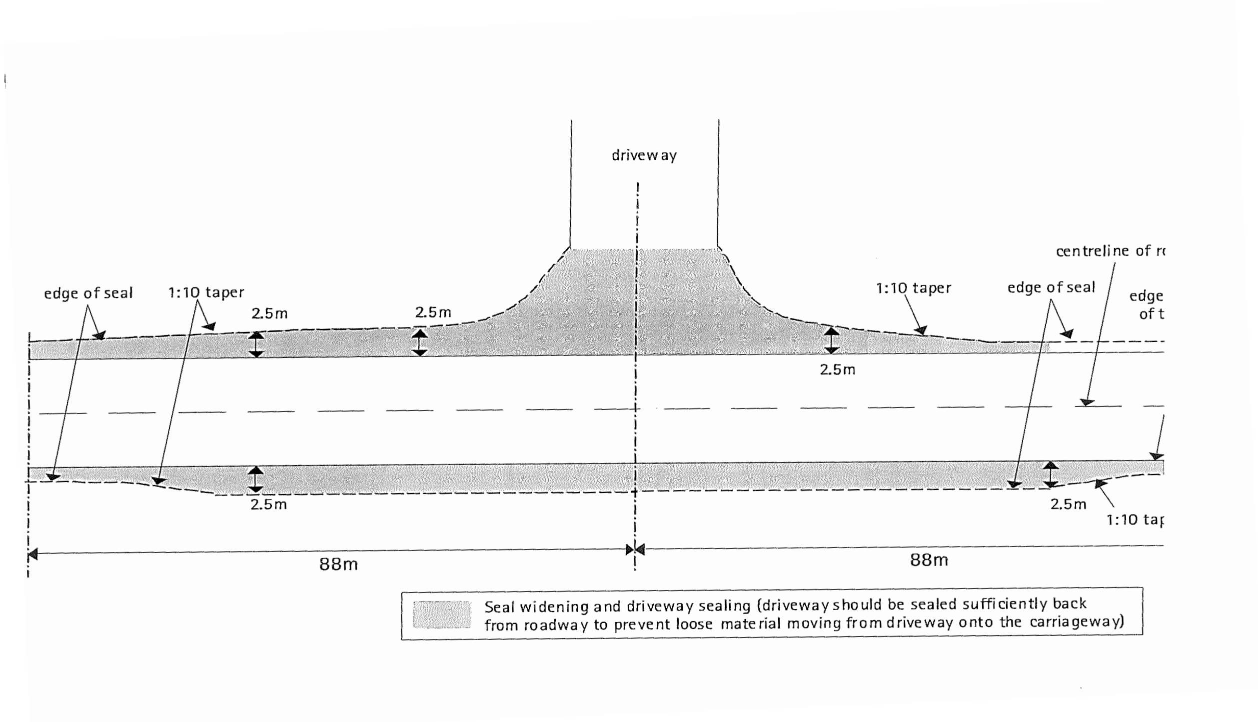


Figure 12: High volume driveways frequently used by heavy vehicles

3.13 Berms

3.13.1 Berms shall accommodate footpath, road lighting, underground services, and landscaping and grass areas.

3.13.2 The minimum berm width shall be 4.5m except for private ways and shared environments and shall have:

(a) A subgrade for grassed areas a minimum CBR of 7.

(b) Minimum compacted depth of topsoil 75mm.

(c) Approved grass seed = Perennial Rye.

(d) A sowing rate of 1.5 kg/100m^2.

3.13.3 For layout, refer to Figure 13: DG 300 Cross section details typical berms (Version: May 2012).

3.13.4 Berms are to be mown during the defects liability period as well as prior to take over by Council.

3.13.5 All landscape planting design and implementation within the road reserve shall be as per Volume 2, Part 7: Street Landscaping. This includes, but is not restricted to, the Dedicated Tree Planting Corridor referenced in Clause 7.3.2.6 that requires a minimum 1200mm wide service-free corridor within the berm.

3.14 Road Lighting

3.14.1 Specifications, regulations and codes of practice

3.14.1.1 The completed design shall comply with all statutory requirements and specifications including, but not limited to, the following:

(a) Relevant Statutory Acts, Regulations and Bylaws.

(b) Local authority regulations and requirements.

(c) Health and Safety in Employment Act 1992 and associated regulations.

(d) Electricity Regulations 2010, handbook to the electricity regulations.

(e) The Electricity Act 1992.

(f) Electrical code of practices.

(g) New Zealand Radio Interference Regulations and Interference Notices.

(h) Ministry of Health Code of Practice for the Safe Management of PCBs; May 2008.

(i) NZTA M/19:1999 Tubular Steel Lighting Columns.

(j) NZTA M/19:2002 Notes – Tubular Steel Lighting.

(k) AS/NZS 1158 Road Lighting.

(l) Auckland Transport Code of Practice Street Lighting.

(m) NZS 3000:2007 Electrical Installations.

(n) AS/NZS 4676:2000 Structural Design requirements for Services Utility Poles.

(o) AS/NZS 4677:2000 Steel Service Utility Poles.

(p) NZS 4203:1992 General Structural Design and Design Loadings for Buildings.

(q) AS/NZS 2312:2002 Guide to Protection of Structural Steel against atmospheric corrosion by use of protective coatings.

3.14.2 Lighting parameters

3.14.2.1 ***Scope***

(a) Road lighting shall be provided on all roads, accessways, walkways/cycleways and service lanes that are, or will be, under control of Waipa District Council.

(b) All lighting shall be designed and installed in accordance with AS/NZS 1152: Lighting for Roads and Public Spaces.

(c) The lighting category shall be selected using the charts in the code AS/NZS 1152 or the Subcategory Selection Tool on the Right website www.rightlight.govt.nz/roadlighting.

(d) Designs shall be whole of life light costs (25 years), including energy usage, maintenance and initial installation costs, to achieve a scheme with the lowest overall whole of life cost. LED technology may be used including dimming or other advanced control technology to better manage the energy usage.

(e) Lamps that produce 'white light' are preferred in pedestrian areas.

3.14.3 Design life

3.14.3.1 All materials shall have the following minimum design lives:

(a) Columns 70 years.

(b) Outreach Arms 70 years.

(c) Luminaires 20 years.

(d) Column coatings 20 years.

(e) LED's L70 design life to be 100,000 hours.

3.14.4 Road lighting equipment

3.14.4.1 All materials supplied shall be new. All fittings and materials used shall be consistent throughout the installation and where there is an addition to an existing system, the new fittings and materials shall match the existing.

3.14.4.2 ***Column and luminaire types***

(a) The standard column to be used on arterial and collector roads is galvanized steel, octagonal section (Oclyte or similar), complying with NZTA M/19 specification and with elliptical or curved out reaches. To assist with minimising maintenance costs, it is desirable that columns and luminaires on new local roads are the same as a type already in use within the District. If a different column or luminaire is proposed, full details of the specification, including independent verification of compliance with relevant specifications, shall be supplied for the approval of Council.

(b) These details should include, but not be limited to, the following:

(i) Structural design and manufacture.

(ii) Corrosion resistance.

(iii) Decorative finish.

(iv) Light outputs and characteristics.

(v) IP ratings of fittings.

(vi) Guarantee period.

3.14.4.3 ***Column location***

(a) Columns shall be located generally in accordance with the following criteria:

(i) Columns should be positioned in the grass berm, a minimum of 0.6m behind the front face of the kerb, and no closer than 300mm to the edge of a footpath.

(ii) Columns should be placed so that a minimum 1.8m corridor width is available between structures for pedestrians.

(iii) Ideally, columns shall be longitudinally located in line with property side boundaries. If this is impracticable then columns should not be located within 6m of side boundaries in order to minimise potential conflict with driveways.

(iv) Staggered installations are preferred.

(v) At an intersection, the first column on the joining road shall be on the left side of the road when entering from the through road and not more than 15m from the through road kerb line.

(vi) In a cul-de-sac, the distance from last column to the front boundary of the end property shall not be more than 40% of the standard column spacing.

3.14.4.4 ***Luminaire Types***

(a) Luminaires shall be of the LED type and shall comply with the LED Road Lighting Luminaire Specification and Assessment Methodology as provided by Auckland Transport Code of Practice Street Lighting. The latest issue of the document shall apply. Verification of full compliance is required to be supplied prior to approval of luminaires.

(b) A lux survey after installation shall be provided for all applications where five or more lights are provided.

3.14.5 Circuit cabling

3.14.5.1 Design of cabling, including control method, shall be in accordance to the specifications and requirements of the local Network Owner.

3.14.5.2 Where lighting columns or circuits are being relocated, extended or upgraded, the existing supply, protective devices and switching control may be reused if it is in compliance with this specification.

3.14.5.3 All new installations shall be designed to be controlled through the Network Owner's ripple control system. No other system will be considered.

3.14.6 Design check

3.14.6.1 In order to demonstrate compliance with this standard the documentation listed in Appendix C of AS/NZS 1158 part 1.1 and part 3.1 shall be supplied with subdivision engineering plans.

3.14.7 Audit lighting system

3.14.7.1 Upon installation and commissioning, the streetlights may be audited by Council. This final audit will ensure that the asset's performance and quality of the work comply with Council's requirements.

3.14.7.2 The audit parameters and methodology are defined as follows:

(a) Min and Max luminance values (Lux) – Values are extrapolated from field luminance measurements approximately along a line 1m off-set from the road centre line and at a height of 1.5m.

(b) Quality of hardware and installation work – site check for indications of items that may affect performance of the light output, hardware or pose a threat to the safety of the public.

3.14.7.3 If the installation fails to meet these criteria, the developer/installer will be liable to remedy the installation to ensure it meets the requirements. This audit may be carried out up to 3 months after the system has been in service.

3.14.7.4 An Energy Audit, as prescribed in AS/NZS 1158, is required for any lighting scheme of 10 or more lights.

3.15 Signs and Road Marking

3.15.1 All regulatory signs and road name signs shall be provided. These shall be located and mounted in accordance with the Volume 3, Part 3, Section 14 of this Manual. White powder coated steel poles shall be used.

3.15.2 Road marking shall be shown on the plans and applied in accordance with Volume 3, Part 3, Section 15 of this Manual.

3.16 Service Lanes

3.16.1 Minimum carriageway width is 3m.

3.16.2 All Residential Service Lanes must incorporate traffic calming measures to ensure traffic speeds do not exceed 20 kph.

3.16.3 Carriageway is to have concrete edging both sides. Stormwater is to be collected and disposed of. Specific geometric and pavement design is required. Carriageway surfacing is to be asphalt.

3.16.4 Service Lanes must connect at both ends to Local Roads only and provide for one-way traffic only.

3.16.5 For street naming refer to Council's Street Naming Policy. Please note that early consultation is encouraged.

3.17 Private Ways (ROW's)

3.17.1 General

3.17.1.1 Private ways shall be designed in accordance with Table 5: Private way retaining wall construction.

3.17.1.2 Private ways in urban areas (including reserves within the urban limits) longer than 75m and servicing 3 lots or less shall be provided with a passing bay.

3.17.1.3 Private ways, in Rural and Large Lot Residential zones, longer than 100m and servicing 3 or less lots shall be provided with a passing bay.

3.17.1.4 Stormwater shall be collected and disposed of, within the boundaries of the Private way. Stormwater shall not discharge across the vehicle crossing from the private way to the road.

3.17.1.5 Vehicle crossings to private ways shall be designed and constructed in accordance with Clause 3.12 and Figure 37: TS 306 Vehicle crossings with kerbed roads, Figure 42: TS 309 Crossing details and Figure 43: TS 310 Cross section details for vehicle crossings and depressed kerb and channel included in Volume 3, Part 3.

3.17.1.6 Where any retaining wall forms an integral part of the right of way construction, an engineering design certified by a Structural Engineer must be submitted. A building consent must be obtained and a code of compliance issued for retaining walls over 1.5m in height.

Table 5: Private way retaining wall construction

Zone	No. of Lots	Formation		Pavement Design	Surface	Min. Cross fall	Max. Gradient	Min. Inside Radius
		Boundary Width	Pavement Width					
Residential	2 - 3 4 - 6	4m 6m	3m 5m	Specific design	Concrete, 2 – coat seal, Hot mix or Paving Blocks	3% min	1 in 6 (16.6%)	9m
Industrial & Commercial(1)	2 - 3 4 - 6	7m 9m	5m 7m	Specific design	Concrete, 2 – coat seal, Hot mix or Paving Blocks	3% min	1 in 12 (8.3%)	12m
Large Lot Residential(2)	2 - 3 4 - 6	6m 9m	3m 5m	Specific Design	All weather surface	5% min	1 in 12 (8.3%)	12m

<table>
<tr><th rowspan="2">Zone</th><th rowspan="2">No. of Lots</th><th colspan="2">Formation</th><th rowspan="2">Pavement Design</th><th rowspan="2">Surface</th><th rowspan="2">Min. Cross fall</th><th rowspan="2">Max. Gradient</th><th rowspan="2">Min. Inside Radius</th></tr>
<tr><th>Boundary Width</th><th>Pavement Width</th></tr>
<tr><td rowspan="2">Rural[2]</td><td>2 - 3</td><td>6m</td><td>3m</td><td rowspan="2">Specific Design</td><td rowspan="2">All weather surface</td><td rowspan="2">5% min</td><td rowspan="2">1 in 12 (8.3%)</td><td rowspan="2">12m</td></tr>
<tr><td>4 - 6</td><td>9m</td><td>5m</td></tr>
<tr><td colspan="9">Further requirements:
For layout refer to Figure 14: DG 301 Standard residential privateways and Figure 15: DG301.1 Standard rural privateways and roads.
1. Kerb and channel to be heavy duty as per Technical Specification Figure 41: TS 308 Kerb and channel profiles.
2. Minimum surface treatment for Private ways (ROW's) in Rural and Large Lot Residential Zones must have an all-weather (metal) surface. Where existing dwellings are located within 25m of the ROW, mitigation of dust nuisance must be undertaken and submitted to Council. Dwellings located within 15m of the ROW, surface must be chip sealed in accordance with Council's standard.
3. The requirements for other Zones will be treated on a case by case basis.</td></tr>
</table>

3.18 Parking Bays

3.18.1 Parking bays shall be constructed to the same standard as the road and continue the carriageway cross fall.

3.18.2 Surfacing may be with interlocking pavers as specified in Clause 3.8.10.

3.19 Features and Berm Furniture

3.19.1 Feature entrance walls

3.19.1.1 Feature entrance walls will be permitted providing that the following criteria are adhered to:

(a) All permanent structures must be erected on land other than road reserve.

(b) The structure must comply with all building consent and District Plan requirements.

(c) The structure must be constructed from durable materials such as concrete, brick, stone, metal, timber.

(d) No lighting shall be installed that could potentially be hazardous to motorists or irritating to residents, nor shall it compromise the required road lighting.

(e) Plaque type name plates may be attached to the walls provided the sign complies with the District Plan requirements.

(f) No services shall be affected by the location and construction of the structure.

(g) All maintenance costs (including electricity supply if required) shall be at the expense of the lot owner upon which the structure is sited.

(h) The structures shall not create traffic safety problems.

(i) The structure shall be set to permanent levels.

3.19.2 Berm furniture

3.19.2.1 Structures or features, which are not part of signage or traffic control, will not be permitted on the road.

3.20 Access Ways

3.20.1 Access ways may be provided to link one road to another in order to improve pedestrian and cyclist access.

(a) Access ways shall be a minimum of 5m wide (boundary-to-boundary).

(b) Access ways shall be provided with lighting to P1 standard (see Clause 3.14.2 of this Part).

(c) Footpaths shall be a minimum width of 3m.

(d) If it is necessary to incorporate steps into the access way, a cycle ramp shall also be provided.

(e) Access paths bounded by private lots and linking between public roads shall be fenced both sides by the Developer. The fence shall be 1.2m high, 2 rails with open timber palings. A suitable design is shown in Figure 91: TS 394 Pedestrian accessway fence detail but other designs that achieve similar outcomes will be considered. The fence shall provide security for the resident and allow passive surveillance of the walkway.

(f) Access ways should have sight lines from one end to the other.

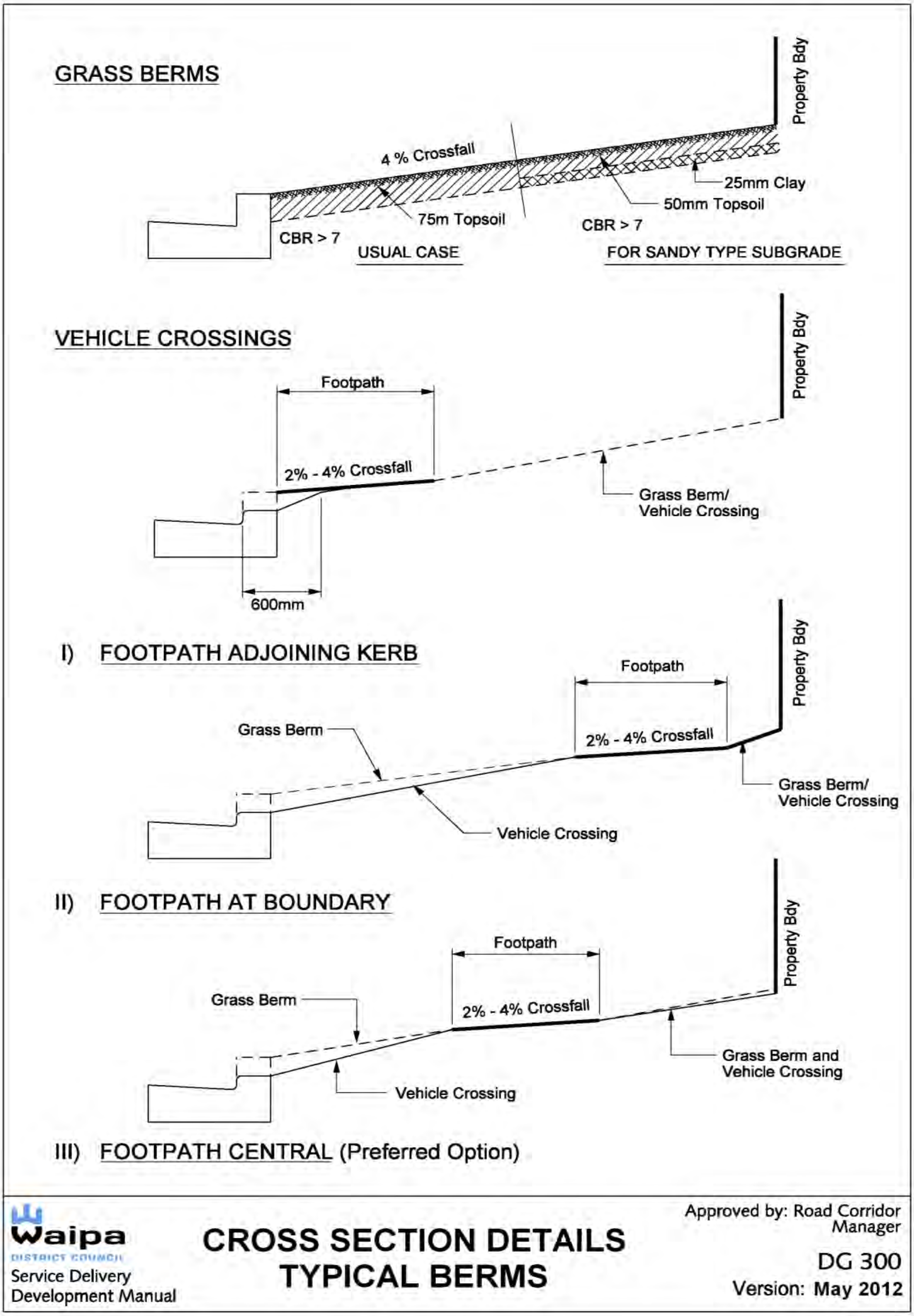
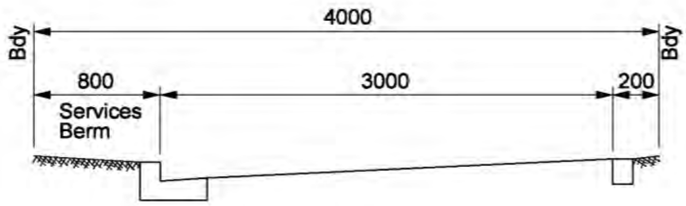
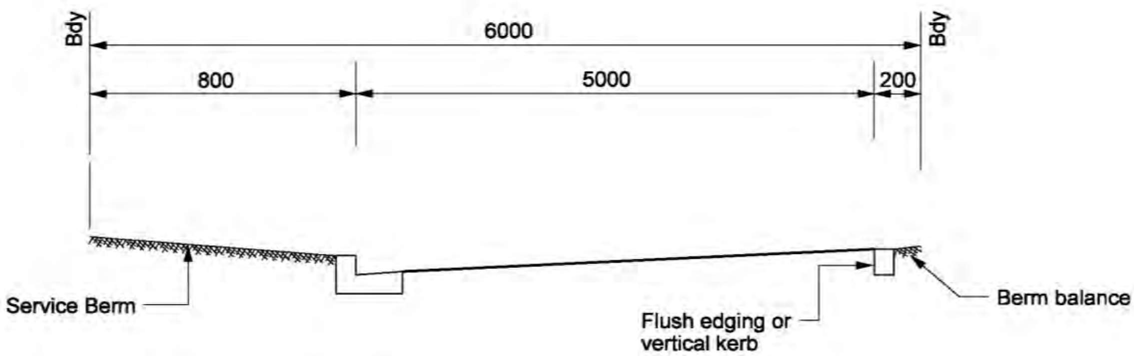


Figure 13: DG 300 Cross section details typical berms (Version: May 2012)



2 - 3 DWELLING UNITS



4 - 6 DWELLING UNITS

Crossfall direction generally with natural crossfall of country unless special reason for otherwise.

All dimensions are <u>minimum</u> unless stated otherwise.

Waipa District Council
Service Delivery
Development Manual

STANDARD RESIDENTIAL PRIVATEWAYS

Approved by: Road Corridor Manager

DG 301

Version: September 2012

Figure 14: DG 301 Standard residential privateways

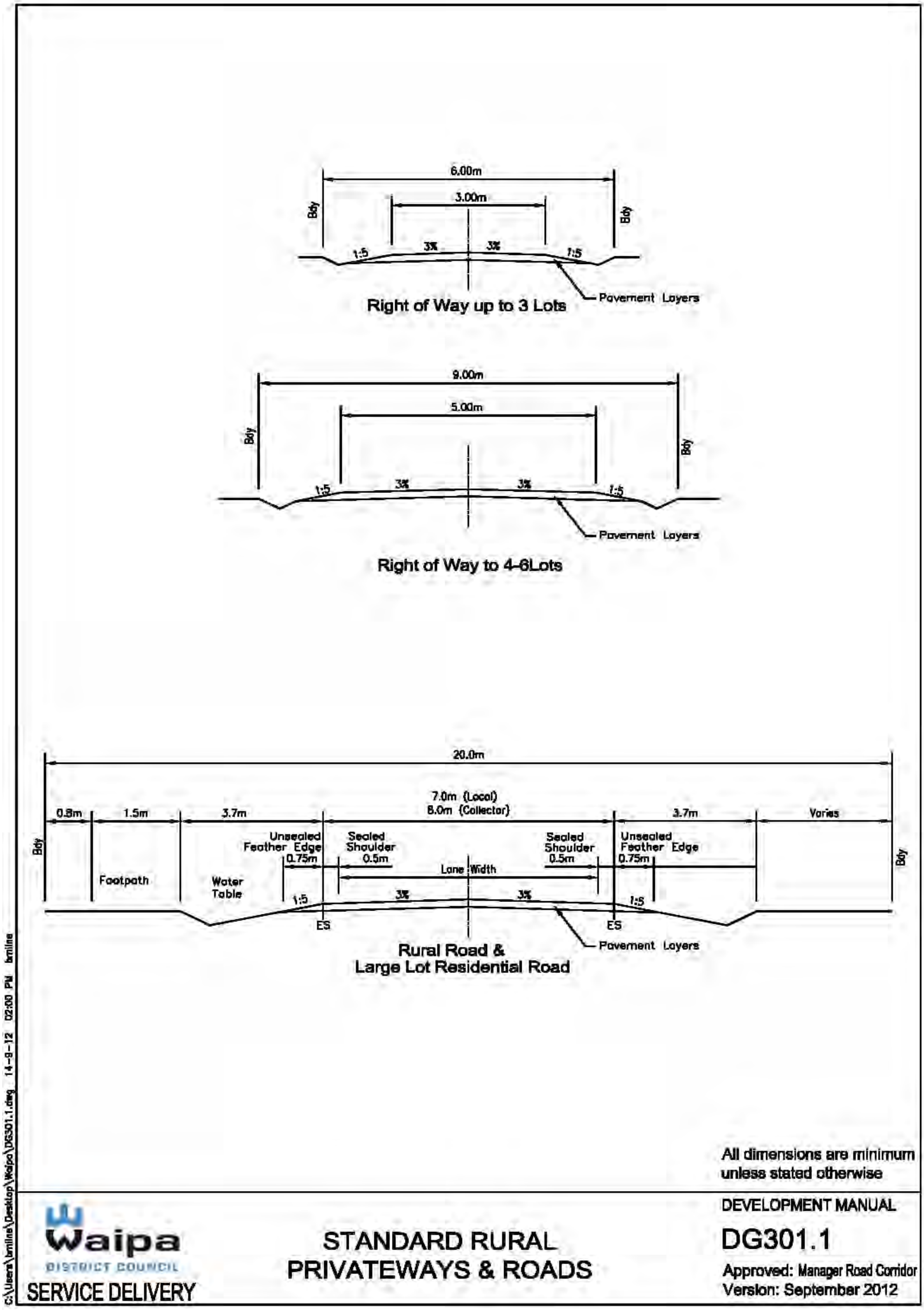


Figure 15: DG301.1 Standard rural privateways and roads

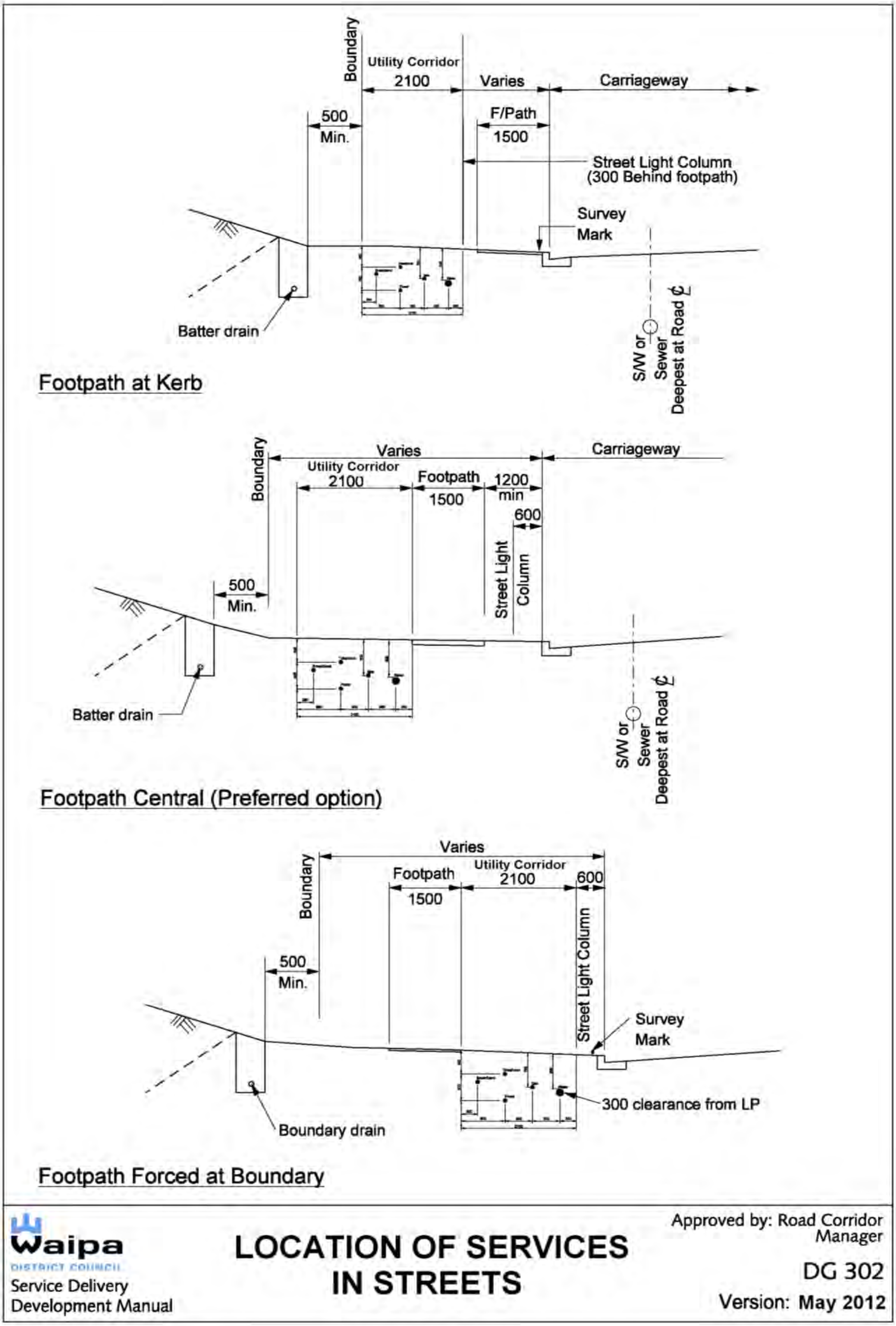
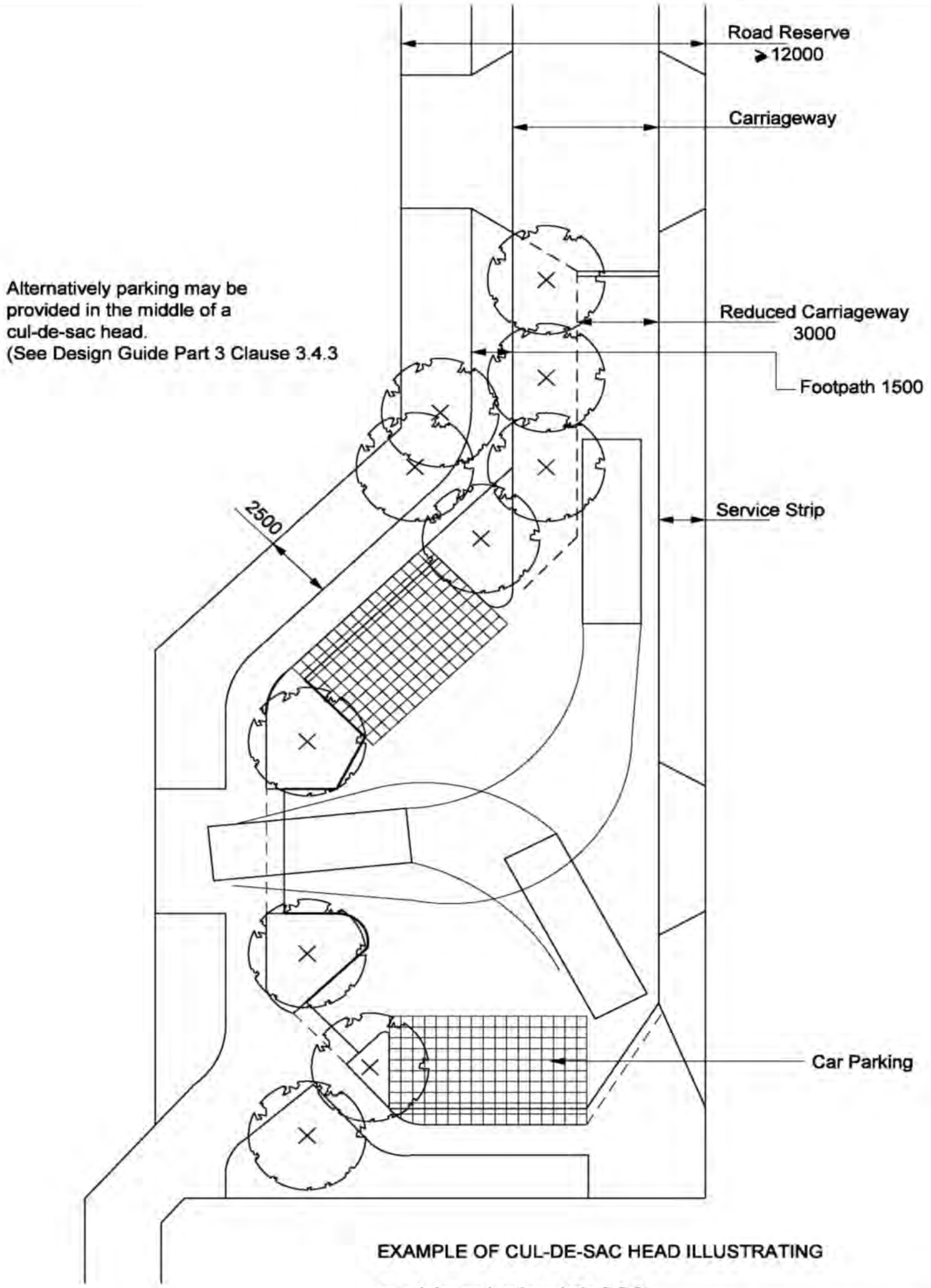


Figure 16: DG 302 Location of services in streets



EXAMPLE OF CUL-DE-SAC HEAD ILLUSTRATING

- minimum turning circle 3.6.6
- kerbside crossing allowing three point turn for heavy vehicles 3.6.6
- reduced carriageway where parking and passing provision specifically designed Table 1 Notes.

Waipa DISTRICT COUNCIL
Service Delivery
Development Manual

OPTIONAL CUL-DE-SAC FOR URBAN ENVIRONMENTS

DG 304
Approved by:
Road Corridor Manager
Version: **May 2012**

Figure 17: DG 304 Optional cul-de-sac for urban environments

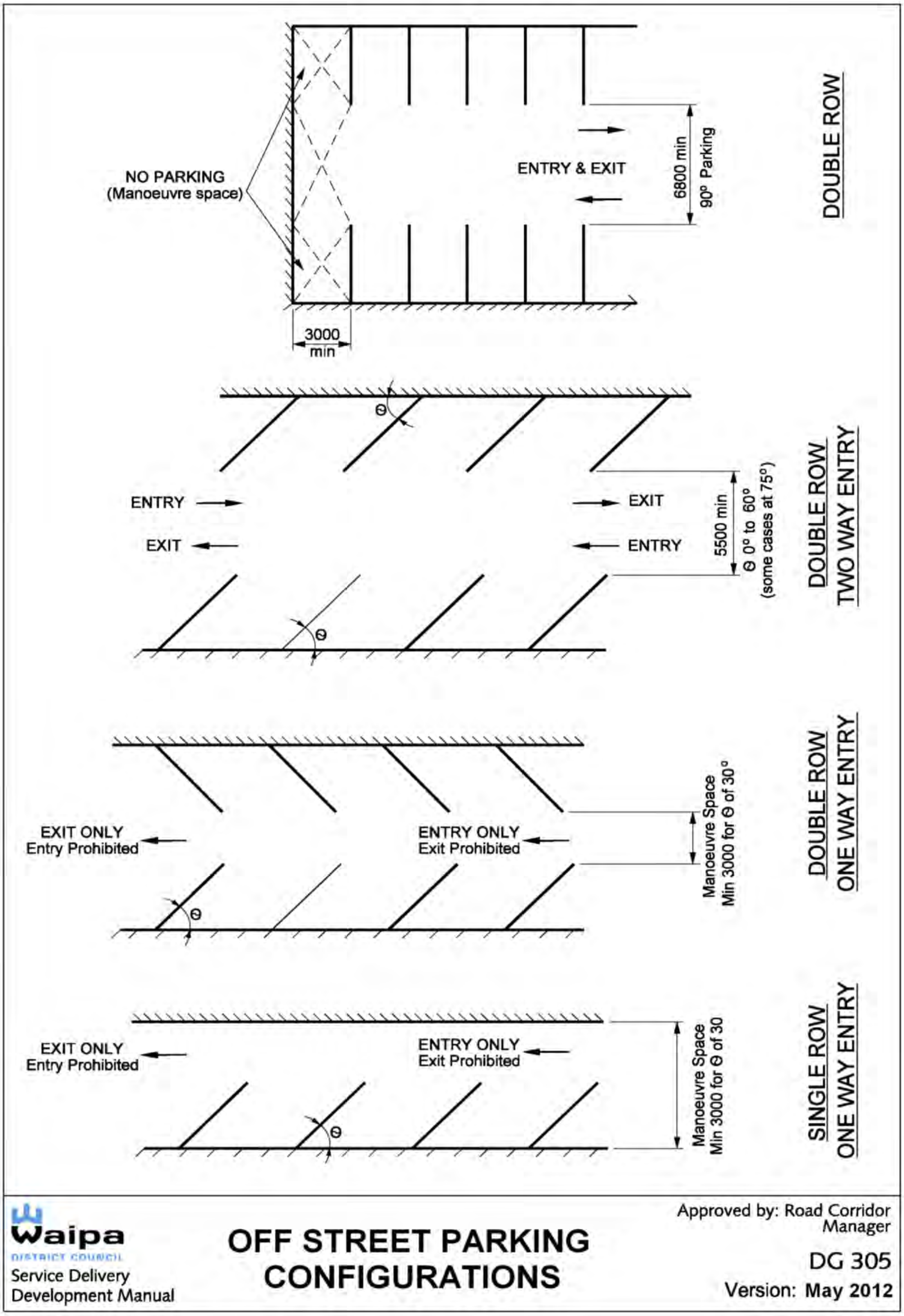
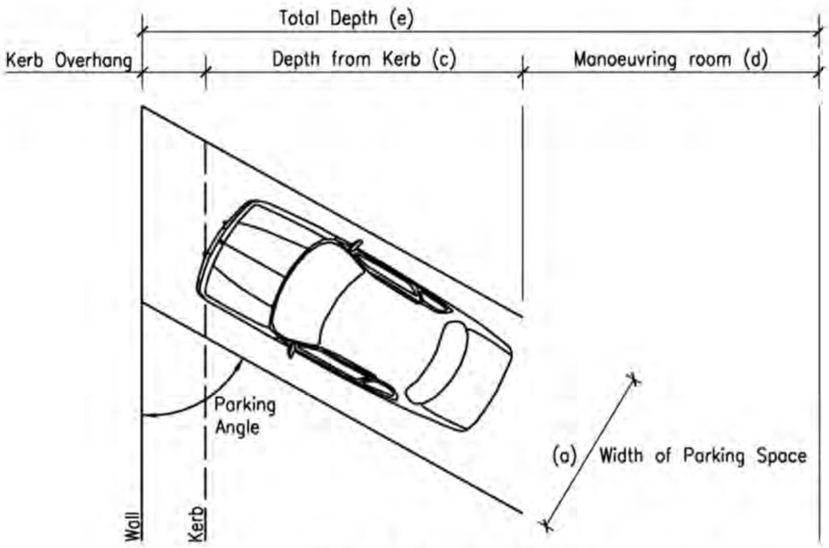


Figure 18: DG 305 Off street parking configurations

Excerpt from Proposed Waipa District Plan



CAR PARKING LAYOUT

Type of Parking		Stall Width (a)	Stall Depth		Manoeuvring Width (d)	Total Depth (e)	
Parking Angle	Type		From wall (b)	From kerb (c)		one row	two rows
		ALL MEASUREMENTS ARE IN METRES					
90°	Nose In	2.4 2.5 2.6 2.7	5.4	4.8	6.2 5.8 5.8 5.8	11.6 11.2 11.2 11.2	17.0 16.6 16.6 16.6
60°	Nose In	2.4 2.5 2.6 2.7	5.7	5.1	4.9 4.6 4.3 4.0	10.6 10.3 10.0 9.7	16.3 16.0 15.7 15.4
45°	Nose In	2.4 2.5 2.6 2.7	5.2	4.8	3.9 3.7 3.5 3.3	9.1 8.9 8.7 8.5	14.3 14.1 13.9 13.7
30°	Nose In	2.4 2.5 2.6 2.7	4.4	4.1	3.0	7.3	11.6
0°	Parallel	2.1	Stall length 6.6m		3.0	5.1	8.7

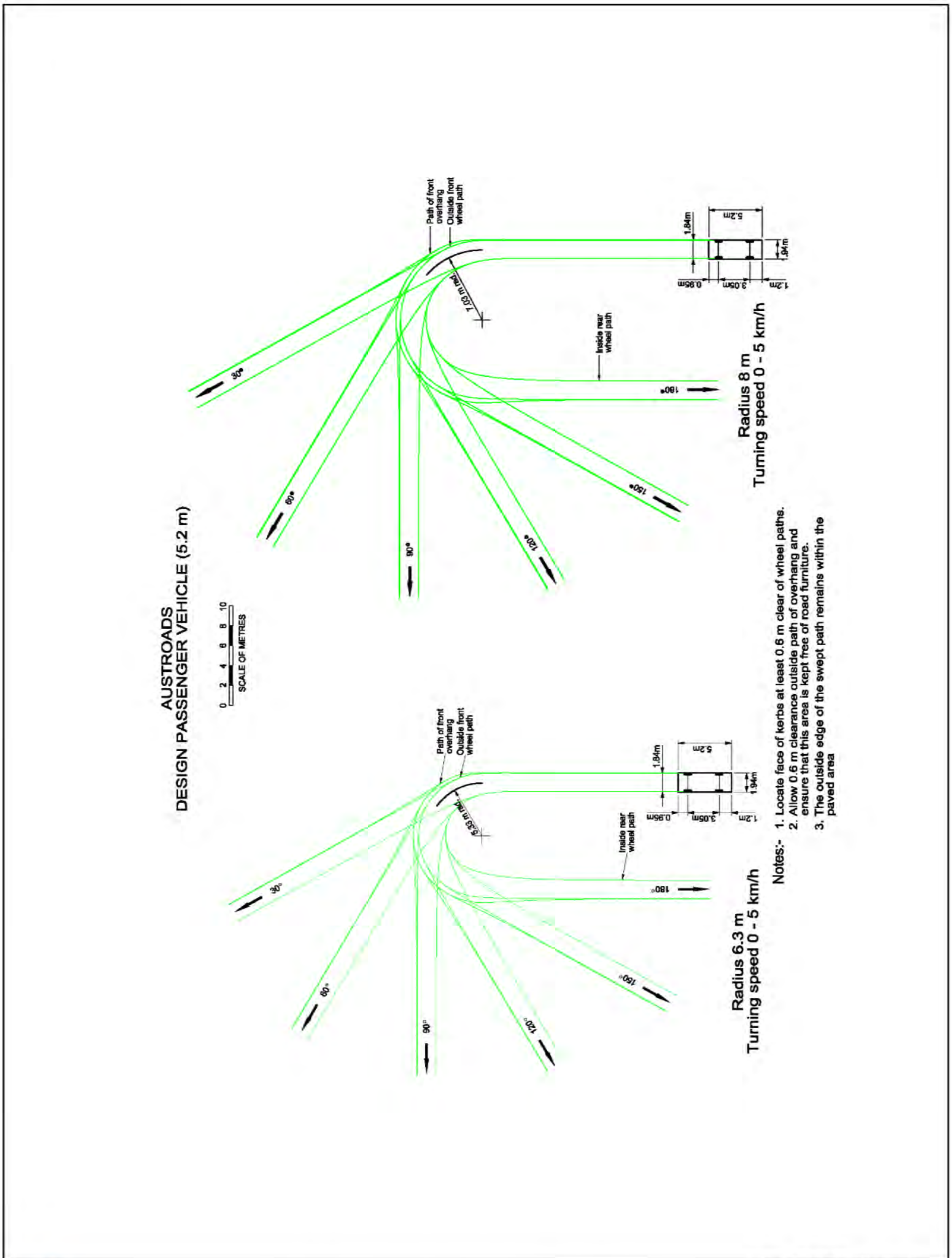
1. Parallel spaces (Parking angle = 0) shall be 6.6m long, except where one end of the space is not obstructed, in which case the length of a space may be reduced to 5.4m)
2. Minimum aisle and accessway widths shall be 3.0m for one way flow, and 5.8m for two way flow. Recommended aisle and accessway widths are 3.5m for one way flow, and 6.3m for two way flow.
3. Maximum kerb height = 150mm

Waipa DISTRICT COUNCIL
SERVICE DELIVERY

CAR MANOEUVRING AND PARKING SPACE DIMENSIONS

DEVELOPMENT MANUAL
DG305.1
Approved: Manager Road Corridor
Version: May 2012

Figure 19: DG 305.1 Car manoeuvring and parking space dimensions



Waipa DISTRICT COUNCIL
SERVICE DELIVERY

99.8 PERCENTILE CAR TRACKING CURVE

DEVELOPMENT MANUAL
DG305.2
Approved: Manager Road Corridor
Version: May 2012

Figure 20: DG305.2 99.8 percentile car tracking curve

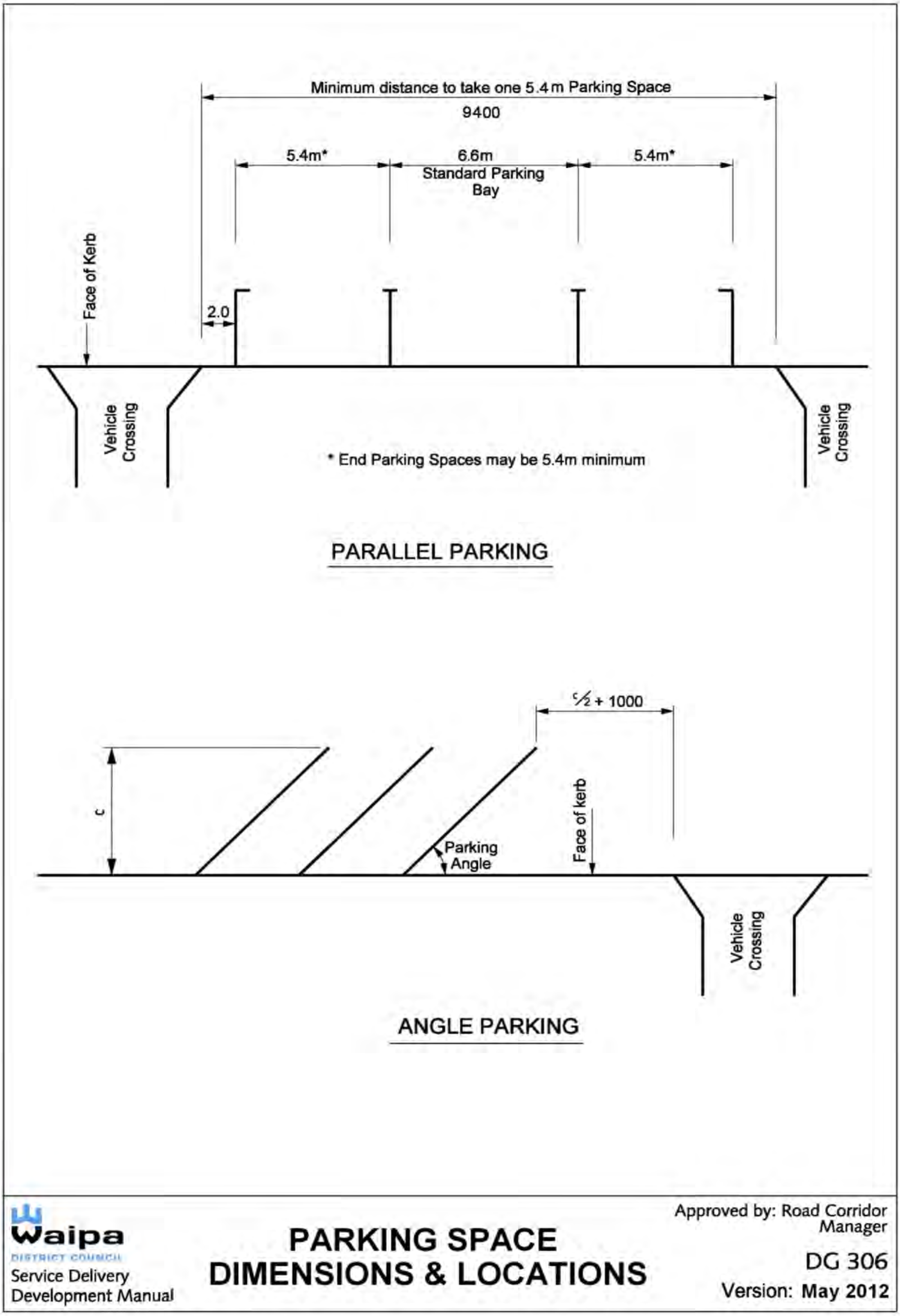


Figure 22: DG 306 Parking space dimensions and locations

Part 4: Stormwater Drainage

4.1 Introduction

4.1.1 This Manual sets out the basic design principles for drainage of stormwater. While some construction information is included for completeness, detailed information on construction standards can be found in Volume 3 Technical Specifications of this Manual.

4.2 General

4.2.1 All lots must provide for stormwater disposal by ground soakage, or where that is not viable, through connection to a public stormwater system, if available. The stormwater system shall provide for the collection and disposal of all stormwater within the land being developed, together with drainage from the entire catchment upstream of the proposed system.

4.2.2 The design intent is to incorporate low impact urban stormwater design within new works. A low impact urban design is both a design approach and a range of structural techniques that can be applied to urban development and stormwater management.

4.2.3 Key objectives are:

(a) To preserve existing and natural drainage systems.

(b) To minimise the amount of stormwater entering the piped drainage system.

(c) All pipeline components having a design life of not less than 100 years.

(d) Facilitate groundwater recharge.

(e) Cover the immediate needs as well as those of foreseeable future developments.

(f) Avoid detrimental effects on downstream properties.

(g) To build infrastructure that minimises lifecycle costs.

(h) To provide stormwater treatment.

4.2.4 Definitions

4.2.4.1 Low Impact Urban Design refers to a design approach and a range of structural techniques that can be applied to urban development and stormwater management. As a design approach, it provides an opportunity within a development to identify and recognise natural features and integrates these into the design of development layouts in order to minimise environmental impacts or enhance natural layout.

4.2.4.2 Design Level of Service refers to Council's design for capacity (expressed as an average Storm return period) for the stormwater reticulation and this is dependent on the zoning of land services by the reticulation.

4.2.4.3 Groundwater Drainage refers to any subsoil drainage system as designed by respective landowners. Subsoil drainage systems are permitted to discharge into land drainage systems provided they prevent any transport of fine sediment. Ground water drainage systems remain the responsibility of the landowners.

4.2.4.4 Infill Development refers to redevelopment of urban land through either subdivision or Building Consent.

4.2.4.5 Land Drainage System refers to the flow of stormwater and groundwater but concentrates mainly on peak surface discharges and their reticulation under urban conditions.

4.2.4.6 Primary Design Flow is the estimated runoff selected to provide a reasonable degree of protection to the surrounding land. In most cases, this flow will be piped or contained within relatively narrow confines under public control by means of a reserve or easement.

4.2.4.7 Secondary Flow Path refers to the path taken by runoff in excess of the primary design flow and is to be capable of producing protection to the surrounding buildings for a once in 50 years return period rain event for commercial, industrial, and habitable residential floor levels.

4.3 Referenced Documents and Standards

4.3.1 Referenced documents

(a) New Zealand Water Environment Research Foundation (NZWERF), On-site Stormwater Management Guideline (October 2004).

(b) Hydraulic Research Paper No. 2 'Charts for the Hydraulic Design of Channels and Pipes'. Third Edition. H.M.S.O. London. 1969. Peter Ackers.

(c) Approved Document for NZ Building Code – Clause E1 “Surface Water” (October 2011).

(d) Auckland Regional Council Stormwater Management Devices: Design Guidelines Manual – revision to Technical Publication 10 (July 2003).

(e) Auckland Regional Council TP 90 Erosion and Sediment Control: Guidelines for Land Disturbing Activities in the Auckland Region 1999.

(f) Auckland Regional Council, TP 124 Low Impact Design Manual for the Auckland Region 2000.

(g) Environment Waikato Erosion and Sediment Control - Guidelines for Soil Disturbing Activities (TR 2009/02).

4.3.2 Standards

(a) NZS 1260:2009 PVC-U Pipes and Fittings for Drain Waste and Vent Applications.

(b) NZS 4442:1988 Welded Steel Pipes and Fittings for Water Sewage and Medium Pressure Gas.

(c) AS/NZS 2566.1:1998 Buried Flexible Pipelines – Structural Design.

(d) AS/NZS 2566.2:2002 Buried Flexible Pipelines – Installation.

(e) NZS/AS 3725:2007 Loads on Buried Concrete Pipes.

(f) AS/NZS 4058:2007 Precast Concrete Pipes (pressure and non-pressure).

(g) AS/NZS 5065:2005 Polyethylene and Polypropylene pipes and fittings for drainage and sewerage applications.

(h) AS 1741:1991 Vitrified Clay Pipes and Fittings with Flexible Joints.

4.4 Stormwater System and Stormwater Management Plan

4.4.1 General

4.4.1.1 Drainage systems, both during construction and for completion, shall be designed such that principally only urban stormwater is conveyed. The Developer shall be responsible for ensuring that mechanisms exist within the pipeline systems to prevent water-borne litter, such as paper and plastics, and gross sediments from entering the system. As far as practical, these materials shall be restricted from entering the stormwater system. Design plans shall demonstrate how this is achieved.

4.4.1.2 Developers are required to provide for stormwater discharge from all lots by ground soakage or, where that is not viable, through connection to a public stormwater system.

4.4.1.3 Where not covered by this Manual, design procedures shall be taken from the Verification Method for the "NZ Building Code Clause E1 Surface Water".

4.4.2 Stormwater Management Plan

4.4.2.1 A Stormwater Management Plan must be prepared by a suitably qualified person to the satisfaction of Council's Development Engineering Manager for the complete subdivision. The Stormwater Management Plan must be provided at the consent holders expense and must include, but not be limited to the following:

(a) Geotechnical engineering investigation, if applicable.

(b) Information regarding onsite soakage and percolation tests, if applicable.

(c) Stormwater runoff design calculations from proposed development including stormwater from roads, right of ways and lots.

(d) Preliminary assessment and layout of proposed stormwater system for development.

(e) Identification of overland flow paths and easements, if applicable.

(f) Provide evidence of the likely impacts on the downstream waterways and include any mitigation proposed.

(g) Design plans for these works need to include:

(i) Diameter, length and gradients of any pipes, drains, flumes and culverts and structures;

(ii) Collection and disposal point details including erosion prevention at any disposal outlets;

(iii) Calculations to support the culvert sizes selected. Calculations should be on the total catchment area, which may include areas outside the property boundary of either of those lots described above or the entire parent property;

(iv) Consideration needs to be given to reasonable roof, paved and land drainage areas; and

(v) Minimum floor levels must be provided for any lots for any development subject to a stormwater management plan.

4.5 Resource Consents

4.5.1 Resource Consents from the Waikato Regional Council could be required for the following work:

(a) The discharge of contaminants during construction work.

(b) The diversion of natural water during construction work.

(c) The permanent diversion of natural water as a consequence of the development.

(d) The discharge of stormwater into natural waterways.

4.5.2 In the case of both discharge of contaminants and diversion of natural water during construction, the necessary Resource Consent shall be applied for by the Developer and is to be exercised in the name of the Developer.

4.5.3 The Resource Consent, in respect of the permanent diversion of natural water, or where the discharge of stormwater into natural waterways is solely from the Developer's subdivision, shall initially be applied for in the name of the Developer. It will be a matter of negotiation between the Developer and Council as to what scope the consents shall have.

4.5.4 Generally construction related consents will not be transferred to Council. The Resource Consent will not be taken over by Council until:

(a) All earthworks including building sites have been completed.

(b) All consent conditions are approved by Council.

(c) The Developer obtains agreement from Waikato Regional Council that the consent has been complied with.

4.6 Design Requirements

4.6.1 The land drainage system shall be capable of serving the entire catchment upstream of the subdivision and must have due regard to the effect it may have on downstream waterways and adjoining areas. It shall be designed within the terms of any approved comprehensive drainage scheme.

4.6.2 The rainfall intensity and depths used in design calculation must allow for climate change.

4.6.3 The design calculations shall be in accordance with Clause 4.6.17 of this Part for Greenfield sites and Clause 4.6.18 for infill developments.

4.6.4 Where open watercourses are to form part of the land drainage system, this shall be determined at scheme plan approval stage and the Developer shall submit sufficient engineering design to enable Council to evaluate the proposals for approval.

4.6.5 The means of stormwater disposal shall be capable of serving the whole of the lot, except where this requirement is unreasonable. The connection must be able to service at least the whole building and developed area available on the lot where connection to Council's system is utilised. Generally each lot will have a single stormwater connection.

4.6.6 Where further subdivision upstream of the one under consideration is provided for in the District Plan or Structure Plan, the stormwater pipelines are to be constructed to the upper limits of the subdivision with sufficient capacity to service further development.

4.6.7 In new residential developments, the preferred means of stormwater disposal shall be to adopt stormwater control measures that retain the pre-development catchment characteristics i.e. hydraulic neutrality for ground soakage and runoff to avoid compromising natural water. Until such time as local specific guidelines can be introduced, developers should take the lead provided in the Auckland Regional Council publications cited in Clause 4.3.1 of this Manual.

4.6.8 There are a number of treatment and detention options available, the preferred solution will either be identified in an approved Integrated Catchment Management Plan (ICMP/CMP) or through discussions with Council. Treatment and detention options will be assessed on the following criteria to determine their suitability:

(a) The treatment and detention option will have life span of not less than 50 years;

(b) The anticipated maintenance frequency over the lifecycle of the asset;

(c) The practicality and cost of the maintenance of the asset;

(d) Land limitations such as available area, stability or ownership;

(e) The suitability of locating a device in the locality;

(f) The engineering capacity and efficiency of the device; and

(g) The optimisation of land use and detention and treatment facilities in the growth area.

4.6.9 The design of the treatment and detention devices shall follow the guidance provided in Auckland Council document TP10, Stormwater Management Devices: Design and Guidelines Manual, 2003; however Council specific requirements will at all times take precedence over TP10. If the device is to be a Council asset it shall be located on land owned by, or to be vested to Council. An easement over private land in favour of Council is not acceptable for treatment or detention device assets that are to be owned by Council. A maintenance plan must be submitted with detailed as-built plans.

4.6.10 Stormwater treatment devices such as stormwater detention areas, rain gardens, and swales are to be landscaped with vegetative cover as set out Volume 2, Part 9: Planted

Stormwater Devices. Landscape plans shall be submitted for the approval of the Council prior to planting. For treatment devices constructed in conjunction with subdivision or land use consents, planting shall be completed and maintained for at least one year prior to vesting the treatment device to the Council. Note that prior to handover of devices to the Council, an Operations Manual shall be supplied in accordance with the requirements of Checklist 4.7 on page 619 and therefore retention of key information from the design stage is advised.

4.6.11 Council encourages early consultation on design to improve maintenance, aesthetics' and functionality of proposed systems.

4.6.12 The issue of river/stream bank stability shall be considered for stormwater control structures, ground soakage, discharge points, etc.

4.6.13 Under no circumstances shall stormwater be directed to or permitted to enter a wastewater system.

4.6.14 Stormwater secondary flow paths shall be identified for the following situations:

(a) Rainfall in excess of design levels of service for the zone (as shown in Table 5: Private way retaining wall construction, Table 6: Predevelopment Runoff Coefficients, Table 7: Stormwater System Design Parameters).

(b) Catch pit blockage.

(c) Culvert blockage (or alternatively provide an unobstructed waterway capable of passing the once in 50 year return period rainfall event while maintaining at least 0.5m of freeboard to building platforms on upstream property).

(d) Infill development sites as detailed in Clause 4.6.18 of this Part.

4.6.15 Stormwater secondary flow paths shall be shown on design plans. Water flow levels shall be determined for rainfall events having a once in 50 years return period.

4.6.16 All stormwater secondary flow paths shall be protected by an easement. The easement shall cover the full extent of the secondary flow path (1m for factor of safety) and shall not be less than 3m wide. The easement shall have the effect of preventing alteration of the ground surface and prohibit location of structures that might impede the flow of water across the land. The easement shall be in favour of the Council and/or the upstream lot(s) as appropriate. The easement shall be duly granted, reserved, and shown on the survey plan. Stormwater secondary flow paths shall be delineated to assist recognition and preservation of their purpose. Figure 103: TS 411 Stormwater secondary flow path treatment shows the minimum treatment required. Additional edge treatments and hardening of the base surfaces shall be provided for, when applicable, due to surface flow volumes and velocities.

4.6.17 Greenfield stormwater flow estimate

4.6.17.1 *Calculation of runoff*

(a) Runoff shall be calculated using the "Rational Method" which is based on the following formula:

$$Q = \frac{C\,i\,A}{3600}$$

Q = Runoff in litres/second.
C = Runoff Coefficient.
i = Rainfall Intensity in millimetres per hour.
(Use a storm duration corresponding to the catchment time of concentration)
A = Area of catchment in square meters.

Equation 1: Stormwater runoff calculation

4.6.17.2 *Design standards*

(a) The runoff coefficients shown in Table 6: Predevelopment Runoff Coefficients are to be used for the runoff calculation and are provided as a guide for initial calculation of system requirements. More accurate investigations into appropriate return periods and runoff coefficients will be necessary for detailed design. Design parameters must allow for climate change. Detailed design should involve calculating a weighted average runoff coefficient by averaging the value for individual parts of the catchment. This may be done for a representative sample area or the whole catchment. The formula for this calculation is shown in Clause 2.1 Verification Method of the “NZ Building Code Clause E1 Surface Water”.

Table 6: Predevelopment Runoff Coefficients

Activity	Industrial	Commercial	Residential (flat terrain)	Residential (slopes >5%)	Large Lot
Rainfall Intensity Curve Annual Exceedance Probability	20% AEP	10% AEP	50% AEP	50% AEP	50% AEP
Runoff Coefficient (C)	0.75	0.75	0.55	0.6	0.4

(b) In refining the estimate of runoff coefficient, the coefficients provided in NZ Building Code E1 Table 2 shall be used. The following Coefficients are provided as a guide:

(i) Roofs C = 0.95

(ii) Asphaltic & Concrete Areas C = 0.90

(iii) Uncultivated Ground, Lawns & Playing Fields C = 0.30

(iv) Cultivated Ground & Dairy Farmland C = 0.20

4.6.17.3 *Time of concentration*

(a) The time of concentration shall be determined as the ‘time of entry’ plus the ‘time of flow’ which shall be no less than 10 minutes.

(b) Time of entry to the system shall be calculated from Figure 23: DG 401 Overland flow graph.

(c) Time of flow can be calculated from the flow velocity in pipes and channels. Note since this is not known initially, an iterative type solution is necessary with time of concentration recalculated from the catchment flow calculation.

4.6.18 Infill developments stormwater flow estimate

4.6.18.1 *Catchment evaluation*

(a) A review of the site catchment is required to include consideration of issues such as run-on, peat soils, and culvert block zones.

4.6.18.2 *Run-off coefficient and return period*

(a) Use the rational formula detailed in Clause 4.6.17.1 above and Tables 6 and 7 below, to calculate the run-off for the storm durations of 10, 20, 30 & 60-minute duration and 2, 6, 12, 24, 48 and 72 hours duration. Note the extra storm events are necessary for the soakage calculations.

Table 7: Stormwater System Design Parameters

Activity	Industrial	Commercial	Residential	Large Lot	Rural
Rainfall Intensity return period for piped discharge - Council level of service. (Primary system)	20% AEP	10% AEP	50% AEP	N/A	N/A
Rainfall Intensity return period for total site system including secondary flows. (Secondary system)	2% AEP	2% AEP	See Table 7	N/A	N/A
Runoff Coefficient (C)	0.9	0.9	0.65	0.55	0.45

Table 8: Rainfall Return Period (AEP) for Infill Residential Development

Secondary Flow Path Scenario	AEP for Infill Residential Development
i) Falls towards public road >2%	50%
ii) Flat (+/– 2%)	10%
iii) Falls away from public road >2%	2%

4.6.18.3 *Soakage test calculation and design*

(a) Refer to Volume 2, Part 4, Clause 4.21.

4.6.18.4 *Secondary flow management solution*

(a) If the site does not slope towards public road, detail the management of the 50-year flows including detention, overland flow paths and easements as appropriate.

Advice Note: Additional guidance is available from Council’s asset managers.

4.6.18.5 ***Time of concentration***

(a) The Time of Concentration for Infill developments shall be calculated as for Greenfield developments as detailed in Clause 4.6.17.3.

4.6.18.6 ***Rainfall***

(a) High Intensity Rainfall Design Systems (HIRDS) Version 3 data must be used within Waipa District to provide rainfall design intensity and depths.

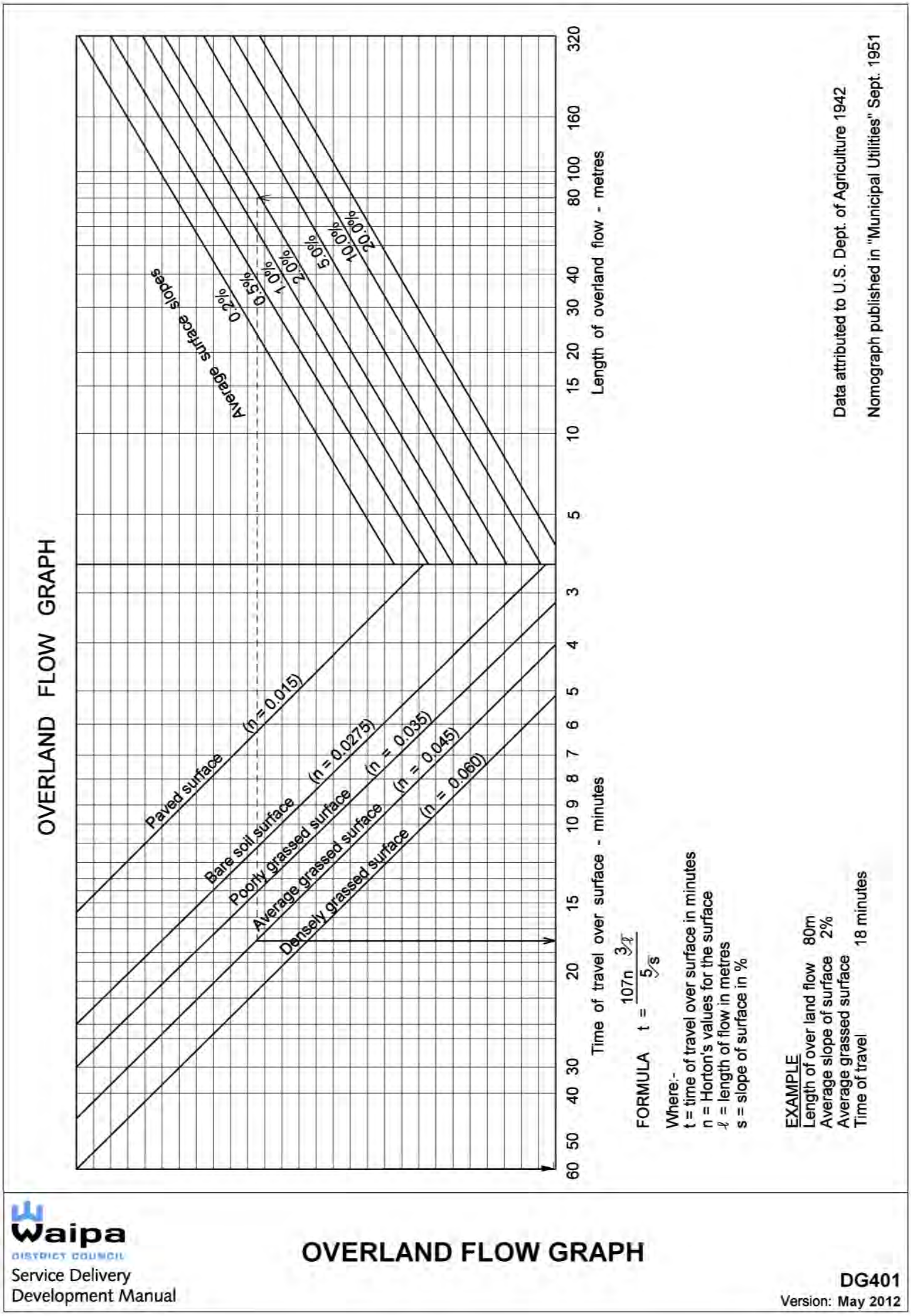
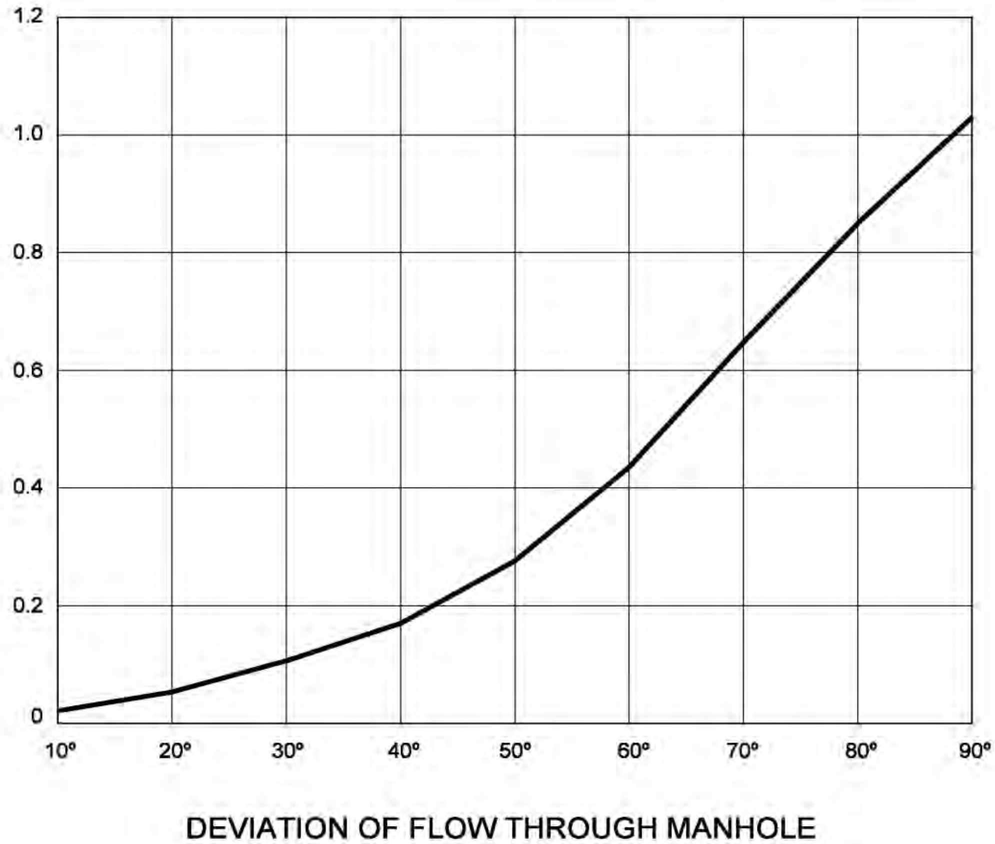
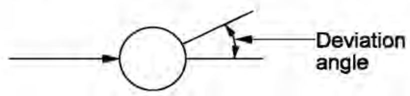


Figure 23: DG 401 Overland flow graph

$he = -ke \frac{V^2}{2g}$ where V is for full pipe flow





EXAMPLE:-

V = 0.2 m/s, Deviation angle = 50°

Drop in manhole = $\frac{0.3 \times 0.2^2}{2 \times 9.8}$ = 61mm

NOTE: Minimum drop in any stormwater manhole = 20mm

Reference: "Degremonts" Water Treatment Handbook Edition 1965

Waipa District Council
Service Delivery Development Manual

HEAD LOSS IN STORMWATER MANHOLES

DG402

Version: **May 2012**

Figure 24: DG 402 Head loss in stormwater manholes

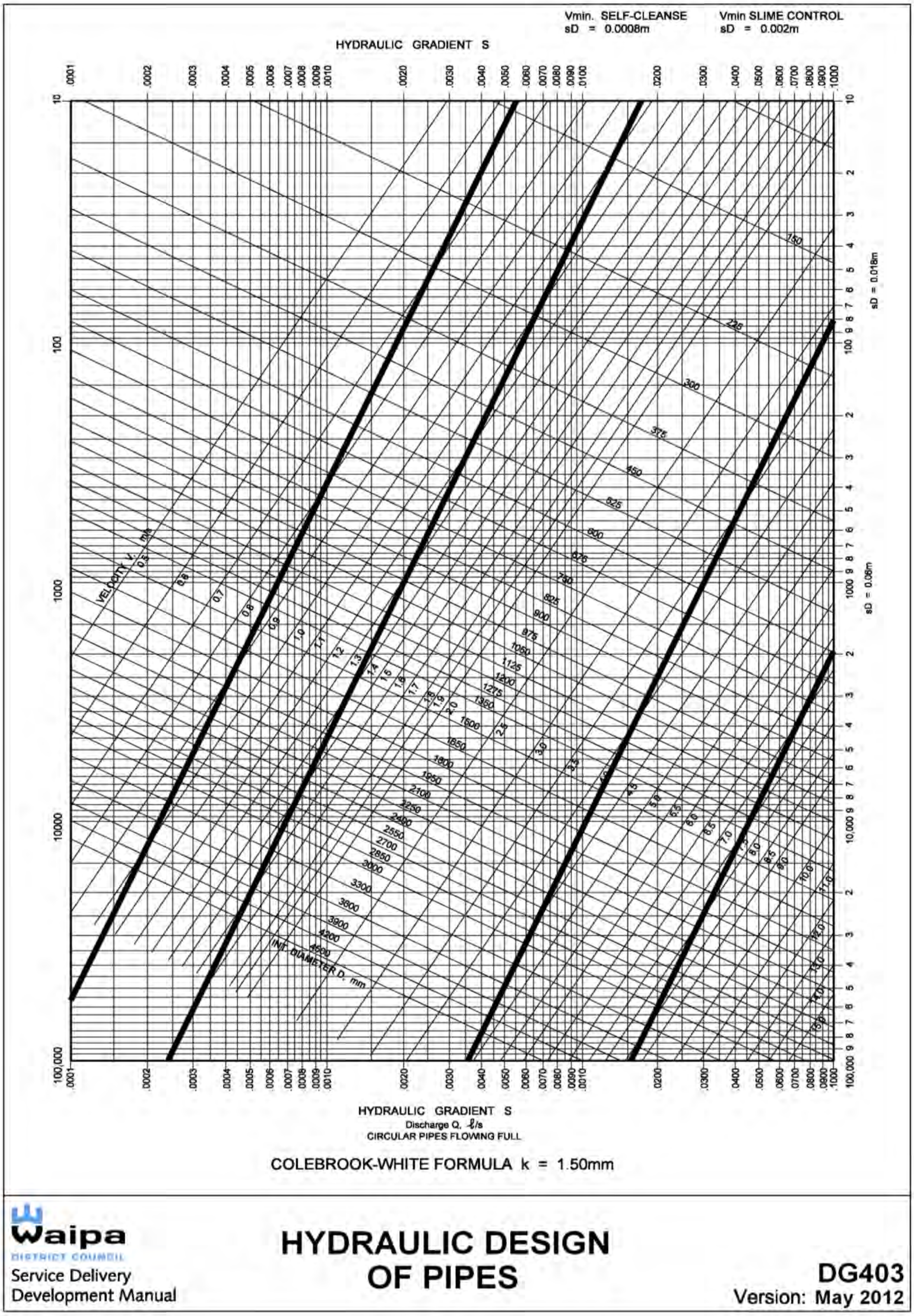


Figure 25: DG 403 Hydraulic design of pipes

4.7 Open Watercourses

4.7.1 Natural watercourses are expected to be retained.

4.7.2 The District Plan sets out requirements which must be incorporated into any design.

4.7.3 The extent of stream drainage work shall be designed to achieve a satisfactory solution recognising community flood protection, bank stability, the retention of the natural topography and ecological values, maintenance, hydraulic and safety considerations, including the downstream effects of the work.

4.7.4 Constructed watercourses (open drains) may be piped if there are valid engineering or design considerations. The Engineering Plans should be noted accordingly.

4.8 The Hydraulic Design of Pipelines

4.8.1 The hydraulic capacity of stormwater pipelines shall be sufficient to convey the design flow as determined by the procedure outlined in Clause 4.6.17 or 4.6.18 of this Part.

4.8.2 All pipes shall be of adequate size to carry the designed flow without surcharge.

4.8.3 The design shall provide that:

(a) No stormwater pipelines, other than connections to individual lots, shall be less than 225mm in diameter;

(b) All public stormwater pipes made from reinforced concrete shall be at least class 4 unless calculations in accordance with AS/NZS 3725:2007 are provided to support the use of another class. Note the preferred method of demonstrating compliance with this requirement is a printout from the software produced by the Concrete Pipe Association of Australasia (http://www.concpipe.asn.au);

(c) Single catch pit outlets shall be not less than 225mm in diameter and shall always be at least Class 4;

(d) Double catch pit outlets shall be not less than 300mm in diameter and shall always be at least Class 4;

(e) The minimum velocity for pipes flowing full shall be 0.7m/s;

(f) The maximum velocity for pipe flow shall be 4.0m/s; and

(g) Where a reticulated system is not available, pipe inlet and outlet capacities must be verified for the design flow.

4.8.4 Special measures to dissipate energy shall be designed at all outfalls to natural and constructed receiving waterways.

4.9 Location of Pipelines

4.9.1 Stormwater pipelines within **RESIDENTIAL ZONES** shall normally be located within the road reserve.

4.9.2 Stormwater pipelines in **INDUSTRIAL ZONES** shall either be located in the road reserve or in the front yard area.

4.9.3 Stormwater reticulation pipelines (and connections) in **COMMERCIAL ZONES** shall be either in the rear service lane or in the rear yard of properties where no service lane exists. Major reticulation and trunk lines shall be in the road reserve (as for residential zones).

4.9.4 Where stormwater pipelines are in the road reserve, they shall conform to the standard location of underground services and shall normally be 2m out from the kerb. The pipeline shall, at all times, be located within the carriageway. Where the offset from the kerb varies due to curves in the street, the manholes shall be located 2m out from the kerb.

4.9.5 Where a stormwater pipeline changes location within a street, it shall do so at an angle of 45 degrees or greater. Where a stormwater pipeline crosses other utility services, it shall do so at an angle of 45 degrees or greater.

4.9.6 On the limited occasions where a stormwater pipeline is within a property, it is required to be parallel to and 1m minimum clearance from a boundary. On sloping ground, the stormwater pipeline should be within the property of the higher land to avoid conflict with excavation levelling of the lower property. Memorandum of Easements will be required over stormwater pipelines where located within private property. For public stormwater infrastructure, a 3m minimum width gross easement shall be created. For private infrastructure (connections) where located within neighbouring lots, a 2m minimum width appurtenant easement shall be created.

4.9.7 Where the pipeline gradients are greater than 1 in 5, anchor and/or anti-scour blocks shall be constructed of a type comparable to that illustrated in Figure 97: TS 405 Anti-scour blocks for steep lines.

4.9.8 No new private pipelines shall pass between one lot and another. If crossing of private property is unavoidable, those parts of the pipeline serving more than one lot shall be a Council mains with service connections to the property boundaries.

4.9.9 Where Council pipes pass through private property, refer to Clause 4.10.2. Pipe location for works under all consents should facilitate future fee-simple subdivision.

4.10 Pipeline Construction

4.10.1 General

4.10.1.1 The construction of the pipelines shall be carried out in accordance with the requirements of Technical Specification (Volume 3, Part 4 of this Manual).

4.10.2 Requirements for building near drainage pipelines

4.10.2.1 With respect to building or excavation, near public sewers, the restrictions as described in the Operative Waipa District Land Drainage and Stormwater Bylaw must be adhered to. These requirements are shown in Figure 102: TS 410 Guidelines for building adjacent to drainage pipelines.

4.10.2.2 The following design considerations must be followed subsequent to Council's approval to work near Drainage Pipelines:

4.10.2.3 ***Structural loads***

(a) No structural loads are to be placed on public drainage pipelines.

(i) The first row of piles must be at least 1.5m clear of the outside of the pipe and down to a depth of at least 1m below the invert of the pipe.

(ii) Subsequent rows of piles must be constructed to a depth of at least 1m below the 45 degree influence line from the pipe invert.

(iii) All structural loads on piles shall be absorbed outside the 45 degree envelope and below the pipe invert of the first row of piles.

4.10.2.4 ***Pile ramming***

(a) Piles within 5m or within the 45 degree envelope from the stormwater pipe centre line must be drilled.

4.10.2.5 ***Effects on pipe and trench lines***

(a) The building or other work must be designed and constructed so that the pipe and trench line is not adversely affected by any future excavation necessary for maintenance of the stormwater system. No piles are permitted within a drainage easement or within 1.5m of any stormwater pipe centre line.

4.10.2.6 ***Effects on structures and buildings***

(a) The structure must allow for settlement of the pipe trench line and backfill.

4.10.2.7 ***Figures required***

(a) Figures of the proposed works must accurately identify the location of the drainage pipeline affected and the distances with cross section details for all structures, footings or piles within the 45 degree line.

4.10.2.8 ***Building over stormwater pipes and associated assets***

(a) Buildings are not permitted to be located over any stormwater infrastructure.

4.11 Joints

4.11.1 All pipes shall be rubber ring jointed unless specifically required to be flush jointed or solvent cemented by the Engineer.

4.11.2 The jointing method must consider the effects on groundwater levels – particularly in peat soils where all efforts are required to minimise groundwater level reduction.

4.12 Pipe Laying

4.12.1 The pipe bedding shall be selected to meet the requirements of the class of pipe to be used and the design loading conditions.

4.12.2 The strength of Council pipes shall be Class 4 unless a specific design in accordance with the pipe laying tables and bedding diagrams in AS/NZS 3725 shows that Class 2 or 3 is acceptable. Catch pit outlets shall always be Class 4. Specific design may be required for flush jointed pipe bedding.

4.12.3 The construction of pipelines shall be carried out in accordance with the requirements of AS/NZS 2566, AS 2032 and AS 3725 and the Volume 3 Technical Specifications for Stormwater and Wastewater Sewers of this Manual.

4.13 Minimum Cover Over Pipes

4.13.1 General

4.13.1.1 All pipelines shall be specifically designed to support the likely loadings in relation to the minimum cover to be provided in accordance with the terms of NZS/AS 3725. The minimum cover for all types of pipes under all conditions shall be 600mm except as otherwise specified in Clause 4.13.2 below.

4.13.2 Private property

4.13.2.1 The minimum cover over Council's pipes in private property shall be 500mm. Where due to the topography this cover cannot be provided, specific design and approval will be required by Council.

4.13.2.2 Where the reticulation lines are located in the front yard of lots, the invert level shall be sufficient so as not to interfere with any future development such as driveway construction.

4.13.3 Private pipes

4.13.3.1 The depth of cover of private pipes must be in accordance with the Building Act, 2004 and to the satisfaction of Council's Building Compliance team.

4.14 Manholes

4.14.1 General

4.14.1.1 Manholes shall normally be designed at each change of direction or gradient, and at each branching line and at a spacing of not more than 100m. Manholes may either be cast insitu or of precast concrete in accordance with Volume 3: Technical Specifications, Part 4 of this Manual.

4.14.1.2 On stormwater pipelines equal to or greater than 900mm diameter, the spacing of manholes may be extended up to 200m, and uniform curvature on the pipeline may be permitted providing that joint deflections are within the limits of the manufacturer's recommendations.

4.14.1.3 On stormwater pipelines equal to or greater than 1.8m, the spacing of manholes may be extended up to 300m between manholes.

4.14.1.4 Manhole structures shall be clear of all boundary lines by at least 1.5m from the outer edge of the manhole chamber plus the height of any nearby retaining walls if they exist.

4.14.1.5 New structures on private property are to be located at least 2m clear of manholes as shown in Figure 102: TS 410 Guidelines for building adjacent to drainage pipelines in Volume 3 of this Manual.

4.14.2 Shallow manholes

4.14.2.1 Shallow manholes less than 1m deep shall be a minimum of 750mm diameter and designed to conform to Figure 110: TS 500.6 Shallow chamber manhole in Volume 3.

4.14.3 Stormwater manholes on larger pipelines

4.14.3.1 The minimum diameter for manholes shall be 1050mm.

4.14.3.2 Manholes on stormwater pipelines, more than 600mm diameter, where the use of standard 1050mm diameter manholes are not suitable, should be designed specifically. The minimum diameter for a manhole shall be equal to the largest pipe size plus 450mm.

4.14.3.3 On larger pipelines, recessed steps with rungs may be required below pipe benching level. In all cases, the lowest rung must be easily reached by a person standing at invert level in accordance with Figure 93: TS 400.2 New manhole on existing line (sheet 1), Figure 94: TS 400.3 New manhole on existing line (sheet 2) and Figure 95: TS 400.5 New install manhole

4.14.4 Hydraulic flow in manholes

4.14.4.1 In addition to the normal pipeline gradient, all pipelines less than 1m in diameter shall have a minimum drop of 20mm plus 5mm per 10 degrees of the angle of change of flow through the manhole.

4.14.4.2 In addition to the normal pipeline gradient, all manholes on pipelines greater than 1m in diameter shall have the drop through the manhole designed to a minimum of 20mm plus compensation for the energy lost due to the flow through the manhole at the deviation angle.

4.14.4.3 The construction tolerance for drop through the manhole shall be:

(a) Constructed Manhole Drop = Manhole Drop (as calculated above) + 5mm – 0mm.

4.14.5 Junctions

4.14.5.1 Catch pit leads not more than 300mm diameter and not more than 20m in length may be saddled on to pipes 600mm diameter and larger without a manhole.

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

4.14.5.3 Strap-on saddles will not be permitted on pipelines 225mm diameter or less. A factory manufactured 'Wye' or 'Lunden' junction shall be installed.

4.14.6 Step irons and steps

4.14.6.1 All manholes other than shallow manholes shall be provided with approved manhole steps in order to give reasonable access. Refer to Volume 3: Technical Specification, Part 4.

4.14.7 Manhole covers and frames

4.14.7.1 Manhole covers and frames shall be designed in accordance with Volume 3: Technical Specification, Part 4. Frame flanges shall be drilled with two 10mm diameter holes to provide for Dynabolt securing to manholes top slab.

4.14.8 Drop connections

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

4.15 Connections

4.15.1 General

4.15.1.1 Connections shall be capable of taking the full primary design flow from the area to be serviced by the connection (refer Volume 2, Part 4, Clause 4.6). Where a secondary flow path needs to be directed to a Council pipe, the stormwater runoff shall be detained to reduce the flow rate to the level of service provided for the zone.

4.15.1.2 Service connections shall be generally located on the lot road frontage. Where a property does not have a road frontage, pipes should be located within that property's legal access.

4.15.1.3 Where feasible:

(a) Private pipes shall not cross property boundaries; and

(b) Existing private connections crossing boundaries shall be replaced by public connections.

Advice Note: Generally existing private pipe work will not be acceptable for vesting to Council due to the lower standard of construction.

4.15.1.4 The standard size and material for single lot domestic connections is 100mm RRJ SN16 uPVC. The preferred depth of a new connector to the boundary is 1.2m (normal range 0.9 – 1.5m).

4.15.2 Infill developments

4.15.2.1 Connection proposals for infill developments shall be fully documented with regard to depth to invert, pipe size and distances to boundaries. Where Council's records are not available, applicants must determine the details of existing connections.

4.15.2.2 Any private pipe work needs a Drainage Consent from Council's Building Compliance team.

4.15.2.3 All connections and disconnections of Council's services to the property boundary shall be undertaken by Council's approved contractors.

4.16 Ramped Risers

4.16.1 Ramped risers shall be designed in terms of good drain laying practice. A typical example is illustrated in Figure 96: TS 404 Connection details.

4.17 Connections To Deep Lines

4.17.1 Where an existing or proposed stormwater pipeline is more than 5m deep to the top of the pipe, connections shall be provided to lots from a shallower branch pipeline connected to the deep stormwater line at a manhole. This method may also be used where ground conditions preclude direct connection to pipelines less than 5m deep.

4.18 Inlet And Outlet Structures

4.18.1 General

4.18.1.1 Approved structures shall be constructed at the inlets and outlets of pipelines. An acceptable type of concrete structure is shown in Figure 100: TS 409 Inlet and outlet structure. Alternative proprietary structures are permissible subject to site-specific approval by Council.

4.18.1.2 Provision must be made for energy dissipation and the design shall ensure non-scouring velocities at the point of discharge.

4.18.2 Waikato River outfalls

4.18.2.1 Outfalls to the Waikato River need to be reviewed by both Tainui and Mighty River Power in conjunction with seeking approval from Council.

4.18.2.2 Outlets should not be located in sites of recognised cultural or historical significance.

4.18.2.3 ***Design considerations***

(a) Fitness for purpose over the design life.

(b) Aesthetics in a natural setting.

(c) River level and flows.

(d) River bank erosion to 0.5m below minimum river level.

(e) Seasonal variations in power generation.

(f) Extending outlet works below the river surface.

(g) Developing a consistent design criteria for outlet works taking into account public access requirements, natural character of the surrounds, amenity and aesthetics of the river.

(h) Appropriate planting of eco-sourced indigenous species where required.

(i) Retaining remnant areas of indigenous riverbank vegetation.

4.18.2.4 These principles are in accordance with the Central Waikato River Stability Management Strategy.

4.18.3 Design criteria

4.18.3.1 Outlet structures are subject to Waikato Regional Council design requirements and approvals.

4.19 Catch Pits & Catch Pit Outlet - Pipes

4.19.1 Standard figures showing catch pits are included in Volume 3 of this Manual. Design requirements for catch pits are included in Part 3: Roading Design of this Volume. Concrete catch pit outlet-pipes to be Class 4 pipe.

4.19.2 PVC and PP (stormboss) pipes are to be SN16 (refer Volume 3, Part 3, Section 9) and must be connected to a manhole at the discharge end.

4.19.3 Outlet pipes from single catch pits must be 225mm diameter minimum.

4.19.4 Outlet pipes from double catch pits must be 300mm diameter minimum.

4.20 Subsoil Drainage

4.20.1 Subsoil drainage shall be designed as private drainage such that it does not pass from one lot to another. Subsoil drainage is subject to approval under the Building Act 1991. Building Consents shall be obtained before commencement of site work.

4.20.2 To prevent instability of the local ground, the design should ensure that no fine soil particles are transported into the stormwater system.

4.20.3 Any subsoil drainage design must consider the effects on groundwater, particularly in peat areas.

4.21 Stormwater Discharge From Private Land

4.21.1 Stormwater discharge from private land (impervious surface runoff) shall be provided for by either:

(a) Ground soakage within the property; or

(b) Where soakage not viable, retention/detention/storage must be provided for within the property with "Greenfield" discharge to a public stormwater system.

4.21.2 Surface Flow – Normal hydrological surface flow from undeveloped land and sub-surface flow may follow a natural drainage path to an appropriate outfall in accordance with common law. Such flow shall not create nuisance at lot boundaries. Where nuisance is likely, allotments may need to be drained to an enclosed pipe system.

4.21.3 Direct discharge to natural watercourses may be subject to both Regional and District council approvals. Resource consents shall be obtained before commencement of site work.

4.21.4 At the time of subdivision, where ground soakage is proposed as the means of stormwater disposal from individual lots, it will be sufficient to submit the soakage system design for approval. It is intended that the soakage system design approved at time of subdivision will be further submitted for approval in conjunction with the Building Consent for the site and the approved design shall be implemented in conjunction with building construction work.

4.21.5 Soakage systems for roads and ROW's shall be constructed and inspected before application for 224(c) Completion Certificates are submitted. All soakage systems shall be protected from sediment ingress both through the discharge surface areas (e.g. by suitable geotextiles) and in the incoming pipe (e.g. by a suitable sediment trap).

4.21.6 The design shall be based on soil soakage tests in accordance with the Auckland Council Soakage Design Manual: August 2003 and any subsequent amendments. The number and extent of soakage tests shall be sufficient to ensure representative testing of all soil profiles and groundwater levels within the development. The design soakage system must be designed to cater for future on-going maintenance.

4.21.7 Stormwater connections to public stormwater drains shall be directed to the nearest manhole, if practical or, alternatively, by way of a saddle or Y-junction connection to an adjacent stormwater pipeline.

4.21.8 If ground soakage is not viable and public reticulation is not available, then some form of Detention/Retention storage device to retain and dispose of all stormwater on site must be provided.

4.21.9 Connection directly to the kerb and channel will only be permitted in exceptional circumstances.

4.22 Planted Stormwater Devices

4.22.1 The type descriptions and planting requirements of Landscaping Engineered Stormwater Devices are contained in Volume 2, Part 9 of this Manual. In order to provide for maintenance of these facilities, an all-weather access track shall always be provided to at least the following specifications:

(a) Width 3m;

(b) Maximum Grade 1 in 8;

(c) Where the access road is longer than 25m, provide a 3-point turning area for a 99 percentile truck adjacent to device, in addition to the excavator working platform (refer to Figure 21: DG 305.3 99 percentile service truck tracking curve);

(d) The excavator working platform shall be level and adjacent to the clean out area; and

(e) The excavator working platform shall be no higher than 2m above the base of the clean out area.

Part 5 - Wastewater Drainage (incorporating pump station design)

5.1 Introduction

5.1.1 This Manual sets out the basic design principles for drainage of wastewater. While some construction information is included for completeness, detailed information on construction standards can be found in Volume 3 Technical Specifications of this Manual.

5.2 General

5.2.1 All lots shall be provided with a single connection to a wastewater drainage system. Council does not permit lots to be served by multiple connections.

5.2.2 The wastewater drainage system shall be designed to serve the whole of the natural upstream catchment area. The flow from all portions of the upper catchment within the city boundary shall be calculated assuming complete urbanisation (excluding reserves).

5.2.3 The system shall have a design life of not less than 100 years for in-ground pipeline components.

5.2.4 Designers are to confirm with Council the specific requirements for each subdivision, including such information as areas of catchment to be either included or excluded in any design calculation. This will be particularly important where further subdivision, upstream of the one under consideration, is provided for in the district or regional planning scheme. In these cases, the wastewater network is to be constructed to the upstream boundaries of the subdivision development.

5.3 Standards

5.3.1 The list of Standards specified in Clause 4.3.2 of this Volume shall also be applicable to this Part of the Manual.

5.4 Calculation of Flows

5.4.1 A statement is to be submitted with each plan to show that the design of the wastewater network has been calculated to meet the projected flows of the area under consideration. The designer shall consider the appropriate allowances for growth and clearly define any assumptions or basis for design inputs.

5.4.2 The pipe system shall be designed to ensure that the system is self-cleaning and that the pipe gradients are such that the velocity at peak daily flow meets this requirement.

5.4.3 Design should be in accordance with the information set out below (see also Clause 5.7 and Pipeline Minimum Grade Guideline).

5.4.4 Calculation Of flows

5.4.4.1 The wastewater flows shall be calculated from the following design parameters:

(a) The water consumption shall be 200 litres per person per day.

(b) The infiltration allowance is 2,250 litres per hectare per day.

(c) The surface water ingress allowance is 16,500 litres per hectare per day. The variable peaking factor dependent on population density for residential areas is determined from Table 9: Wastewater Peaking Factors.

(d) Population equivalent as per Table 10: Population Equivalent.

(e) Gross contributing land area upstream of the wastewater pipe is defined as the total catchment area, excluding reserve land, but including land within legal road boundaries.

(f) Contact Council for advice regarding the extent (both present and future) of any upstream catchment boundaries.

5.4.4.2 ***Average Daily Flow***

(a) The average daily flow is calculated as the sum of the infiltration allowance and the daily wastewater flow (product of water consumption and the population equivalent):

ADF = infiltration allowance + water consumption x population equivalent

Equation 2: Wastewater average daily flow

5.4.4.3 ***Peak Daily Flow (PDF)***

(a) To ensure that the pipe system has self-cleaning velocity, the PDF has to be calculated by the following method:

PDF (L/sec) = infiltration allowance with peaking factor (L/sec/ha) x water consumption (L/person/day) x population equivalent (person/ha)

Equation 3: Peak daily flow

5.4.4.4 ***Peak Inflow and Infiltration Factor (PIIF)***

(a) The PIIF with units (L/sec/gross ha) is the allowance for surface/groundwater leakage into the wastewater network.

(b) Council has adopted the following PIIF for all sewers:

PIIF (L/sec/ha) = infiltration allowance (L/sec/ha) + surface water ingress (L/sec/ha)

Equation 4: Peak inflow and infiltration factor

5.4.4.5 ***Peak Wet Weather Flow (PWWF)***

(a) To ensure that the pipe system does not surchange, the reticulation must accommodate the PWWF:

PWWF (L/sec) = PIIF (L/sec/ha) x Gross Land Area upstream of the pipe (ha)

Equation 5: Peak wet weather flow

5.4.5 Industrial domestic flow and trade waste

5.4.5.1 Where the industrial domestic waste and trade waste flows from a particular industry are known, these shall be used as the basis for the wastewater design. When this information is not available, then flows shall be calculated as above, except that the industrial peaking factor shall be used as shown on Table 9: Wastewater Peaking Factors and the equivalent population density shall be 45 persons per hectare.

5.4.5.2 Provision for liquid trade wastes and 'wet' industries shall be considered and provided for by the design.

5.4.5.3 Peak Daily and Peak Wet Weather flows shall be calculated as in Domestic wastewater calculations.

5.4.6 Hydraulic design of pipelines

5.4.6.1 All wastewater pipelines shall be designed such that they have sufficient capacity to cater for the design wet weather flow from the area they serve without surcharge and that on at least one occasion every day a minimum velocity for solids re-suspension (self-cleaning) is achieved. The minimum velocity for self-cleaning at peak daily flow will be deemed to be 0.6 m/s.

5.4.6.2 The capacity and velocity of flow in wastewater pipelines shall be determined by using the Colebrook White formula. A roughness coefficient (k) of 1.5mm as shown in Figure 26: Pipeline minimum grade guideline can be used as a check of the design so that if the operational point falls within the appropriate envelope, then the pipeline will have adequate capacity for peak wet weather flows and achieve a self-cleaning velocity at least once every day.

Table 9: Wastewater Peaking Factors

Population Equivalent for Catchment or Sub-catchment Area	Wastewater Peaking Factor	
	Residential	Commercial / Industrial
10	14	13
15	12	11
20	10	9.5
25	9.1	8.5
30	8.5	8.0
35	8.0	7.5

Population Equivalent for Catchment or Sub-catchment Area	Wastewater Peaking Factor	
	Residential	Commercial / Industrial
40	7.5	7.2
45	7.0	6.9
50	6.8	6.3
55	6.7	6.0
60	6.3	5.7
65	6.2	5.5
70	6.0	5.4
75	5.9	5.3
80	5.8	5.1
90	5.5	5.0
100	5.3	4.8
125	5.0	4.2
150	4.8	4.0
175	4.4	3.8
200	4.1	3.7
250	4.0	3.5
300	3.8	3.3
350	3.7	3.1
400	3.5	3.0
450	3.4	2.9
500	3.3	2.8
600	3.2	2.7
700	3.2	2.6
800	3.1	2.55
900	3.0	2.5
1000	3.0	2.4
1500	2.9	2.2
2000	2.8	2.1
2500	2.8	2.0
3000	2.7	1.9
3500	2.6	1.85

Table 10: Population Equivalent

Area	Population Equivalent
Residential Zone, Large Lot Residential Zone	45 person per hectare, or not less than 2.7 person per dwelling

Area	Population Equivalent
Compact Housing Development	120 person per hectare
Commercial Zone, Lake Karapiro Events Zone, Mystery Creek Events Zone, Marae Development Zone, St Peters School Zone	30 person per hectare
Industrial Zone, Airport Business Zone	45 person per hectare
Rural Zone, Significant Mineral Extraction Zone, Karapiro and Arapuni Hydro Power Zone	15 persons per hectare
Reserves Zone	2 persons per hectare
Other establishments should be treated as follows:	
Primary Schools	45 persons per hectare
Secondary Schools	150 person per hectare
Hospitals	3.5 person per hectare
Motels	0.6 person per hectare

5.4.6.3 Assessment criteria to determine flows from any development, or re-development, not covered in this section shall be determined in conjunction with Council.

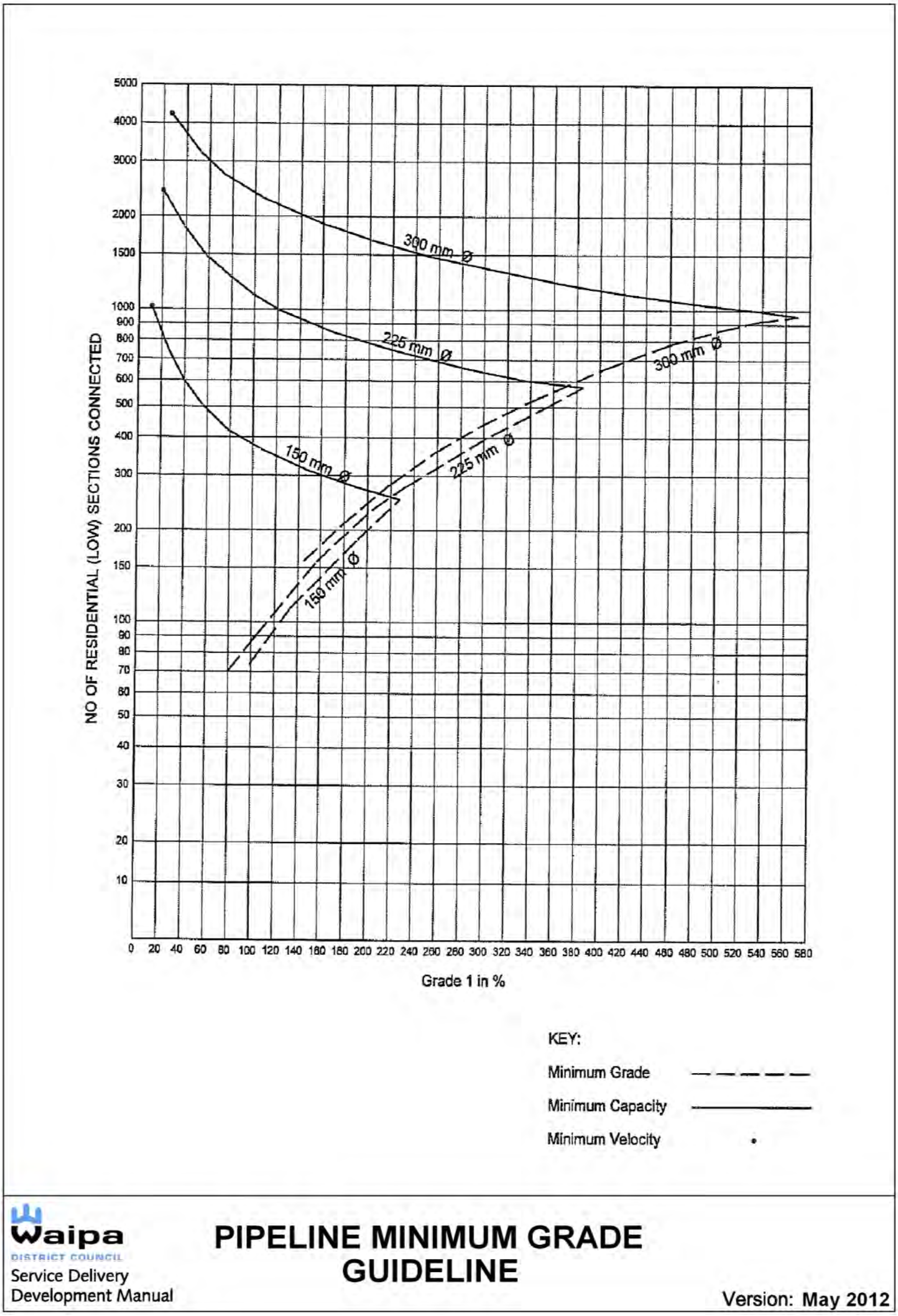


Figure 26: Pipeline minimum grade guideline

5.5 Location of Pipelines

5.5.1 General

5.5.1.1 Wastewater pipelines within **RESIDENTIAL ZONES** shall normally be within the road reserve except where the properties served are below road level.

5.5.1.2 Wastewater pipelines in **INDUSTRIAL ZONES** shall be either in the road reserve or in the front yard area.

5.5.1.3 Wastewater networks (and connections) in **COMMERCIAL ZONES** shall be either in the rear service lane or at the rear of properties to be served where no service lane exists. The major reticulation and trunk lines, however, shall be in the road reserve (as for Residential Zones).

5.5.1.4 Where the pipelines are in the road reserve they shall conform to the standard location of underground services and shall be sited within the carriageway, normally 2m from the kerb. Where the offset from the kerb varies due to curves in the street, the manholes shall be located 2m out from the kerb.

5.5.1.5 Where a wastewater pipeline changes location within a street, it shall do so at an angle of 45 degrees or greater. Where a wastewater pipeline crosses other utility services, it shall do so at an angle of 45 degrees or greater.

5.5.1.6 No new private pipelines shall pass between one lot and another. If crossing of private property is unavoidable, those parts of the pipeline serving more than one lot shall be private mains up to the single service connection to Council reticulation on the property boundary. Council responsibility for maintenance of the main shall cease at the service connection at the property boundary.

5.5.1.7 On the limited occasions where a wastewater pipeline is within a property, it is required to be parallel to and 1m minimum clearance from a boundary. On sloping ground, the wastewater pipeline should be within the property of the higher land (to avoid conflict with excavation levelling of the lower property). Easements will be required over wastewater pipelines where located within private property. For public wastewater infrastructure, a 3m minimum width gross easement shall be created. For private infrastructure (connections), where located within neighbouring lots, a 2m minimum width appurtenant easement shall be created.

5.5.1.8 Manhole structures shall be clear of all boundary lines by at least 1.5m from the outer edge of the manhole chamber plus the height of any nearby retaining walls if they exist.

5.5.1.9 Where the pipeline gradients are greater than 1 in 5, it is expected that anchor and/or anti-scour blocks shall be constructed of a type comparable to that illustrated in Figure 97: TS 405 Anti-scour blocks for steep lines (Volume 3).

5.5.1.10 Where Council pipes pass through private property, refer to Clause 5.10.3. Pipe location for works under all consents should facilitate future fee-simple subdivision.

5.5.2 Clearance from underground services

5.5.2.1 Where a pipe is designed to be located in a road which contains other services, the clearance between the pipe and other services, shall comply with the minimum horizontal and vertical clearances shown in Table 11 below.

Table 11: Clearances Between Wastewater Pipes and Other Underground Services

Utility (Existing service)	Minimum horizontal clearance for new pipe Size <DN 300 (mm)	Minimum vertical Clearance$^{(1)}$ (mm)
Gas mains	300$^{(2)}$	150
Telecommunication conduits and cables	300$^{(2)}$	150
Electricity conduits and cables	500	225
Drains	300$^{(2)}$	150
Water mains	1000$^{(3)}$/600	500

Further Requirements

1. *Vertical clearances apply when wastewater pipes cross one another, except in the case of water mains when a vertical separation shall be maintained, even when the wastewater pipe and water main are parallel. The wastewater pipe should always be located below the water main to minimise the possibility of backflow contamination in the event of a main break.*
2. *Clearances can be further reduced to 150mm for distances up to 2m when passing installations such as poles, pits and small structures, providing the structure is not destabilised in the process.*
3. *When the wastewater is at the minimum vertical clearance below the water main (500mm) maintain a minimum horizontal clearance of 1000mm. This minimum horizontal clearance can be progressively reduced to 600mm as the vertical clearance increases to 750mm.*

5.5.3 Clearance from structures

5.5.3.1 Pipes adjacent to existing buildings and structures shall be located clear of the “zone of influence” of the building or structure foundations. If this is not possible, a specific design shall be undertaken to cover the following:

(a) Protection of the pipeline;

(b) Long term maintenance access for the pipeline; and

(c) Protection of the existing structure or building.

5.5.3.2 The protection shall be specified by the designer for evaluation and acceptance by the Council’s Water Services Manager.

5.6 Pipes

5.6.1 Acceptable pipeline products that may be used for wastewater pipe work are listed in Part 5 of Volume 3: Technical Specifications.

5.6.2 Where concrete-lined steel pipes are included in the design, these shall be as specified in Volume 3.

5.6.3 Concrete pipes intended for wastewater applications shall be manufactured using a sulphate resistant concrete mix and, in addition to the standard thickness of concrete mix around steel reinforcing, the pipes shall have a 25mm thick internal sacrificial lining of concrete mix. This reduced internal diameter shall be taken into account when determining the flow capacity of concrete pipes.

5.6.4 uPVC wastewater pipe may be used for pipe sizes ranging from 100mm to and including 375mm nominal diameter. The pipes and fittings shall comply with AS/NZS 1260:2002. Stiffness class SN16 pipes shall be specified in all cases.

5.6.5 The minimum pipe diameter for a public wastewater drain shall be 150mm.

Advice Note: 100mm diameter pipes are permitted for lot connections.

5.7 Pipeline Minimum Grade Guideline

5.7.1 Clause 5.4.4 "Calculation of Flows' does not lend itself to determining the grade applicable to pipelines draining upper parts of a catchment. Council experience is that the minimum gradients shown in the following table provide satisfactory flow conditions for 150NB Pipe in both general soils and peat soils (those with greater than 300mm of peat between 0.5m and 4m depth of the natural ground surface).

5.7.2 Where the depth of soil exceeds 2m then specific design is required.

Table 12: Pipeline Minimum Grade Guideline

Houses	Population	General Minimum Grade		Peat soil Grades
3-4*	7-10	1:100	1.0%	1:60
5-8	12-20	1:120	0.83%	1:80
9-18	22-45	1:150	0.67%	1:80
More than 18	45 and above	1:200	0.50%	1:80

*see also the guidelines for service connections Clause 5.14

5.8 Joints

5.8.1 Specification of joints shall be as follows:

(a) All pipes shall normally have flexible joints of an approved type, such as RRJ.

(b) Steel pipes shall be flexibly jointed (gibault or approved rubber ring).

(c) Solvent cement joints shall only be used for PVC if specifically required by Council.

(d) Joints shall be provided adjacent to manholes to the requirements of AS/NZS 2566 with the exception of PVC where proprietary connections may be used.

(e) All joints are to be designed and constructed to remain fully watertight for the design life (100 years) of the pipe network.

5.9 Structural Strength of Pipes and Bedding

5.9.1 Pipe bedding will be designed to meet the requirements of the class of pipe used under the design loading conditions set out in the manufacturer's specifications.

5.10 Pipeline Construction

5.10.1 The construction of the pipelines shall be carried out in accordance with the requirements of Standard Technical Specification (Volume 3, Part 5) of this Manual.

5.10.2 General

5.10.2.1 Pipes acceptable for use in wastewater drainage work are listed in the Standard Technical Specifications for Wastewater Sewers (Volume 3, Part 5).

5.10.3 Requirements for building near drainage pipelines

5.10.3.1 With respect to building near, or excavation near public sewers, the restrictions as described in the Operative Waipa District Wastewater Drainage Bylaw must be adhered to. These requirements are shown in Figure 102: TS 410 Guidelines for building adjacent to drainage pipelines (Volume 3, Part 5).

5.10.3.2 The following design considerations must be followed subsequent to Council approval to work near drainage pipelines:

5.10.3.3 ***Structural loads***

(a) No structural loads are to be placed on public drainage pipelines.

(b) The first row of piles must be at least 1.5m clear of the outside of the pipe and down to a depth of at least 1m below the invert of the pipe.

(c) Subsequent rows of piles must be constructed to a depth of at least 1m below the 45 degree influence line form the pipe invert.

(d) All structural loads on piles shall be absorbed outside the 45 degree envelope and below the pipe invert level of the first row of pipes.

5.10.3.4 ***Pile ramming***

(a) Pile ramming is not permitted within 5m or within the 45 degree envelope from the wastewater pipe centre line. The placement of piles within this range, but not closer than 1.5m, will be permitted subject to specific design and must be drilled.

5.10.3.5 ***Effects on pipe and trench lines***

(a) The building or other work must be designed and constructed so that the wastewater pipe and trench line is not adversely affected by any future excavation necessary for maintenance of the sewer.

5.10.3.6 ***Effects on structures and buildings***

(a) The structure must allow for settlement of the wastewater pipe trench line and backfill.

5.10.3.7 ***Figures required***

(a) Figures of the proposed works must accurately identify the location of the drainage pipeline affected and the distances with cross section details for all structures, footings or piles within the 45 degree line.

5.10.3.8 ***Building over associated assets***

(a) Buildings are not permitted to be located over any wastewater infrastructure.

5.10.3.9 ***Internal inspection***

(a) Buildings to be built near pipes shall be jetted and CCTV'd before and after construction work.

5.11 Minimum Cover Over Pipes

5.11.1 General

5.11.1.1 All pipelines other than those in private property shall be specifically designed to support the likely loading in relation to the minimum cover to be provided in accordance with the terms of AS/NXS 3725:2007. The minimum cover for all types of pipes (other than those in private property) under all conditions shall be 600mm.

5.11.2 Private property

5.11.2.1 The minimum cover over unreinforced Council pipes in private property shall be 600mm. Where, due to the topography, this cover cannot be provided, the pipeline shall be protected. Specific design information will be required.

5.11.2.2 Where the reticulation lines are located in the front yard of lots, the invert level shall be deep enough so as not to interfere with any future development such as driveway construction.

5.11.3 Under carriageways

5.11.3.1 Where pipes are designed below the carriageway, they shall be specifically designed to support the pavement design loading appropriate to the minimum cover to be provided at both subgrade and finished level.

5.11.3.2 The minimum cover for unreinforced pipe shall be 1000mm and for reinforced pipe shall be 600mm. Refer to Figure 104: TS 412 Protection for shallow pipes under carriageways.

5.11.4 Private pipes

5.11.4.1 The depth of cover of private pipes must be in accordance with the Building Act~~,~~ 2004 and to the satisfaction of Council's Building Compliance team.

5.12 Manholes

5.12.1 General

5.12.1.1 Manholes shall be located away from areas likely to pond water and away from potential building sites. They are to be designed and constructed to exclude groundwater for the life of the network.

5.12.1.2 Manholes up to 2400mm deep shall be constructed using a single riser with a pre-cast external flange base. Manholes in excess of 2400mm deep shall be constructed using a 2400mm long pre-cast riser with external flange base and then completed to final ground level using no more than a single riser for manholes up to 5m deep. Three risers are allowable for manholes in excess of 5m depth.

5.12.1.3 In no case shall a series of short risers be permitted.

5.12.1.4 Manholes shall be a minimum of 1050mm diameter for depths of 1m or more. Manholes of 750mm diameter may be used for depths less than 1m (typically infill situation).

5.12.1.5 Manholes on pipelines less than 300mm diameter shall be provided at each change of direction or gradient, and at each branching pipe, and at a spacing of not more than 100m.

5.12.1.6 Manholes on pipelines 300mm diameter and over may have the spacing increased with the specific approval of Council.

5.12.1.7 For infill developments, manholes shall not be required for a 150mm connection on a 150mm pipeline where a manhole is provided immediately inside the property being served and another manhole exists within 100m on the existing pipe and these provide adequate accessibility without needing another manhole.

5.12.1.8 New structures in private property are to be located 2m clear of manholes as shown in Figure 102: TS 410 Guidelines for building adjacent to drainage pipelines.

5.12.2 Standard manholes

5.12.2.1 These are to be circular manholes with a minimum internal diameter of 1050mm (refer to Figure 105: TS 500.1 Manhole top and chamber slabs, Figure 106: TS 500.2 New manhole on existing line (sheet 1) and Figure 107: TS 500.4 New install manhole) and are to be used on pipelines up to and including 600mm diameter. Manhole steps shall be provided in accordance with Standard Technical Specification (Volume 3 of this Manual).

5.12.3 Specific design manholes

5.12.3.1 Where manholes are more than 5m deep or where water table is known to be shallow, they shall be specifically designed including consideration of wall strength, foundation support, and adequate ballast to resist buoyancy.

5.12.3.2 Where a manhole is to be constructed in soft ground, the area under the manhole shall be undercut down to solid ground and backfilled with suitable hard fill to provide an adequate foundation for the manhole base. Where undercutting exceeds 1.5m, a special design will be required.

5.12.4 Hydraulic flow in manholes

5.12.4.1 In addition to the normal pipeline gradient, all manholes for pipelines less than 1m in diameter shall have a minimum drop of 20mm plus 5mm per 10 degrees of the angle of change of flow within the manhole.

5.12.4.2 In addition to the normal pipeline gradient, all manholes on pipelines greater than 1m in diameter shall have the drop through the manhole designed to a minimum of 20mm plus compensation for the energy lost due to the flow through the manhole at the deviation angle.

5.12.4.3 The construction tolerance for drop through the manhole shall be:

Constructed Manhole Drop = MH Drop (as calculated above) + 5mm – 0mm

Equation 6: Hydraulic flow in manholes

5.13 Connections

5.13.1 General

5.13.1.1 Before connecting to the public system, Council connection process shall be completed by the applicant and Council approval obtained. This applies to:

(a) All new connections and disconnections from private property.

(b) All new connections of new wastewater mains to be tied into the existing public sewer.

(c) All connections where trade waste will be discharged. Note compliance with the Operative Trade Waste Bylaw is also required.

(d) The lateral connections should be designed to suit the existing situation and any future development.

5.13.2 Requirement of Design

5.13.2.1 A single connection provided at the boundary of each lot shall be of a type capable of taking an approved pipe of 100mm nominal diameter, unless a larger size is required by design. Council does not permit lots to be served by multiple connections.

5.13.2.2 Each connection shall be capable of serving the whole of the lot by gravity. This requirement shall allow adequately graded drains within the lot, together with the depth required for gully traps.

Advice Note: Private wastewater pumps will not be approved where gravity discharge is feasible.

5.13.2.3 The standard depth of a new connection at the boundary is 1.2m (range 0.9 – 1.5m).

5.13.2.4 Drop connections at manholes shall be designed as internal connections in a manner similar to the illustrations in Figure 107: TS 500.4 New install manhole. For any new manhole involving internal drops the minimum manholes diameter shall be 1200mm.

5.13.2.5 Where the connection is to be installed is to be within 5m of a manhole, the connection shall be to the manhole, where practicable.

5.13.2.6 All connections, which are to be made directly to the line, shall be designed using a factory manufactured 'Wye' or 'Lunden' Junction and shall be watertight.

5.13.2.7 Service connections shall generally enter each lot from the road frontage. Where a property has no road frontage, pipes are to be located within that property's legal access.

5.13.2.8 Where service connections are located within a road reserve, the connection shall be terminated with a rodding point inside the property boundary. Refer to Figure 112: TS 504.1 Rodding points (Volume 3, Part 5).

5.13.2.9 Where the wastewater pipe is outside the lot to be serviced by it, the connection shall be extended to the boundary of the lot.

5.13.2.10 The standard size material for single lot domestic connections is 100mm RRJ SN16 uPVC. The minimum size material for commercial and industrial connections shall be 150mm RRJ SN16 uPVC.

5.13.2.11 In laying 'greenfield' service connections which are capped pending connection of house drainage (refer to Figure 96: TS 404 Connection details) the maximum depth at the end of the service connection pipe shall be 1.5m.

5.13.2.12 Connection proposals for infill developments shall be fully documented with regard to depth to invert, pipe size and distances to boundaries. Where Council's records are not available, applicants must determine the details of existing connections.

5.13.2.13 Sections, which slope away from the drainage direction, may require a service connection that is deeper than 1.5m at the boundary in order to comply with the requirement to drain the whole of the lot. In such cases, the service pipe shall be extended into the property on grade and to the extent that its end cap is no deeper than 1.5m. Note the service pipe needs to be located near the boundary or within an easement in order to avoid conflict with possible building locations. This detail shall be shown on construction plans.

5.13.2.14 Any private pipe work needs a Building Consent in accordance with the Building Act 2002. All connections and disconnections of Council's services to the property boundary must be undertaken by a Council approved contractor.

5.13.2.15 If the above conditions cannot be met, then contact Council for further advice.

5.13.3 Services in Accessways, Access Lots, or Right of Ways

5.13.3.1 The following should be considered when preparing design:

(a) Where a right-of-way is to be provided, wastewater services for all newly created lots should drain to the right-of-way where possible.

(b) A public sewer system can be located within the right-of-way where it services 2 or more properties. Existing common private drainage reticulation that has been upgraded, in accordance with this standard, can be vested in Council from the existing Council system to a point where it services 2 or more properties.

5.14 Requirements For Connections for Multi-Unit/Dwelling Properties

5.14.1 General

5.14.1.1 For multiple occupancies on a site lot or title, service of the whole property shall be achieved by providing a single point of connection to the existing Council wastewater system. Connection of the individual dwellings/units is by a joint service pipes owned and maintained by the body corporate or the company as the case may require. Private drainage is to be approved and constructed pursuant to the Building Act 2004.

5.14.2 Requirement of Design

5.14.2.1 For 1 to 4 dwellings/units on a single lot a 100mm nominal bore service pipeline is adequate.

5.14.2.2 For five or more dwellings/units on a single lot or title, a 150mm nominal bore service. (Refer Volume 2, Part 5, Clause 5.7).

5.14.2.3 The service pipeline shall be laid to a public drain as a straight pipeline between boundary inspection fitting and manhole or between boundary inspection fitting and a wye connection on the wastewater main or between a boundary inspection fitting and a wye connection on a service pipeline conforming to either of the previously listed variations.

5.14.2.4 The minimum acceptable grade is 1:80 (preferred grade 1:60) except on peat soils where 1:60 is required.

5.14.2.5 It shall be no longer than 50m.

5.14.2.6 It must comply generally with the in-roadway alignment guideline, i.e. where a wastewater pipeline changes location within a street, it shall do so at an angle of 45 degrees or greater. Where a wastewater pipeline crosses other utility services, it shall do so at an angle of 45 degrees or greater.

5.15 Ramped Risers

5.15.1 Unless required otherwise by the Engineer, a ramped riser shall be constructed to bring the connection to within 0.9 - 1.5m of ground level or to such depth that will permit a gravity connection to service the whole lot. Ramped risers shall be constructed as shown in Figure 96: TS 404 Connection details.

5.16 Connection to Trunk And Interceptor Pipelines

5.16.1 Connections to wastewater interceptor pipelines shall only occur at manholes.

5.16.2 Connections to wastewater trunk pipelines shall be preferably at manholes, or alternatively, and only with specific approval of Council, utilising factory fabricated ‘wye’ junctions in pipelines of PVC or vitrified clay materials.

5.17 Connections To Deep Lines

5.17.1 Where an existing or proposed sewer is more than 5m deep to the top of the pipe, or where required by the ground conditions, the connection shall be designed as a manhole constructed on the deep line and a shallower branch sewer shall be laid from the manhole.

5.18 Testing

5.18.1 All wastewater mains and branch pipelines, including extended connections, shall be pre-tested during construction. On completion of all other engineering work within the subdivision, there shall be a final test conducted. Test requirements are set out in Volume 3, Part 5, Section 2, Clause 5.2.16 of this Manual.

5.19 Pumping Stations

5.19.1 General

5.19.1.1 Where the proposed subdivision cannot be adequately serviced by a gravity system, then a sewer pumping station(s) shall be provided. The sewer pumping stations shall be logically located and designed to service the entire catchment area of land beyond the reach of the existing gravity system. The design life shall be not less than 50 years.

5.19.1.2 Calculations shall be submitted in a similar format as that shown in Checklist 5.1 of Volume 2, Part 5 of this Manual.

5.19.1.3 All equipment and/or components used for similar functions and purposes must be of the same design, make or model for ease of operation and maintenance. This includes new pumping stations. The requirements for the design of new pumping stations are detailed on Figure 118: TS 520 Pump station - typical site layout to Figure 126: TS 601 Valve marker plate, and must be constructed in accordance with the Standard Technical Specifications.

5.19.2 Requirements

5.19.2.1 Pumping stations shall be located on a separate lot vested in Council as Local Purpose (Utility) Reserve. All sites shall be of adequate size to allow for the free movement of services vehicles and shall be connected to a public road/street by a sealed/concrete access. The site shall be capable of accommodating turning movement for a Truck (4 tonne) and tandem trailer.

5.19.2.2 The site shall be fully serviced with water and power and may be required to be securely fenced. Landscape planting may also be required to screen the site from adjacent land.

5.19.2.3 Refer Typical Site Layout for Sewer Pump Stations is shown on Figure 118: TS 520 Pump station - typical site layout.

5.19.3 Design basis

5.19.3.1 The sewer pumping station and rising main shall be designed to meet the following criteria:

5.19.3.2 ***Wet-well & pumps***

(a) Separate wet-well and valve chamber.

(b) Design pumping capacity based on Peak Wet Weather Flow (PWWF).

(c) Pump sized on most efficient pump to discharge required flow at design head. Minimum pump flow rate shall be 2.5 litres per sec.

(d) Design system head based on friction losses and fitting losses. Manifold and rising main friction losses based on ks =1.0mm (Colebrook White).

(e) Minimum two x Flygt submersible pumps setup to operate on Duty/Standby basis – each pump shall include a 4901 flushing valve.

(f) Wet-well inlet shall be 1500mm minimum above duty pump start level.

(g) 6 hours Emergency storage of Average Dry Weather Flow (ADWF) within wet well and/or separate storage chamber – storage range to be designed 100mm above duty pump start level and 300mm below the lower of:

   (i) Lowest MH lid level in gravity reticulation system.

   (ii) Lowest property gully trap.

(h) Single lift to gravity reticulation – multi stage pumping will only be considered in exceptional circumstances.

(i) Maximum depth of pump chamber shall be 5.5m unless agreed otherwise.

(j) The pump station wetwell shall be designed to have negative or zero buoyancy. Ground water level shall be assumed to be at ground level unless an actual level is established by geotechnical investigation. The mass of the wet-well structure included in the stability analysis shall not include the associated mechanical and electrical components of the pump station. Nor can the soil friction forces of backfill around the wetwell chamber be taken into account. Any additional weight needed shall be added in the form of mass concrete in the bottom of the chamber as indicated in Figure 119: TS 521 Standard sewer pump station details. The pump station figures shall provide dimensions of the extent of mass concrete needed to counter buoyancy of the chamber.

5.19.3.3 ***Operational***

(a) Pump level control by ultrasonic level sensor.

(b) High-level alarm to be float type.

(c) High-level alarm, Power Fail and Pump Fault to be linked to telemetry system.

5.19.3.4 ***Electrical & controls***

(a) Refer also to Volume 3, Part 5A.

(i) Three phase power supply to be provided – minimum rating shall be 60 amps.

(ii) Two pumps to be capable of operating together.

(iii) Pumps start and stop separately.

(iv) Emergency generator plug shall be 32 amp PDL 56 series.

(v) Soft Start and Stop.

(vi) Telemetry system required – Abbey Systems, configuration of Abbey System base station to be setup by a Council nominated sub-contractor at cost to the Developer.

5.19.4 Rising main

5.19.4.1 Rising mains shall meet the requirements for water supply pressure mains.

5.19.4.2 Rising mains in private property shall be located clear of building sites and the alignment protected by ‘Easement in Gross’.

5.19.4.3 Minimum diameter shall be 80mm internal diameter (ID).

5.19.4.4 Minimum velocity in rising main - 0.75m/s.

5.19.4.5 Maximum velocity in rising main - 3m/s.

5.19.4.6 Minimum positive grade - 0.3%.

5.19.4.7 Minimum negative grade - 0.6%.

5.19.4.8 Air valve to be installed at high point(s).

5.19.4.9 Scour valve at low point(s).

5.19.5 Water supply

5.19.5.1 A standard 40mm ID (50mm OD MDPE) pipeline as used for water supply pipelines (Volume 3, Part 6, Section 4) shall be provided to the pump station. Wastewater pump stations are a "High Hazard" risk requiring reduced pressure zone type backflow prevention devices installed above ground level (refer BIA Acceptable Solution G12/AS1 and AS/NZS 2845.1). The backflow prevention device is to be positioned adjacent to the power cabinet.

5.19.6 Commissioning test

5.19.6.1 All pumping stations shall undergo a commissioning test witnessed by Council. A minimum of 24 hours' notice shall be given prior to the test-taking place. See Volume 3, Part 5A, Section 3 for as-built requirements.

Checklist 5.1: Design of Wastewater Pump Stations

Proposed Wastewater Pump Station At

Designed By

Date ____________________

Inflows *See Fig. 5.1 in Volume 2 - Design Guide - Part 5.*

Average dry weather flow	____________	l/s
Peak daily dry weather flow	____________	l/s
Peak wet weather flow	____________	l/s

Head Losses

- **Static Head**

Level at rising main discharge		= m		
(or highest point)				
Level at pump bowl		= m		
Static Head			=	____________

- **Friction Head**

Required Discharge (@ P.W.W.F.)		= l/s		
Select Diameter		= mm		
Rising Main	Type	=		
	Length	= m		
Head Loss (from flow resistance chart)		= m		
Fitting Loss			=	____________
TOTAL HEAD (@ P.W.W.F)			=	____________

Checklist 5.2: Pump Selection (Page 1)

Proposed Pump Type ____________ Impeller ____________

Plot System Curve and Check Selection

Discharge (l/s)	( )	( )	( )	( )	( )	( )	( )
Head Loss (m)							
Static Head (m)							
Fitting Losses (m)							
Total (m)							

Operating Discharge (from System curve) = ____________ l/s

Operating head (from system curve) = ____________ m

Wastewater Flow Velocity = ____________ m/s
(1.0m/s <VEL> 3.0 m/s)
(From System Head Curve and Rising Main dia.)

Check Efficiency of Various Impellers (see notes)

Revised Pump (if applicable) Type ____________ Impeller ____________

(Attach system curve to final calculation sheet)

Revised Initial Impeller *(see note)*

Pump Chamber Size

Chamber diameter = ____________ mm

Chamber Invert = ____________ m

Overflow Invert = ____________ m

Storage Volume Chamber = ____________ l

Storage Volume in Pipes and Manholes = ____________ l

Total Storage = ____________ l

Checklist 5.2: Pump Selection (Page 2)

Chamber Volume required for Desirable Storage at A.D.W.F		=	______________	l
Final Storage Time at A.D.W.F (see note)		=	______________	hrs.
Inlet Invert		=	______________	m
Distance between Start and Stop Points		=	______________	mm
Volume between Stop and Start Points	$V_{min} = \frac{Tmin \times Q}{4}$	=	______________	l
Overflow (if required)			______________	
Invert of Overflow at Chamber		=	______________	m
Invert of Overflow at Discharge		=	______________	m
Diameter		=	______________	mm
Capacity			______________	l/s
Check low points in catchment	✓			

Advice Note:

Check capacity of rising main receiving sewer.

Check class of rising main is compatible with operating pressure head.

Check capacity of overflow receiving line. (Check to consider possible surcharge under storm conditions – is it likely to flood pump station?).

Check that stop and start levels are adjusted to prevent surcharge in inlet pipe.

Check alignment of inflow pipe into station as to prevent airlock of pump. (May require baffle).

A smaller impeller may be desirable if only part of the overall catchment is initially contributing.

Checklist 5.2: Pump Selection (Page 3)

Sump volume $V_{min} = \frac{T_{min} \times Q}{4}$

Where V_{min} is in litres

T_{min} (cycle time) is in seconds

Q (pump capacity) is in l/s

The recommended maximum number of start/hour is 15.

The recommended minimum is 1 start/hr.

Therefore $T_{min} = \frac{60 \text{ minutes}}{15}$ = 4 minutes = 240 secs.

$$\text{Power Consumption} = \frac{\text{A.D.W.F}}{\text{Pump Capacity}} \times \text{Pump Power Input} \times 24$$

"Time to Overflow"

- In most cases this should not be less than 6 hours at A.D.W.F

- For small stations with no standby pump this should not be less than 12 hours at A.D.W.F

Part 6: Water Supply

6.1 Introduction

6.1.1 This Manual sets out the basic design principles for the provision of reticulation for the supply of water. While some construction information is included for completeness, detailed information on construction standards can be found in Volume 3 Technical Specifications.

6.2 General

6.2.1 Design life

6.2.1.1 The water supply system shall have a design life of not less than 100 years for in-ground pipeline components.

6.2.2 Level of service

6.2.2.1 The design of the reticulation shall be such that a water supply connection can be readily provided to the 'front' of each allotment (i.e. where the driveway will be installed).

6.2.2.2 The water supply reticulation shall comply with the New Zealand Fire Service Fire Fighting Water Supplies Code of Practice (SNZ PAS 4509:2008 and subsequent amendments) and shall be the relevant minimums for the usage as shown in Clause 6.4.4.

6.2.2.3 For firefighting, the minimum residual running water pressure shall be 100 kPa (1 atmosphere, 10m head of water) at any hydrant.

6.2.2.4 The working residual water pressure, in other than firefighting conditions, shall be 100 kPa (1 atmosphere, 10m head of water) at the ground level at the building site in each lot. Designers may be limited by the water pressure available and Council will consider the implications of any such limitations in assessing the engineering plans with the possible outcome that special water supply conditions may apply to the affected properties.

6.2.2.5 Individual rainwater tanks, individual privately owned bores, wells or restricted supply, may adequately serve isolated small subdivisions in rural settings. Adequate fire protection in accordance with the NZ Standards and acceptable to the NZ Fire service is required in rural settings.

6.2.2.6 Rural trickle feed water supply schemes may require an alternative source to provide fire-fighting capacity.

6.2.2.7 To protect the level of service of new subdivisions, no more than 100 lots are to be serviced, at any point in time, from a single ended water main. Connectivity of the water network is to be established prior to further lots being brought forward for 224(c) release.

6.3 Referenced Documents

6.3.1 Referenced documents

(a) New Zealand Fire Service Fire Fighting Water Supplies Code of Practice (SNZ PAS 4509:2008).

(b) Volume 3 Technical Specifications and Figures.

(c) Waipa District Plan.

(d) Operative Waipa District Council Water Supply Bylaw.

6.3.2 Standards

(a)	AS/NZS 2566.1:1998	+ Supplement 1 Buried Flexible Pipelines – Structure Design.
(b)	AS/NZS 2032:2006 + A1	Installation of uPVC Pipe Systems.
(c)	AS/NZS 2280:2004 + A1	Ductile Iron Pipes and Fittings.
(d)	AS/NZS 2033:2008 + A 1 & 2	Installation of Polyethylene Pipe Systems.
(e)	SNZ/PAS 4509:2008	New Zealand Fire Service Fire Fighting Water Supplies Code of Practice.

6.4 Design Requirements

6.4.1 Water demand and pressure

6.4.1.1 The water supply system shall be designed for the worst-case flow and pressure requirements. In most subdivision design, the firefighting requirements will control the design. The designed network should be checked to ensure that the annual, seasonal and peak demands are met using the available pressures in existing mains. Calculations supporting the proposed design are required.

6.4.2 Domestic supply

6.4.2.1 The design shall provide for a domestic demand of 260 litre/person/day with a peak flow rate of five times this amount. A population density of 45 persons per hectare shall be the basis of the design.

6.4.3 Commercial and industrial supply

6.4.3.1 The water demand for commercial and industrial areas shall be analysed and specifically allowed for in the design.

6.4.4 Firefighting supply

6.4.4.1 The water reticulation shall be designed to comply with the requirements SNZ/PAS 4509:2008: New Zealand Fire Service Fire Fighting Water Supplies Code of Practice.

Designs shall meet the code requirements with regard to firefighting flows, running pressure and the spacing of hydrants, together with any additional requirements set out herein, including storage where applicable.

6.4.4.2 Where additional firefighting coverage is required, private storage shall be designed to comply with the requirements of SNZ PAS 4509:2008 New Zealand Fire Service Fire Fighting Water Supplies Code of Practice. The developer is responsible to determine the size of the storage required. The minimum requirements are based on SNZ PAS 4509:2008, however this may need to be increased to ensure security of supply for operational purposes within the premise. Council recommends all commercial and industrial premises have 25 hours of operational storage.

6.4.5 Design basis

6.4.5.1 *Pressures*

(a) Details of the working pressure or pressures at the point or points of connection to the existing reticulation are contained in the table below. These details shall be used for design purposes.

6.4.5.2 *Existing Flows*

(a) Existing Waipa District Council reticulation is generally designed to provide a water supply classification - FW 2 of NZS PAS 4509:2003. Flow testing of existing water reticulation is required to confirm available flow.

Table 13: Working pressure at the point of connection

Feature	Value
Maximum pressure	100m head (1000 kPa)
Minimum pressure	10m head (100 kPa)
Normal operating pressure	20 – 30m head (200 – 300 kPa)

6.4.6 Pipe working pressures

6.4.6.1 The minimum acceptable pipe class is PN12.

6.5 Reticulation Layout

6.5.1 A water main of a minimum of 100mm nominal bore fitted with fire hydrants (hereinafter referred to as the principal main) shall be laid and on one side of all through-streets and one side of every cul-de-sac to the head of the cul-de-sac, subject to the requirements for hydrant spacing and required flow.

6.5.2 A rider main shall be laid to the road frontage of all lots not fronted by a principal main. Rider main street crossings shall be kept to a minimum.

6.5.3 In the case of arterial and dual carriageway streets, principal mains may be required to be laid on both sides of the street.

6.5.4 In order to provide firefighting water supplies in excess of the FW2 standard, principal mains shall be laid on both sides of the street. To provide sufficient flow for firefighting, principal mains may need to be larger than the minimum 100mm nominal bore; this will depend on the proximity of trunk water mains and the adequacy of the selected pipe size may need to be proved with reticulation flow modelling. At street intersections the arrangement of pipe connections shall spread firefighting flow rates to both sides of the adjoining street.

6.6 Alignment of Water Mains In Street

6.6.1 General

6.6.1.1 The standard position of water mains in the street shall be in the roadway berm between the kerb and front edge of the footpath. Where water mains cannot be laid in the standard alignment, an alternative alignment showing the relative locations of all services shall be designed and proposed with the engineering plans.

6.6.2 Clearance from underground services

6.6.2.1 Where a public owned water main is designed within either a road or gross easement (e.g. ROW's), the position of the pipe with respect to other services shall comply with the minimum and vertical clearances shown in Table 14 below.

Table 14: Clearances Between Water Mains and Underground Services

Utility (Existing service)	Minimum horizontal clearance (mm)		Minimum vertical clearance(1) (mm)
	New Main Size (mm)		
	DN < 200	DN > 200	
Water mains DN > 375	600	600	500
Water mains DN < 375	300(2)	600	150
Gas mains	300(2)	600	150
Telecommunication conduit and cables	300(2)	600	150
Electricity conduits and cables	500	1000	225
Stormwater mains	300(2)	600	150(3)
Wastewater mains	1000/600(4)	1000/600(4)	500(3)
Kerbs	150	600(5)	150 (where possible)

Further requirements:

1. *Vertical clearances apply when water mains cross another utility service, except in the case of wastewater when a vertical separation shall always be maintained, even when the main and wastewater pipe to minimize the possibility of backflow contamination in the event of a main break.*
2. *Clearances can be further reduced to 150mm for distances up to 2m when passing installations such as poles, pits and small structures, providing the structure is not destabilised in the process.*

Utility (Existing service)	Minimum horizontal clearance (mm)		Minimum vertical clearance[1] (mm)
	New Main Size (mm)		
	DN < 200	DN > 200	

3. Water mains should always cross over wastewater and stormwater drains.

4. When the wastewater pipe is at the minimum vertical clearance below the water main (500mm), maintain a minimum horizontal clearance of 1000mm. This minimum horizontal clearance can be progressively reduced to 600mm as the vertical clearance is increased to 750mm.

5. Clearance from the kerb and channel shall be measured from the nearest edge of the concrete. For water mains of DN < 375, clearances can be progressively reduced until the minimum of 150mm is reached for mains DN < 200.

Where a main crosses other services, it shall cross at an angle as near as possible to 90 degrees.

6.6.3 Clearance from structures

6.6.3.1 Pipes adjacent to existing buildings and structures shall be located clear of the "zone of influence" of the building or structure foundations. If this is not possible, a specific design shall be undertaken to cover the following:

(a) Protection of the pipeline;

(b) Long term maintenance access for the pipeline; and

(c) Protection of the existing structure or building.

6.6.3.2 The protection shall be specified by the designer for evaluation and acceptance by Council's Asset Manager.

6.6.3.3 Table 15: Clearance from structures may be used as a guide for minimum clearances for mains laid in public streets.

Table 15: Clearance from structures

Pipe diameter DN (mm)	Clearance to wall or building (mm)
< 100	1500
100 – 150	1500
200 – 300	2500
> 375	2500

6.6.3.4 These clearances should be increased for mains in private property (even with easements) as access is often more difficult and damage risk greater.

6.7 Intersections

6.7.1 At street intersections, 90 degree tees or 90 degree bends are preferred rather than two 45 degree bends (refer to Figure 142: TS 622 Water main locations at intersections).

6.7.2 Pipes shall comply with the relevant Standard and the Standard Technical Specifications: Part 6, Section 1.

6.8 Rider Mains

6.8.1 Rider mains shall be 63mm OD MDPE. The maximum number of domestic connections permitted to be served by a rider main shall be 7 for a one-end supply or 15 for a two-end supply.

6.8.2 In areas of higher pressure, proven by testing and modelling, Council may approve design of rider mains as 'Medium Pressure' as set out in NZS 4404:2010.

6.8.3 Rider mains with supply from only one end shall have a flushing valve at the terminal end (refer to Figure 146: TS 626 Flushout at end of ridermain).

6.9 Hydrants

6.9.1 Type

6.9.1.1 Hydrants shall comply with Volume 3 Technical Specifications.

6.9.2 Spacing

6.9.2.1 Hydrants shall be spaced at intervals not exceeding the following:

(a)	Residential areas	135m.
(b)	Commercial and industrial areas	90m (on each side of the road).

6.9.2.2 In a cul-de-sac or in other terminal streets, the last hydrant shall be not more than 65m from the end of the street measured at the property boundary.

6.9.2.3 Where houses or residential units are situated on private ways, there shall be a hydrant within 135m of any house or unit.

6.9.2.4 Where a residential private way is more than 65m long, a hydrant shall be sited at the street end of the private way or on the other side of the street immediately opposite the entrance.

6.9.2.5 If necessary, a principal main shall be constructed and a hydrant placed within the private way in order to ensure each house or unit is within 135m of a hydrant.

6.9.2.6 Hydrants should be located clear of property entranceways (in the grassed roadway berm). In new developments, where formation of property entranceways are deferred until construction of the buildings, hydrants should be located in the centre of the street frontage to avoid the most likely location of the entranceways alongside boundaries.

6.9.2.7 In addition to hydrant spacing for firefighting, hydrants shall be positioned at high points to facilitate flushing air from the mains and at low points to facilitate flushing sediment from the mains.

6.9.2.8 Hydrants shall be placed within hydrant boxes and the location marked in accordance with Volume 3 Technical Specifications.

6.10 Valves

6.10.1 Valves shall be installed as necessary to permit isolation of sections of the pipe network for maintenance purposes. The spacing and location of valves shall be such as to limit the number of dwellings affected by a shutdown to no more than 30.

6.10.2 Valves shall be placed on at least two of the three legs leading from each tee intersection. The maximum spacing of valves shall be 250m.

6.10.3 Air release valves are not normally required on principal mains. Automatic air release valves shall be installed when required by Council; they must be positioned so that ground water cannot enter the main should it become depressurised.

6.11 Depth of Water Mains

6.11.1 Both principal mains and rider mains shall have the following minimum cover. Greater depths may be required by specific design of the system:

(a)	Under grass berms and footpaths	: Principal mains	750mm
		: Rider mains	600mm
(b)	Under carriageways	: Principal mains	900mm
		: Rider mains	900mm

6.11.2 The sections of main adjacent to a carriageway crossing shall be gradually deepened, to allow the required cover under the carriageway without the provision of vertical bends. Similar provision shall be made to ensure the necessary cover over valve and hydrant spindles.

6.11.3 Service connection pipes shall have a minimum cover of 350mm at the point of connection.

6.12 Anchor or Thrust Blocks

6.12.1 Concrete anchor blocks shall be provided on mains exceeding 50mm diameter at all points where an external thrust occurs.

6.12.2 The design of anchor blocks shall be based on the allowable bearing capacity of the site soil conditions, except that the maximum value used shall be 75 kPa. The inner face of the block shall not be of a lesser thickness than the diameter of the fittings, and shall be constructed so as not to impair access to the bolts on the fittings. Concrete shall have a minimum compressive strength of 17.5MPa at 28 days.

6.13 Connections to Private Property

6.13.1 General

6.13.1.1 Before connection to the water network, Council connection process and forms shall be completed by the applicant and Council approval obtained. This applies to:

(a) All new connections and disconnections from private property; and

(b) All new connections of new water mains to be tied into the existing public water network.

6.13.1.2 The connection should be designed to suit the existing situation and any further development.

6.13.2 Requirement of Design

6.13.2.1 The point of supply to the consumer is shown on Figure 148: TS 627.1 20mm metered connections residential and Figure 148: TS 627.1 20mm metered connections residential.

6.13.2.2 The following practices are deemed acceptable and these design requirements shall be met:

(a) A single DN 20mm metered service connection in residential subdivisions shall be provided to all lots. Council does not permit lots to be served by multiple connections.

(b) Other customers sizing will be determined by specific design. However, no connection shall be sized at the same size as Council main it is figure from.

(c) No water supply pipes shall pass between one lot and another except where lots are amalgamated under one rating assessment (refer Operative Waipa District Council Water Supply Bylaw).

(d) Services shall be located at the centre of each front lot or close to one side boundary of the access ways to rear lots.

(e) No connections will be allowed from bulk mains.

(f) The service connection shall have a meter, manifold incorporating a toby valve and backflow preventer (where applicable) under a meter box located in the road reserve, 300mm from the boundary and the supply connection be extended 300mm inside the boundary (refer to Figure 147: TS 627 Standard connection installation 20-50mm pipework, Figure 150: TS 630.1 Water meter and valve assembly type 1, Figure 151: TS 630.2 Water meter and valving assembly, and Figure 152: TS 630.3 Water meter and valving assembly type 3.

(g) No service connections need be provided by a subdivider to rural, large lot, industrial or commercial properties.

6.13.3 Services in access ways, access lots, or right of ways

6.13.3.1 The following shall apply:

6.13.3.2 ***Servicing up to 4 lots***

(a) Where there are between two and four (inclusive) services in a common right of way an appropriately sized manifold box and lid is to be used to house up to four service connections per box. The manifold box shall be located in the right of way clear of vehicle traffic movements (refer to Figure 147: TS 627 Standard connection installation 20-50mm pipework and Figure 149: TS 629 Multi-service connections for connection details).

6.13.3.3 ***Servicing 5 or more lots***

(a) Where five or more service connections are required in an access lot or right of way, a single pipe shall be used, subject to the following design criteria:

(i) Pipe work shall be 63mm OD MDPE unless fire-fighting requirements control the design.

(ii) Service pipes crossing the access lot shall be 25mm OD MDPE and shall be placed in 50mm internal diameter ducts.

(iii) The supply pipe shall be designed to be in the grass berm.

(iv) Service connections, meters, backflow preventer (where applicable), manifold boxes and gate valves shall be laid and marked in accordance with Figure 147: TS 627 Standard connection installation 20-50mm pipework and Figure 150: TS 630.1 Water meter and valve assembly type 1.

(v) The supply pipe shall have a flushing valve of minimum 50mm internal diameter at the furthest point from the reticulation (refer to Figure 146: TS 626 Flushout at end of ridermain).

(vi) Metallic detector tape, laid directly above the supply pipe at a maximum depth of 200mm is required where the alignment of the pipe is not clearly defined as a straight line between valve box lids and, in other circumstances as required by Council.

(vii) An "Easement in Gross" shall be granted in favour of Council to allow access for maintenance of the pipe. The minimum width of the easement shall be 3m.

(viii) Council's responsibility for maintenance of the supply pipes shall cease at the point of supply. Refer Clause 6.13.2 of this Part and the Operative Waipa District Council Water Supply Bylaw.

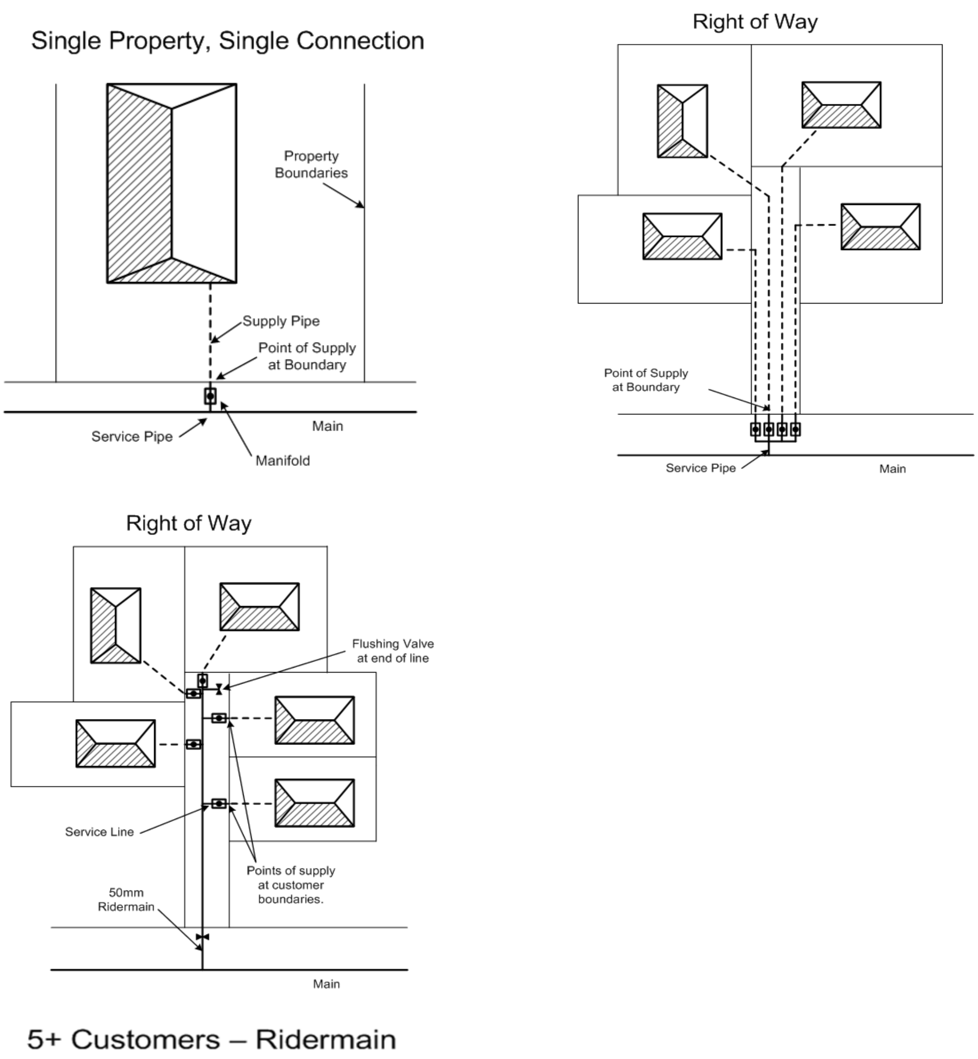


Figure 27: Point of supply for five or more lots

6.13.4 Connections for fire fighting

6.13.4.1 Refer to the Operative Waipa District Council Water Supply Bylaw for acceptable pipe and fitting arrangements for firefighting water supply.

6.13.5 Water Meters

6.13.5.1 ***Residential Connections***

(a) Meter boxes and manifolds are required to be installed in all connections. Water meters are required to be installed in all residential connections.

(b) Standard meter boxes (for use on grass berm) shall be rectangular, with minimum dimensions 200mm x 250mm clear access, and be at least 350mm deep. The meter box material shall have a blue lid with the word “METER” embossed on top.

(c) Heavy-duty meter boxes (for use in trafficked areas) shall be designed and constructed in special cases.

(d) Where four connections are required to be installed side by side, the use of two (2) jumbo meter boxers can be used.

6.13.5.2 ***Rural, Restricted, Large Lot, Commercial and Industrial Connections***

(a) Water meters are required to be installed in all Rural, Restricted, Commercial and Industrial connections.

(b) Heavy-duty meter boxes (for use in trafficked areas) shall be designed and constructed in special cases.

6.13.6 Connections for multiple ownership on a Single Lot

6.13.6.1 Council does not own or operate pipelines on private property. While Unit Title developments are recommended to conform to service connection layouts described in Clause 6.13 this is in order to facilitate for subsequent water billing and sub-division should this be required as a future development of the site.

6.13.6.2 Isolation valves for individual units (required under Clause 5.4.1 of the Building Act Compliance Document G12 Water Supplies) shall be located outside of the building platform.

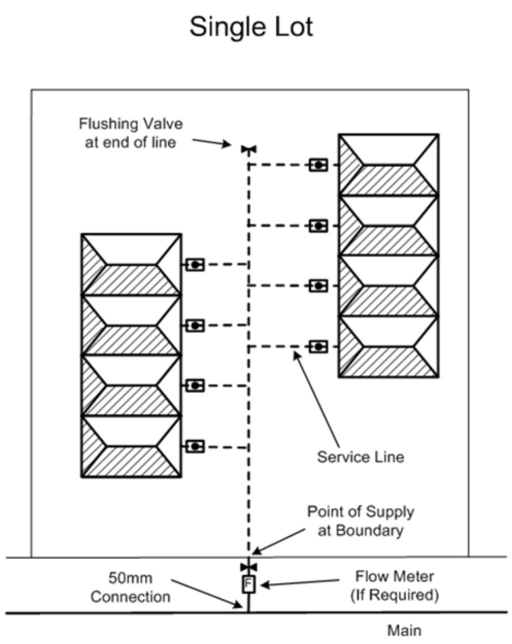


Figure 28: Connections for multiple ownership on a single lot

Part 7: Street Landscaping

7.1 Introduction

7.1.1 This section applies to all proposed road reserve landscape design or works in any part of Council's road network, in respect to both existing and proposed roads, including any subdivision or where required as a condition of subdivision consent. This section applies to all public road landscape works.

7.1.2 Approval, rejection, proposed landscape design, or works shall be at the sole discretion of Parks and Reserves Team Leader or nominee.

7.1.3 Street landscaping includes street trees and permanent planting on traffic islands and other sites within the road reserve.

7.1.4 Landscape Plans will be required by Council and must be submitted for approval with the Engineering Plans.

7.2 Minimum Requirements

7.2.1 Subdivision form and landscape development

7.2.1.1 Minimum subdivision design requirements are as follows:

(a) The landscaping of streets shall be carried out as part of the overall landscaping of the subdivision where attention will already have been paid to the preservation and incorporation of land form, existing vegetation (where this is characteristic of the area), topsoil, and features of heritage (including waahi tapu), ecological and geological significance.

(b) Street landscaping shall enhance and strengthen the existing character, intended future character of neighbourhood areas, and unify those areas into an integrated neighbourhood.

(c) Any landscaping shall provide maximum long-term benefit with minimum on-going maintenance. It shall not compromise the safe use of the legal road reserve or affect its structural integrity.

(d) The safety of the site by incorporating CPTED (Crime Prevention Through Environmental Design) principles. These principles, as outlined below, form the underlying strategy for the design and use of the environment that supports desired behaviours, enhances the intended functionality, and reduces undesired behaviour by placing potential offenders at a disadvantage.

7.2.2 Crime prevention through environmental design principles:

7.2.2.1 Territoriality – physical design is used to promote a sense of ownership, respect, responsibility, and community.

7.2.2.2 Natural Surveillance – places where all publicly accessible places are overlooked, people can see and be seen.

7.2.2.3 Access Control – places with well-defined routes, spaces, and entrances that provide for convenient movement without compromising security.

7.2.2.4 Space Management – appropriate use of space and well cared for, attractive and vandal resistant facilities and buildings.

7.2.2.5 Activity Support – places where human activity is appropriate to the location.

7.2.3 Minimum planting provision requirements:

7.2.3.1 Planting of street trees generally at an equivalent rate of one tree per residential property; groups of trees may be approved where the kerb line and location of services allow for local features.

7.2.3.2 Planting of all approved traffic islands and traffic control devices necessary for traffic management purposes.

7.2.3.3 Protection of existing trees or vegetation identified as being of value in the District Plan and/or as a condition of any consent.

7.2.3.4 Generally, all landscape works must have low long-term maintenance characteristics.

Advice Note: Refer also to Part 3 of this Volume.

7.3 Means of Compliance

7.3.1 Location

7.3.1.1 Trees and garden plantings shall be located so that they do not compromise the integrity and efficient operation of infrastructural services.

7.3.1.2 The minimum separation and site distances referred to in Clause 3.7.1 of this Manual should be observed for tree planting. These distances are guidelines and may have to be increased depending on the road geometry.

7.3.1.3 Alternative location and design proposals may be considered, such as provision of trees in a dedicated "non-services" berm, either side of a footpath. "Curved" footpaths may allow for tree planting in groups, and may help to accentuate road groups and road perception. Strategically placed grouped plantings of trees may be of greater benefit and impact than individual trees placed outside each house. Refer to Figure 29: DG 701 Typical utility and street tree locations, Figure 30: DG 702 Minimum planting for standard and non-standard designs, and Figure 31: DG 703 Minimum planting for non-standard design.

7.3.1.4 Where traffic control devices are required as part of the road works, they shall be planted as traffic island planting. Refer to Figure 32: DG 704 Minimum planting for traffic control devices and Figure 33: DG 705 Minimum planting for traffic control devices.

7.3.2 Street trees

7.3.2.1 Street tree planting is required to be provided by the Developer in all subdivisions incorporating new roads to vest in Council with details of the planting to be supplied at the time of application for engineering plan approval.

7.3.2.2 Species are to be selected from the table below.

Table 16: Suggested Street Trees

Botanical Name	Common Name	Size
Acer autumn blaze	Autumn blaze maple	medium
Acer buergerianum	Trident maple	medium
Acer davidii	Davids maple	medium
Acer griseum	Paperbark maple	small
Acer palmatum 'Bloodgood'	Japanese maple Bloodgood	medium
Acer palmatum 'Osakazuki'	Japanese maple Osakazuki	small
Acer palmatum 'Senkaki'	Japanese maple Senkaki	medium
Aesculus carnea briotii	Red horse chestnut *(Suitable as centre feature in large roundabouts only - Specific Council approval is required).*	large
Carpinus betulus 'Fastigiate'	Upright hornbeam	medium
Cercis canadensis 'Forest Pansy'	East American Redbud	medium
Cercis siliquastrum	Judas Tree	medium
Cornus controversa	Wedding cake tree	medium
Cornus florida	Flowering dogwood	small
Cornus florida 'Cherokee Chief'	Flowering dogwood Cherokee Chief	small
Cornus florida x c. nuttallii	Cornus Eddies White Wonder	medium
Diospyros kaki	Persimmon	medium
Ginkgo biloba 'Autumn Gold' (male only)	Maidenhair tree	large
Koelreuteria paniculata	Golden rain tree	small
Lagerstromia indica	Crepe myrtle	medium
Liriodendron tulipifera 'Fastigiatum'	Fastigiate tulip tree	large
Magnolia 'Black Tulip'	Magnolia black tulip	small
Magnolia 'Caerhay's Belle'	Magnolia Caerhay's belle	medium
Magnolia 'Koban dori'	Magnolia Koban dori	small
Magnolia 'vulcan'	Magnolia vulcan	small
Magnolia 'Yellow Bird'	Magnolia yellow bird	medium
Malus strathmore	Flowering crabapple	medium

Botanical Name	Common Name	Size
Malus trilobata	Pillar apple	medium
Melia Azadarach	Indian bead tree	medium
Nyssa sinensis	Chinese tupelo	small
Nyssa sylvatica	Tupelo	medium
Platanus x acerifolia	London Plane Tree *(Suitable as centre feature in large roundabouts only – Specific Council approval is required)*	large
Pistacia chinensis	Chinese pistachio	large
Prunus cerasifera 'Nigra'	Purple leaf cherry plum	small
Prunus 'Okame'	Flowering cherry Okame	small
Prunus yeodensis 'Awanui'	Flowering cherry Awanui	medium
Pyrus calleryana 'Bradford'	Ornamental pear Bradford	medium
Quercus robur 'fastigata'	Upright oak	large
Sorbus accuparia 'Chinese lace'	Rowan Chinese lace	small
Sorbus accuparia 'Scarlet king'	Rowan scarlet king	medium
Tilia europaea	Common lime	large
Tilia platyphyllos 'Laciniata'	Cut leaf lime	medium
Ulmus carpinifolia 'Variegata'	Smooth variegated elm	medium
Ulmus parvifolia Frontier	Hybrid Chinese elm	medium
Ulmus procera Louis van Houtte	Golden elm	medium
Zelkova serrata 'Green Vase'	Japanese zelkova green vase	large

Table 17: Suggested street trees: New Zealand native trees

Botanical Name	Common Name	Size
Agathis australis	Kauri *(Suitable as centre feature in large roundabouts only – Specific Council approval is required)*	large
Alectryon excelsus	Titoki	medium
Cordyline australis	Ti kouka (Cabbage Tree)	medium
Dacrycarpus dacridiodes	Kahikitea *(Suitable as centre feature in large roundabouts only – Specific Council approval is required)*	large
Dacrycarpus cupressinum	Rimu *(Suitable as centre feature in large roundabouts only – Specific Council approval is required)*	large
Phyllocladus trichomanoides	Tanekaha (Celery Pine)	Large
Plagianthus regius	Manatu (Ribbonwood)	medium
Pseudopanax crassifolius	Horoeka (Lancewood)	small

Botanical Name	Common Name	Size
Sophora tetraptera	Kowhai	small

* small <5m, medium 5 - 9m, large >9m

7.3.2.3 Installation of street trees shall comply with the Manual, Volume 3, Part 7, Section 5: Street Tree Planting.

7.3.2.4 The following matters are to be considered for species selection:

(a) Suitability to environmental conditions, e.g. ground moisture, wind.

(b) Pest and disease resistance.

(c) Non-suckering habit.

(d) Longevity.

(e) Shading consistent with location.

(f) Minimum maintenance requirements.

(g) Compliance with Clause's 3.7.1 and 3.11.1 of this Manual in regard to sight distances.

(h) Minimal leaf fall in autumn (which can block catch pits).

7.3.2.5 ***Species***

(a) Any new development shall use species selected from the street tree species. Normally only one species should be used for street trees in any one street.

7.3.2.6 ***Dedicated tree planting corridor***

(a) A service-free corridor, minimum 1200mm wide shall be located within the berm as required in Table 3: Roundabout Minimum Design Criteria of this Volume.

(b) Alternative tree planting areas shall be provided where streets are narrow or such a corridor cannot be provided. Alternative areas are equivalent to $1m^2$ per metre of street length with any one area having a minimum site area of $12m^2$.

(c) Areas protecting existing trees may be accepted as contributing to dedicated tree planting areas.

(d) All trees planted within the road reserve or within 3m of any utility services must have root protection/direction devices installed.

7.3.2.7 ***Location***

(a) Tree-planting locations should conform to those shown in Figure 29: DG 701 Typical utility and street tree locations. One tree per property frontage is acceptable. No trees are to be planted within the SISD or RSD visibility splays. Trees planted within the CSD visibility splays must be clear pruned to 2.5m above ground level.

(b) Refer to Volume 2, Part 3, Section 3 of this Manual for visibility splay specifications.

7.3.3 Traffic island and berm planting

7.3.3.1 Traffic islands and berms to be planted shall be shown on the Landscape Plans submitted with the Engineering Plans, and must have particular regard for the SISD or RSD visibility splays specified in Volume 2, Part 3, Section 3 of this Manual.

7.3.3.2 Species used shall be approved by the Manager - Road Corridor.

7.3.3.3 All shrub and groundcover planting shall comply with the visibility splays specified in Volume 2, Part 3, Section 3. Within all SSD and RSD visibility splays, planting shall be designed to be no more than 450mm high. In front of low sign boards at intersections, planting shall be designed to be not more than 100mm high or these areas are to be paved to ensure compliance with Volume 2, Part 3, Section 3 of this Manual.

7.3.3.4 In general, traffic islands with an infill area of less than $4m^2$ shall not be planted. The width of the planted area should not be less than 600mm. Tapered or curved areas should be squared off and paved or concreted when the infill width is less than 600mm. Single or isolated islands should generally be larger than $4m^2$ to be considered for planting, whereas islands smaller than $4m^2$ will be considered where they are an integral part of a larger landscaping scheme, or there are traffic engineering reasons for planting.

7.3.3.5 At roundabout intersections, groundcovers or bedding not exceeding 300mm height in the Criterion 2 areas and 400mm height in the Criterion 3 areas although these may vary depending on road grades and levels.

7.3.3.6 For roundabouts greater than 12m diameter, it is preferably that 65 percent of the internal area be planted up with approved intersection plant species while ensuring that visibility splays, frangibility requirements and utility services remain uncompromised. The centre of roundabouts greater than 12m diameter can be planted with taller approved shrub and tree species to aid in slowing traffic and act as a visual nodal reference.

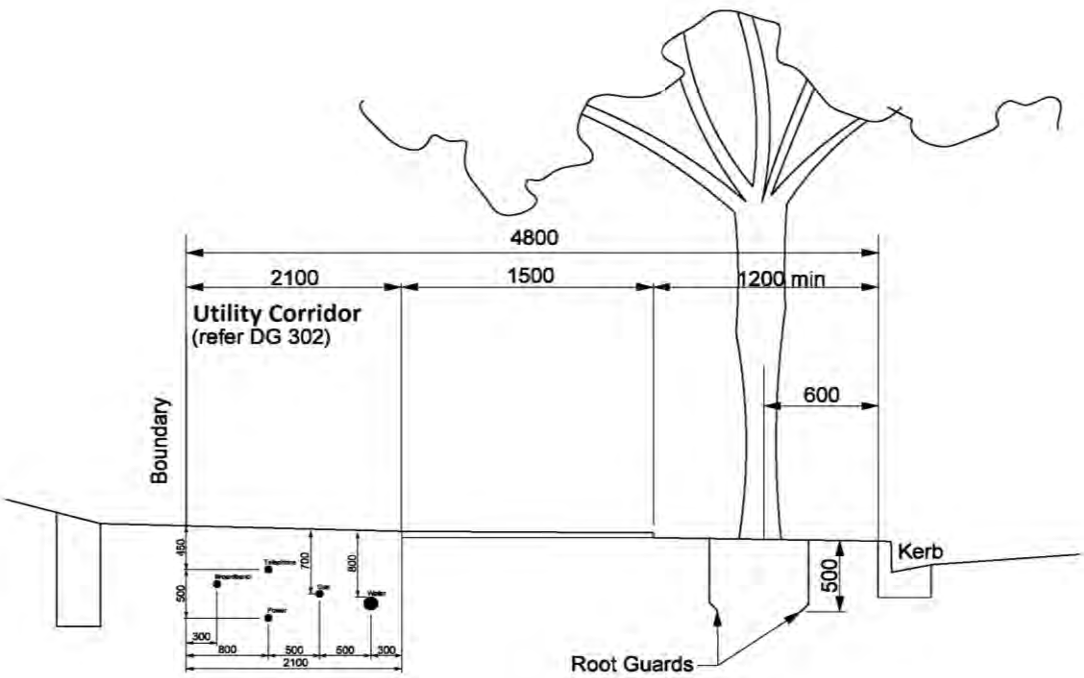
7.3.3.7 When planting in traffic islands, ensure that mature plants are at the required heights and at centres that will not spread over the back of the kerb and channel into the road lanes, with a minimum setback of 200mm from the back of kerb. This is especially pertinent in respect to flax species.

7.3.3.8 Likewise, plants are to be located at centres so that at maturity they cover as much of the traffic island planter bed area as possible to reduce weed maintenance. Ensure that planting does not impair sightlines to road signs.

7.4 Standard and Non-Standard Options for Street Tree Location

7.4.1 Design of streets may include kerb extensions for intersections and speed controls, which allow non-standard tree planting where utilities are not a problem and visibility requirements, are designed to incorporate planting as a means of slowing traffic (Refer to Figure 30: DG 702 Minimum planting for standard and non-standard designs, Figure 31: DG 703 Minimum planting for non-standard design, Figure 32: DG 704 Minimum planting for traffic control devices and Figure 33: DG 705 Minimum planting for traffic control devices).

Advice Note: With a full complement of utilities, the minimum berm width required for street tree planting is 4800mm. If these minima cannot be met, Clause 7.3.2.6 applies (i.e. Trees provided in alternative locations).



NOTE:

This diagram is for the typical situation for street tree planting

With a full complement of utilities, the minimum berm width required for street tree planting is 4800 mm.

If these minima cannot be met, Clause 7.3.2.2 applies (i.e. Trees provided in alternative locations).

Waipa District Council
Service Delivery
Development Manual

TYPICAL UTILITY AND STREET TREE LOCATIONS

Approved by: P & R Team Leader

DG 701

Version: **May 2012**

Figure 29: DG 701 Typical utility and street tree locations

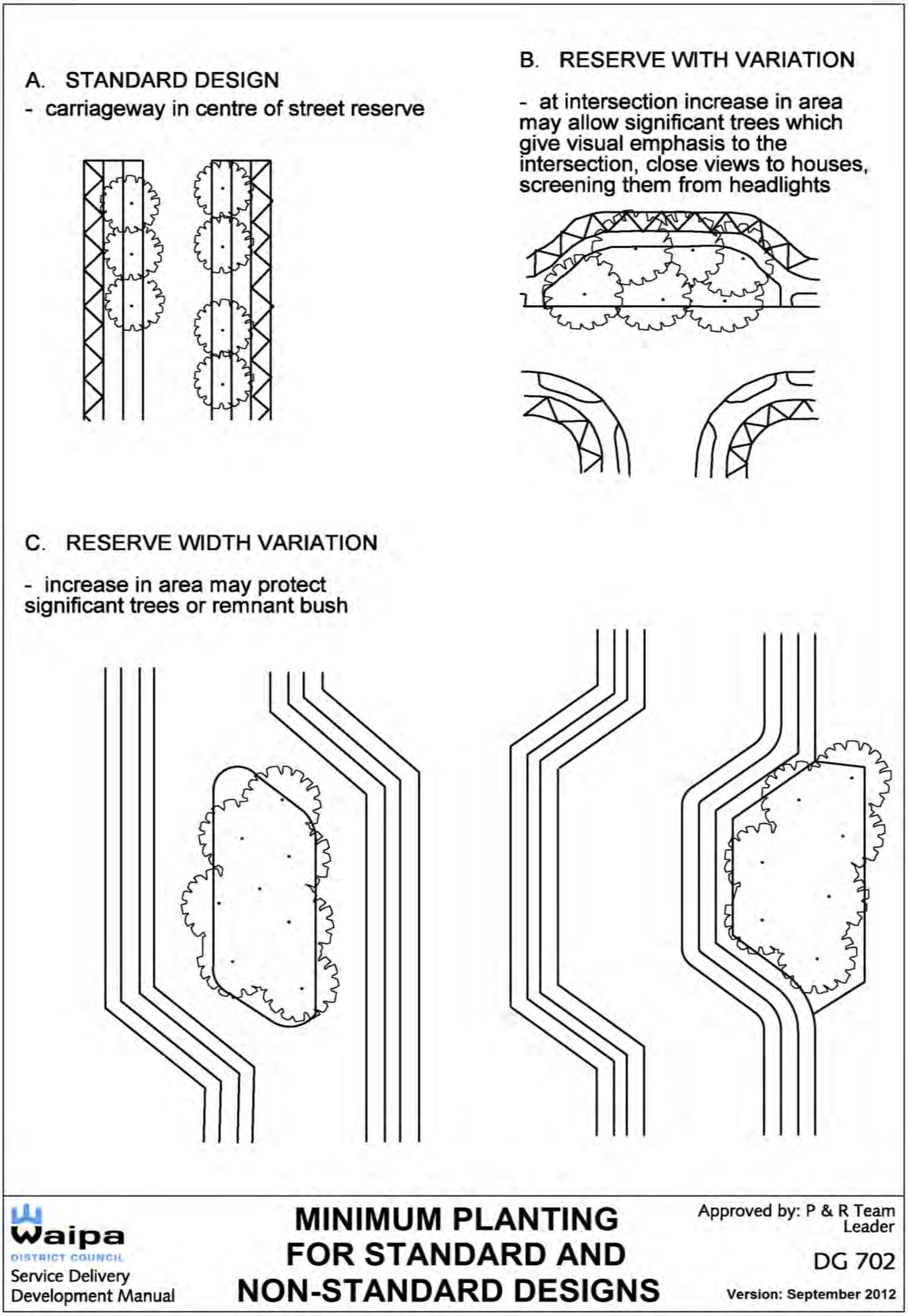
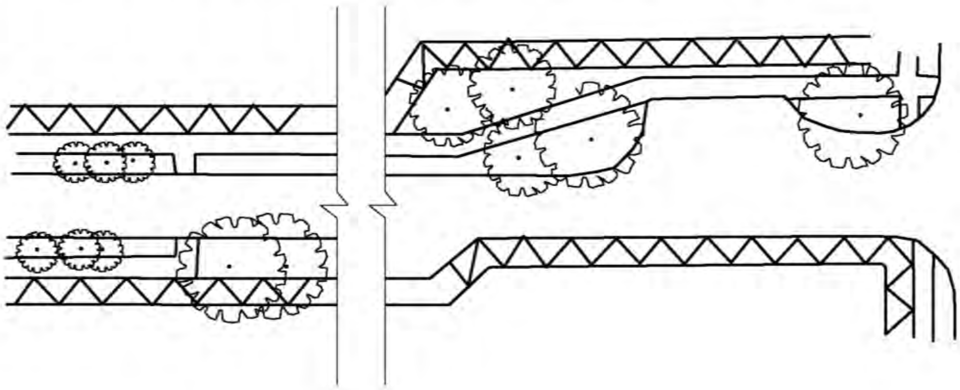


Figure 30: DG 702 Minimum planting for standard and non-standard designs

A. FOOTPATH, CARRIAGEWAY AND RESERVE VARIATION

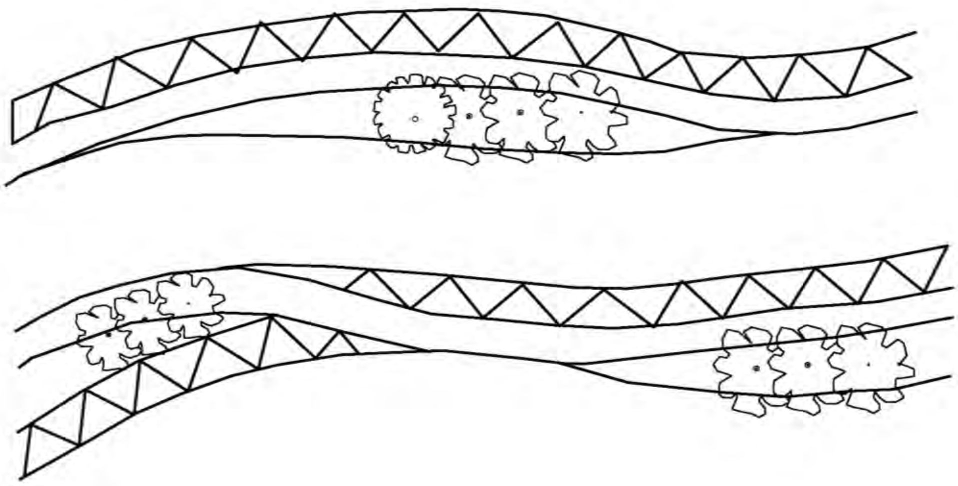
- for speed restriction, parking provision and more intimate street scale. Small radius curve at street entry and narrowed area act as speed control devices

Version 1



B. FOOTPATH AND CARRIAGEWAY VARIATION

- to discourage high speeds and vary the driver's experience of streetscape in an informal manner. Boundary planting links with private planting service strip can be located relative to boundary lines or footpath. Location adjacent to boundary extends the useable lawn-garden area. Location adjacent to outside edge of footpath provides pedestrian buffer zone



Waipa DISTRICT COUNCIL
Service Delivery Development Manual

MINIMUM PLANTING FOR NON-STANDARD DESIGN

Approved by: P & R Team Leader

DG 703

Version: September 2012

Figure 31: DG 703 Minimum planting for non-standard design

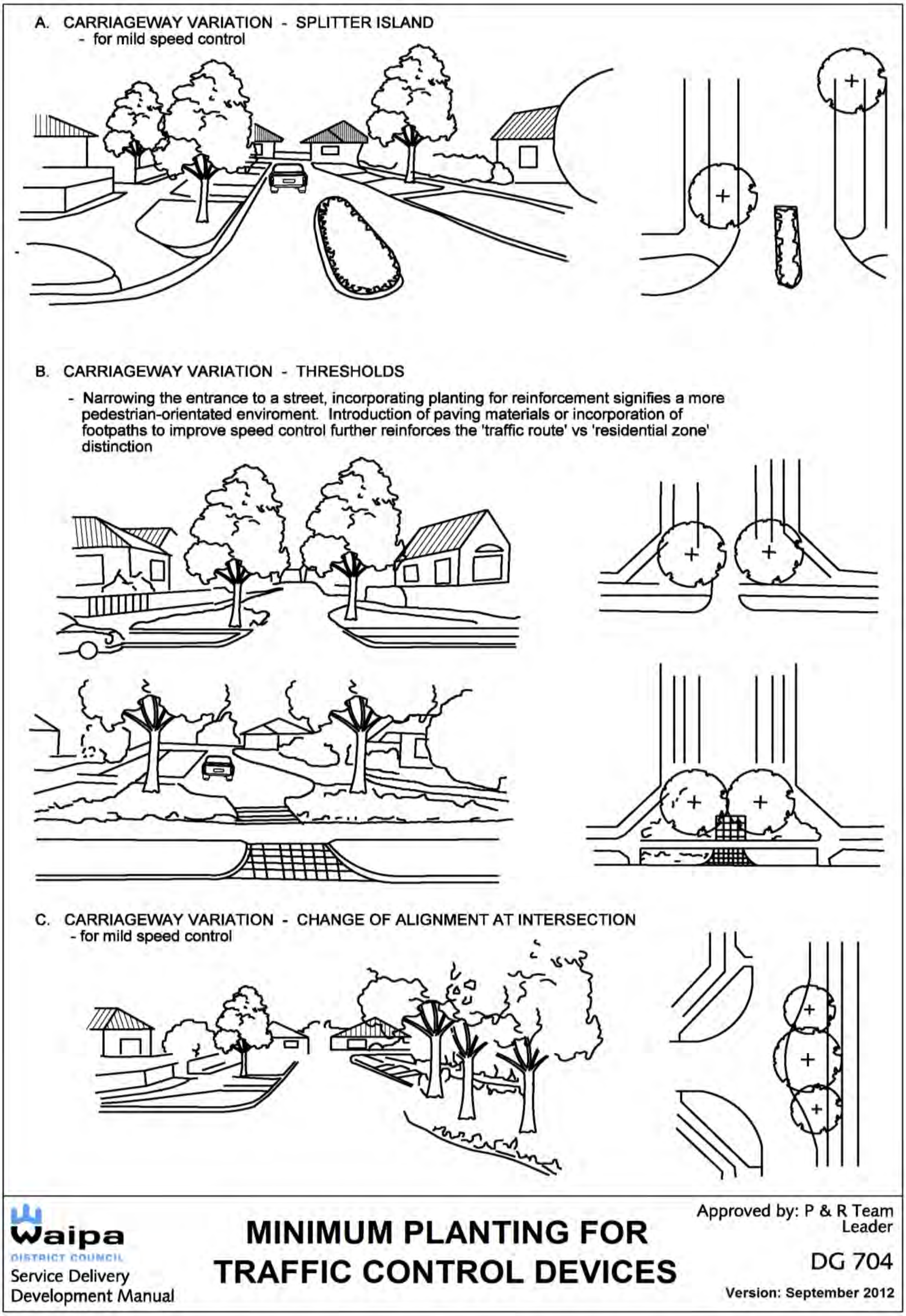


Figure 32: DG 704 Minimum planting for traffic control devices

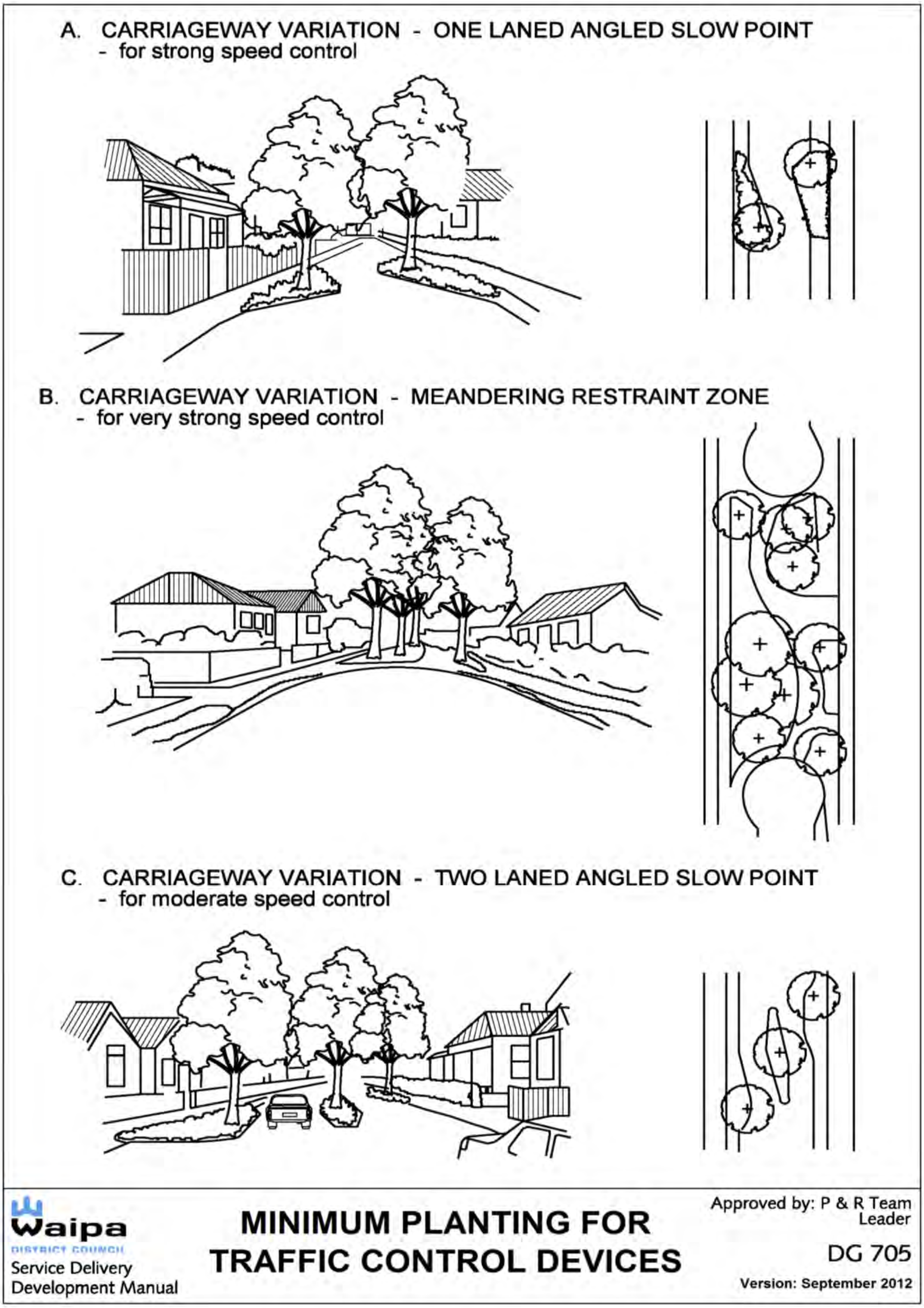


Figure 33: DG 705 Minimum planting for traffic control devices

Part 8: Network Utilities – Power, Telephone & Gas

8.1 General

8.1.1 The developer is required to make all arrangements with the appropriate network utility for the supply and installation of services for:

(a) Electric power.

(b) Telephone.

(c) Gas.

8.1.2 In industrial areas, the reticulation of gas may be considered as optional if the requirements for this service are unknown. In all other zones, the supply of gas is mandatory.

8.1.3 All reticulation shall be in underground systems in a services corridor of a width acceptable to all utilities (refer to Figure 16: DG 302 Location of services in streets).

8.1.4 Under road carriageways and vehicle crossings to private ways, ducts shall be installed to facilitate the installation of the services and future extensions of the networks.

8.1.5 Above ground structures required for network utility operators shall be located on separate lots specifically identified for that purpose. These may include:

(a) Power transformers.

(b) Switching stations.

(c) Phone boxes.

(d) Gas regulation control stations.

8.1.6 Where the developer is required to install ducts, the developer shall advise the network utility operator before ducts are backfilled to enable the network utility operator to plot the location.

8.1.7 Council will not issue a certificate under Section 224 of the Resource Management Act 1991 until the relevant clearance certificates are completed and provided to Council.

8.1.8 Where a water or gas main is on the kerb side of a proposed cable, delaying the installation of service connection pipes will facilitate laying of the cable. Stormwater connections from the boundary to the stormwater system should be carried out before the installation of utility services.

8.1.9 In preparing the engineering plans, due regard shall be given to the requirements of the network utility operators as to:

(a) Minimum cover to cables.

(b) Standard alignment.

(c) Minimum separation distances between power or telephone cables, and gas or water.

(d) Mains.

8.1.10 The width of berm which must be clear of other services and obstructions to enable efficient service laying operations.

8.1.11 The Developer shall obtain work clearance from each network operator in the form of Checklist 8.1 on page 641 in Volume 4. These checklists shall be submitted to Council with the application for 224(c) Certificate.

8.2 Conversion to Underground on Existing Streets

8.2.1 Where a proposed subdivision fronts onto an existing street, the conversion of overhead reticulation to underground will usually be desirable. Agreement on the feasibility and benefit will first be agreed between the electrical network utility operator, telephone network utility operator and Council.

8.3 Industrial and Commercial Subdivisions

8.3.1 The service requirements for industrial and commercial areas are often indeterminate. Close liaison between the developer and the network utility operator is essential, particularly immediately before cabling or piping is installed so that changes can be incorporated to accommodate extra sites or the requirements of a particular industry.

8.4 Location of Services

8.4.1 Network utility operators are required to maintain a procedure for recording the location of underground services on plans.

8.4.2 It is essential that all services be laid to predictable lines if there is to be a reasonable opportunity of laying new services within existing systems. These should generally be parallel or perpendicular to the legal land area. In addition to specifying the location of any service in the street berm, there should also be a tolerance which must on no account be exceeded without proper measurement and recording on the detailed record plan. A maximum tolerance of no more than ± 100mm is required.

Part 9: Planted Stormwater Devices (PSD)

9.1 Introduction

9.1.1 This section applies to engineered stormwater devices that have a planted component (PSD) or works in any way related to the use of landscaping as either an amenity or water mechanism in the development of new engineered stormwater devices and the remediation of existing engineered stormwater devices.

9.1.2 This Design Guide and Volume 3: Standard Technical Specifications, Section 4 are supplementary to the following sections of this Manual:

(a) Volume 2, Part 7: Street Landscaping;

(b) Volume 3, Sections 1 and 2; and

(c) Are to be read in conjunction with this Manual's Volume 2, Part 4: Stormwater Drainage.

9.1.3 Where there is a variation, the PSD Design Guide and Volume 3, Part 7, Section 4 Specifications take precedence in all PSD works.

9.1.4 These design guidelines apply to all PSDs that are located in any part of a road reserve, drainage reserve, subdivision or vested reserve, or where required as a condition of resource consent. These include, (but may also include other stormwater devices as required by resource consent conditions):

(a) Permanent Stormwater Ponds.

(b) Rain gardens.

(c) Swales.

9.1.5 Proposed landscape designs or works shall be approved or rejected at the sole discretion of Council or its delegated officer.

9.1.6 Landscape Plans will be submitted for approval with the Engineering Plans.

9.2 Applicable Engineered Stormwater Devices

9.2.1 Refer to the Auckland Regional Council publication TP10 "Stormwater Management Devices: Design Guidelines Manual" for in-depth definitions of engineered stormwater devices.

9.2.2 Examples of devices that require a landscaping component are as follows:

9.2.2.1 ***Permanent stormwater ponds***

(a) These are either wet ponds (where there is a permanent pool of water) or detention ponds (which have temporary pooling dependent on rain events). Both are used to capture and store stormwater in rain events and then release it at a slow rate. This rate is intended to be consistent with pre-urbanisation stormwater flow from the catchment. Landscape planting is used to:

(i) Prevent erosion and stabilize the pond slopes and flood zone;

(ii) Minimise long-term maintenance costs;

(iii) Increase run-off water quality;

(iv) Increase local amenity values; and

(v) Increase the quality of ecological greenbelts throughout the city for regional flora and fauna.

9.2.2.2 ***Rain gardens***

(a) These are stormwater detention devices that temporarily retain water and release it into the stormwater catchment over a designed period of time, such as 24 hours, when peak stormwater flows have diminished. Water is absorbed by the plants and released through vegetative evapotranspiration. Plants also use trapped sediments for nutritional requirements. Depending on the design, stormwater flows and the trapped sediment loading, these last for 15-30 years, after which they will need to be excavated and replanted.

9.2.2.3 ***Swales***

(a) These are mechanisms to control stormwater flow velocities from or through a site. Engineered ditches reduce the impermeable area of sites and assist with groundwater recharge. To be effective, they need to have low water velocities and are normally planted with a grass cover that is maintained at a calculated height so that velocities are slowed but not impeded. On slowing, suspended solids drop and aid in the soil nutritional value. Other plants may be used depending on the swale design.

9.3 Minimum Requirements

9.3.1 Minimum PSD design requirements are as follows:

9.3.1.1 Stormwater Devices embankments must be permanently planted if the slope ratio is steeper than 1 (vertical) to 4 (horizontal).

9.3.1.2 Any embankment that the Engineer determines is either too inaccessible or unsafe for regular grass mowing shall be permanently planted.

9.3.1.3 Perimeter fencing shall be constructed in accordance with one of the types as described at Items 1 to 5 of the Second Schedule of the Fencing Act 1978 or its amendments.

9.3.1.4 All inlet pipes must have a 1m wide concrete apron or band around the external portion. Between this apron and 2m from the inlet pipe, carex virgata and/or carex geminata shall be planted on the embankment with mulch matting, unless otherwise specified by the Engineer. No other plant species, including grassing, may be installed within 2m of the inlet pipe.

9.3.1.5 PSDs need to enhance and strengthen the existing character and intended future character of neighbourhood areas.

9.3.1.6 Any landscaping shall provide maximum long-term benefit with minimum on-going maintenance. It shall not compromise the safety of adjacent property owners nor the local community.

9.3.1.7 PSDs are to be landscaped so that they:

(a) Comply with engineering requirements;

(b) Improve stormwater water quality discharge, where possible;

(c) Become a community asset and positive visual amenity; and

(d) Provide, where possible, forage and habitats for native flora and fauna.

9.3.1.8 Safety of the site should be enhanced by incorporating CPTED (Crime Prevention Through Environmental Design) principles (refer to Part 7: Street Landscaping).

9.3.1.9 Plant species allocations are to be specific to soil type and conditions, site topography and exposure, post-development groundwater table levels and alignment with local indigenous native plant species. Plant species are to be indigenous to the Waikato Region, although native New Zealand grasses are permitted. Likewise, plants are to be eco-sourced, where possible, from the Waikato Region.

9.3.1.10 Planting plans are to be detailed, indicating different mixes and/or individual planting as applicable to the different Planting Zones, topographical, ecological and amenity zones within the PSD and surrounding environment.

9.3.1.11 Pond planting may be staged to minimise slope erosion. The initial stage shall be grassing the site with Council approved PSD grass mix, followed by landscape planting once grass has established.

9.3.2 Minimum planting provision requirements are:

9.3.2.1 Quick establishment of plant cover is required for PSDs throughout the site, as engineering requirements permit.

9.3.2.2 PSDs are to be landscaped with groundcovers, shrubs and trees where site conditions and engineering requirements permit, otherwise the PSDs are to be grassed or turfed as site design permits.

9.3.2.3 Of the vegetation mix in Stormwater Ponds, at least 10 percent and no more than 25 percent must be staked 1.5m high grade trees.

9.3.2.4 Avoid planting woody vegetation near the slope toe of Stormwater Ponds to prevent future bank stability issues when the plant reaches the end of its lifecycle and its root systems decompose.

9.3.2.5 Swale surface treatments shall be preferably established with low maintenance treatments such as rolled turf (for short lengths) or planted up in approved Carex species or other approved materials. Swales sown with grass seed, though low cost to construct are often difficult to establish and maintain. Acceptance of grassed swales or other swale surface treatments shall be at the Engineers discretion.

9.3.2.6 Where bark mulch is used, it is to be contained within the plant area that it is providing cover for. Other mulch applications are to be utilized on slopes greater than 1:3.

9.3.3 The minimum maintenance required post-landscaping is to comply with the PSD Defects Liability minimum standards and Maintenance Schedule in Volume 3, Part 9, Section 4.

9.4 Means of Compliance

9.4.1 Location

9.4.1.1 Planting shall be located so that the integrity and efficient operation of the engineering stormwater device or any other infrastructural service or structure both within and adjacent to the site are not compromised in any way.

9.4.2 Site preparation

9.4.2.1 In regard to adjacent water bodies and/or courses, ensure that no debris or chemical spray enters or impedes the functionality of the water body, whether it is natural or manmade.

9.4.3 Planting zones

9.4.3.1 In addition to the aesthetic appeal and ecological benefits, plants in and around PSD's contribute to the stormwater device functional requirements such as trapping sediment and preventing scouring of the embankments.

9.4.3.2 The following planting zones define the planting regimes within PSDs. They are intended for stormwater ponds but can be applied to other PSDs and are based on vegetative tolerances to wet/damp roots and frequent/infrequent inundation. Refer to Table 19: Approved PSD plant species for approved plant species.

9.4.3.3 Due to site conditions and PSD configuration it may not be feasible for all Planting Zones to be used within a PSD. Consult with the Engineer to confirm the applicable Planting Zones.

9.4.3.4 ***The Planting Zones are:***

(a) *Wet zone*

(i) This area is where the pond ground surface is capable of being permanently submerged and where the plant roots may be permanently water logged.

(b) *Marginal zone*

(i) This area is likely to be submerged or partially submerged in a 2-year return storm event.

(c) *Lower bank zone*

(i) This is the planting zone between the Marginal Zone and Upper Bank Zone where plants may be occasionally submerged (storm events more severe than the 2-year return period storm). Plants are able to withstand inundation for short periods of time.

(d) *Upper bank zone*

(i) This planting zone is generally above the spillway level. Plants are able to sustain damp roots for periods but should not be fully inundated.

9.5 Planting

9.5.1 Site screening

9.5.1.1 Site vegetative screening is to comply with Council's Proposed District Plan requirements.

9.5.2 Planting grades

9.5.2.1 Planting grades are to be of a suitable size to ensure that vegetation establishes rapidly with minimum mortality rates and/or replacement requirements. Refer to Table 19: Approved PSD plant species for the minimum plant grades. Trees are to be a minimum grade of 1.5m high. Planting shall be according to Volume 3, Part 7: Landscape Works for Planting Specifications.

9.5.3 Plant spacing and selection

9.5.3.1 ***Species selection***

9.5.3.2 Species are to be selected with regard to good conformation, healthy robust root systems, low maintenance and shall comply with Council's planting policies.

9.5.3.3 Planting species are to be selected according to the planting list indicated in Table 19: Approved PSD plant species and corresponding site topography and ecology unless there are more suitable plants according to site conditions and/or local ecology.

9.5.3.4 Other possible species may be referenced from the Hamilton City Council Gully Restoration Guidelines or the Waikato University Vegetation Types of Hamilton Ecological District. Where trees, shrubs and groundcovers are to be planted within a road reserve, Volume 2, Part 7: Street Landscaping design considerations and requirements shall also apply.

9.5.3.5 Species selection considerations include:

(a) Compliance with Clause 3.7.1 and 3.12.1 of this Manual in regard to sight distances where the PSD is within or near the road reserve.

(b) Engineering requirements, including improving post-treatment stormwater water quality.

(c) Ensure that intended plants are not classified as regionally noxious weed or pest species.

(d) Longevity and corresponding maintenance requirements.

(e) Minimal leaf fall in autumn (which can reduce PSD efficiency).

(f) Pest and disease resistance.

(g) Services, including overhead power lines.

(h) Shading consistent with location and adjacent landowners.

(i) Suitability to environmental conditions, for example, modified groundwater table, exposure to wind and frost, vehicular and cycle traffic.

(j) Ensure that no species that drop branches, debris, or may in any other way cause damming and/or unplanned flooding in and adjacent to watercourses (such as streams and spillways) are planted within 5m of watercourses.

9.5.3.6 ***Plant Selection for Specific Landscaped Engineering Stormwater Devices***

(a) *Rain gardens*

(i) Plants selected shall be a mix of groundcovers, shrubs and/or small trees (up to 4m high) that are able to withstand periods of soil water logging according to the Marginal and Lower Bank Planting Zone plant species.

(ii) Where PSDs occur in the road reserve, suitable plants from the Road Reserve Planting Strategy (refer to Part 7: Street Landscaping) may be used in addition to species indicated in the list of Approved PSD Plant Species at the end of this Part.

(iii) Ensure that no large trees are selected that may impede maintenance requirements and/or require a resource consent for removal should this be required in the future. Should Council's approved biodegradable matting be used for mulch, this shall not be visible once plants are fully established.

(b) *Stormwater Ponds*

(i) Stormwater ponds are to be planted up as soon as possible after civil construction is completed according to the Planting Zones indicated in 9.4.3. All stormwater ponds with an inner batter slope ratio of 1 (vertical) to 4 (horizontal) or steeper must be landscaped, as the slope is too great for safe maintenance.

(ii) Where site conditions such as unstable soil structures require a more rapid groundcover than shrubs and trees provide, exposed surfaces above the Upper Bank and Lower Bank Planting Zones shall be stabilised with grassing first prior to landscape planting.

(iii) Planting within the Marginal Zone shall be installed at the same time that the upper slopes receive grassing to minimise slope toe erosion. The Wet Zone shall be planted up once the normal standing water level has been achieved. Refer to Stormwater Pond Staged Landscape Planting.

(iv) Pond plant species shall be a mix of Council's approved groundcovers, shrubs and trees from the list of Approved PSD Plant Species at the end of this Part as site conditions and engineering requirements permit.

(c) *Swales*

(i) Swales may be turfed or grassed to ensure rapid establishment and mitigate channel surface scouring. Generally, grass needs to be maintained at heights between 50 and 150mm, depending on engineering design parameters.

(ii) Where engineering requirements permit, Carex virata or Carex geminata may be planted in the Wet and Marginal Zones. No other groundcover, shrub or tree species are permitted in these Zones. These need to be planted with mulch rounds.

9.5.3.7 ***Plant spacing***

(a) Plants are to be planted according to the following spacing allocations:

(i) Trees, shrubs and groundcovers required spacing's as per the list of Approved PSD Plant Species at the end of this Part.

(ii) Within the Marginal Zone, Carex shall be evenly staggered at 1m intervals.

(iii) Where plantings are to include approved partially submerged species, these are to be irregularly clumped in groups of three to seven plants along the circumference of the stormwater pond.

(iv) For permanent stormwater ponds, plant 0.4m below the designed normal standing waterline, approved sedges and rushes.

(v) Amenity plantings of tussocks are to be clumped in groups of three to ten plants.

(vi) Trees shall be spaced at minimum 2.5m centres from other trees and under planted with 4 equidistant same-species groundcovers, installed 0.75m from the tree stem. The groundcover species shall provide a weed suppression canopy while the tree is establishing, and as such will have no more than 1m mature height and minimum 0.75m spread. Ensure that the groundcover species does not compete with the tree establishment requirements. Depending on the Zone planting location, possible plants could be Phormium 'Green Dwarf', various Carex such as Carex virgata, and Coprosma groundcovers such as Coprosma kirkii 'Minogue'.

(vii) In respect to the pond maintenance access track:

- No shrub or groundcover centres are to be located within 1m of the track.
- No trees centres are to be located within 2.5m of the track.
- Plantings within 2m either side of the access track are to have species that are able to recover quickly should they become damaged during pond maintenance.

- In subdivision and shopping precincts, planting design either side of the access track should also ensure that the track may be used for pedestrian amenity purposes.

9.5.4 Planting definitions

9.5.4.1 The following definitions are applicable when implementing and maintaining PSD planting:

9.5.4.2 ***"Established"***

(a) Plants are established when they:

(i) Are healthy and free of pests, disease, spray and weed-trimmer damage;

(ii) Have grown to the approximate species mature height;

(iii) Have obtained a shape and form generally consistent with the species type; and

(iv) Are producing seeds/propagating naturally.

9.5.4.3 ***"Establishing"***

(a) Plants are establishing when they:

(i) Are healthy & free of pests, disease, spray & weed-trimmer damage; and

(ii) Are growing generally consistent with the species type shape and form.

9.5.4.4 ***"Failed" or "Failure"***

(a) Plants have failed when one or more of the following has occurred:

(i) Stunted growth (up to 5 years post installation). This requires further investigation to determine the cause and who or what is responsible.

(ii) Been more than 25% irreparably damaged by pests and/or disease and/or weed cover suppression.

(iii) Been severely spray damaged.

(iv) Been ring barked or severely damaged by a weed-trimmer or manual tool.

(v) The plant has died.

9.5.4.5 ***"Installed" or "Installation"***

(a) Installed plants are those that have been planted intentionally according to the PSD planting plan.

9.6 Plant Sourcing

9.6.1 Plants are to be eco-sourced from the Waikato Region where possible, at grades that minimize potential mortality rates, from reputable nursery stock. It is strictly prohibited to transplant vegetation from existing wetlands and other such environments to be used in PSD landscaping.

9.7 Mulching

9.7.1 The types of mulching specified are to ensure rapid planting establishment while maintaining good ground infiltration without souring the soil or causing negative amenity values, and allowing some scope for landscape design variations. Mulching for the PSD's shall be as detailed in Table 18: Council's Approved Landscape Mulching for PSDs.

9.7.2 Council favours biodegradable weed mats over synthetic geotextile weed matting. No synthetic geotextile weed matting or weed matting with synthetic geonet content is to be utilised in the installation of the landscaping portion of landscaping engineered stormwater devices. However, synthetic geotextiles and other materials may be used, as applicable, to meet device engineering requirements, for example, at inlets, outlets and high velocity channels. Biodegradable matting must:

(a) Have a minimum of 24 months life expectancy and be fully biodegradable into soil within 6 years.

(b) Prevent weed growth within the mulched area.

(c) Help stabilize the soil while plants are establishing.

(d) Not easily lift from the ground if submerged for periods of time.

(e) Appear reasonably tidy from a visual amenity perspective.

(f) Examples of approved biodegradable matting products include:

(i) Coir matting, 10mm thick minimum.

(ii) Jute-Hessian weed control mats, 800 gms/m^2 minimum.

(iii) Densely woven flax matting.

9.7.3 Where bark mulch is used, it is to be contained within the plant area that it is providing cover for. Likewise bark mulch is not permitted in any PSD:

(a) Within 3m of any watercourse or water body;

(b) Where water ponding or flooding may occur;

(c) On slope gradients of greater than a 1:3 ratio; and

(d) Biodegradable netting may be used in high corrosion sites as per Volume 3, Part 7, Section 1.

Table 18: Council's Approved Landscape Mulching for PSDs

Engineering Device	Planting Zone	Mulch Type
Rain garden	All	Council approved biodegradable weed matting, 50-150mm diameter River Rocks in 100-300mm deep, Council approved gabion matting
Stormwater Pond	Amenity Planting – Site Entrance and Drainage Reserve Boundary Line to Upper Bank Zone where no ponding, flooding, or mulch travel is possible	Council approved Bark and/or aged Woodchip

Engineering Device	Planting Zone	Mulch Type
	Amenity Planting – Site Entrance and Drainage Reserve Boundary Line to Upper Bank Zone where ponding or flooding is possible	Council approved biodegradable weed matting
	Upper Bank and Lower Bank Zones	Council approved 0.5m diameter biodegradable weed matting rounds
	Marginal Zone	Council approved biodegradable weed matting
	Wet Zone	No mulch required
Swale – Roll on Turfing	All	No mulch
Swale – Vegetated (Carex grasses)	All	Council approved biodegradable weed matting

Table 19: Approved PSD plant species

Botanical Name	Common Name	Minimum Centres (m) **	Minimum PB Grade	Type	APPLICABLE PSD	POND & WETLAND	Upper Bank Zone	Lower Bank Zone	Marginal Zone	Wet Zone (Depth range in bold)	RAIN GARDEN	VEGETATED SWALE	VEGETATED FILTER	TOLERANCE	Peat Soil	Frost	Wet / Moist	Dry	Wind	LIGHT REQUIREMENTS	Full Sun	Part Shade ***	Full Shade ***	CHARACTERISTICS	Rapid Growth	Nurse Plant	Bird Forage
Apodasmia similis	Oioi / Jointed Rush	1.00	RT	Medium Rush																							
Aristotelia serrata	Wineberry	2.00	5	Small Tree					x																		
Arthropodium cirratum		1.00	3	Low Shrub																							
Asplenium bulbiferum	Hen & chicken fern	1.0	5	Low Fern																							
Astelia grandis		1.00	3	Medium Shrub																							
Baumea articulata		1.00	RT	High Rush						**0.30m**																	
Baumea rubiginosa		1.00	RT	Low Rush																							
Blechnum novae-zelandiae	Kiokio	1.00	3	Medium Fern																							
Carex dispacea		1.00	RT	Sedge					>																		
Carex dissita		1.00	RT	Sedge																							
Carex gaudichaudiana		1.00	RT	Sedge																							
Carex geminata		1.00	RT	Sedge					>	**0.05m**																	
Carex secta		1.00	RT	Sedge					>	**0.05m**		?															
Carex testacea		0.30	RT	Sedge																							
Carex virgata		1.00	RT	Sedge					>																		
Coprosma grandifolia	Raurekau	1.00	5	Tall Shrub					x																		
Coprosma 'Hawera'*		0.50	3	Groundcover					x																		
Coprosma kirkii 'Minogue'		1.00	3	Groundcover					x																		
Coprosma propinqua	Mingimingi	1.00	5	Tall Shrub					x																		
Coprosma rhamnoides		1.00	5	Tall Shrub					x																		
Coprosma rigida		1.00	5	Tall Shrub					x																		
Coprosma robusta	Karamu	1.00	3	Tall Shrub					x																		
Coprosma tenuicaulis	Swamp Coprosma	1.00	5	Tall Shrub					x																		
Cordyline australis	Cabbage tree	1.00	3	Small Tree					x	**0.10m**																	
Cortaderia fulfida	Small Toe toe	1.00	RT	Small Grass																							
Cortaderia toe toe	Toe toe	1.00	3	Medium Grass																							
Cyathea dealbata	Ponga	1.00	8	Tree Fern					x																		
Dacrycarpus dacrydioides	Kahikatea	2.50	1.5m High	Tall Tree					x																		
Dianella nigra		1.00	5	Small Shrub					x																		
Dicksonia fibrosa	Wheki ponga	1.00	8	Tree Fern					x																		
Dicksonia squarrosa	Wheki	1.00	8	Tree Fern					x																		
Dodonea viscosa	Ake ake	2.00	5	Small Tree					x																		
Eleocharis acuta	Sharp spike rush	1.00	RT	Low Rush						**0.20m**																	
Eleocharis sphacelata	Kuta	1.00	RT	Low Sedge						**0.40m**																	
Fuschia excorticata	Kotukutuku	2.50	1.5m High	Medium Tree					x																		
Griselinia littoralis	Papauma	2.50	1.5m High	Medium Tree					x																		
Hebe paviflora*		1.00	3	Medium Shrub																							
Hebe stricta	Koromiko	1.00	3	Medium Shrub																							
Hebe 'Wiri Cloud'*	Hebe cultivar	0.50	3	Small Shrub																							
Hebe 'Wiri Splash'*	Hebe cultivar	0.50	3	Small Shrub																							
Hoheria sextylosa	Lacebark	2.00	5	Small Tree					x																		
Kunzea ericoides	Kanuka	2.50	3	Tall Tree					x																		
Leptospermum 'Crimson Glory'*	Manuka cultivar	1.00	3	Small Shrub																							
Leptospermum scoparium	Manuka	2.00	3	Small Tree					x																		
Libertia ixioides	NZ Iris	0.50	3	Small Shrub																							
Melicytus ramiflorus	Mahoe	2.00	3	Medium Tree					x																		
Myrsine australis	Mapou	2.00	3	Medium Tree					x																		
Phormium cookianum	Wharariki	1.00	3	Medium Flax					x																		
Phormium 'Green Dwarf'*	Flax culitvar	1.00	3	Low Flax																							
Phormium tenax	Harakeke	1.00	3	Medium Flax					X	**0.15m**																	
Pittosporum crassifolium*	Karo	2.00	3	Small Tree					x																		
Pittosporum eugenoides	Lemonwood	2.00	3	Small Tree					x																		
Pittosporum tenuifolium*	Kohuhu	2.00	3	Small Tree					x						No			No									
Pittosporum tenuifolium 'Mountain Green'*	Kohuhu cultivar	2.00	3	Small Tree					x						No			No									
Plagianthus regius	Ribbonwood	2.50	1.5m High	Medium Tree					x																		
Podocarpus totara	Totara	2.50	1.5m High	Tall Tree					x																		
Pseudopanax ferox	Fierce Lancewood	2.00	5	Small Tree					x																		
Schefflera digitata	Pate	2.00	5	Small Tree					x																		
Sophora 'Dragons Gold'*	Kowhai cultivar	2.00	5	Small Shrub																							
Sophora microphylla	Kowhai	2.00	1.5m High	Small Tree					x																		
Streblus heterophyllus	Turepo	2.00	3	Small Tree					x							No											
Syzgium maire	Swamp Maire	2.50	1.5m High	Tall Tree					x																		
Typhus orientalis	Raupo	1.00	RT	Rush																							
Grassing				Groundcover																							
Roll-on Turfing				Groundcover																							

KEY:

(grey shading)	These species may be planted according to PSD requirements and species tolerances. Only those nominated cultivars are acceptable unless approved otherwise by Council.
X	Plant must not be planted in the Marginal Zone as they may damage the slope toe should they fall over and/or require future removal.
>	Indicates that the vegetation mix for this planting zone should have a high percentage of this plant.
#	Swales: Plant only on slopes. Forms trunks that impede water flow.
*	Plant species is not indigenous to the Waikato region, but is an approved PSD plant.
**	Minimum staggered centres unless otherwise specified. Tree centres indicated are the minimum distances from other tree species and are to be underplanted with 4 equidistant same species groundcovers at 0.75m centres from tree trunk/stem.
***	Light Requirements: Those species that cannot tolerate Full Sun are not to be planted until after the initial planting stage has formed sufficient canopy to provide understorey

9.8 Referenced Documents & Standards

9.8.1 Auckland Regional Council, (2003), TP10: Stormwater Management Devices – Design Guidelines Manual.

9.8.2 Clarkson, B.D., Clarkson, B.R., Downs, T.M., (2001), Indigenous Vegetation Types of Hamilton Ecological District, The University of Waikato: Centre for Biodiversity and Ecology Research.

9.8.3 Clarkson, B.D. and Wall, K., (2002), Gully Restoration Guide: A Guide to Assist in the Ecological Restoration of Hamilton's Gully Systems, Hamilton City Council.

9.8.4 Environment Waikato Regional Council, (1995), Design Guidelines for Earthworks, Tracking and Crossing.

9.8.5 Environment Waikato Regional Council, Volumes 1 and 2, Erosion and Sediment Control: Guidelines for Soil Disturbing Activities (TR 2009/02).

Waipa
DISTRICT COUNCIL

Volume 3

TECHNICAL SPECIFICATIONS

Table of Contents

Part 1: General

1.1 General

1.1.1 These standard technical specifications set out the standards for materials and construction that are required by Waipa District Council.

1.1.2 These standard technical specifications apply to all works that are for Council whether by way of direct contract to Council or as part of a development where the infrastructural assets will become part of Council's network following completion.

1.2 Health & Safety

1.2.1 All work being carried out either as a direct contract to Council, or as part of a subdivision development shall be completed in such a manner that it complies in every aspect with the Health & Safety in Employment Act 1992 and its amendments.

1.2.2 Prior to any work commencing, it is necessary that a Health & Safety Plan be provided.

1.2.3 Where the work extends onto the existing road network, the Contractor shall provide and maintain an approved temporary traffic management scheme in accordance with the NZTA Code of Practice for Temporary Traffic Management: 2012.

1.3 Existing Utility Network Services

1.3.1 General

1.3.1.1 Works of any nature may encounter existing utility network services whether overhead or underground.

1.3.1.2 The contract documents will set out the respective responsibilities of the parties.

1.3.2 Service plans

1.3.2.1 The Contractor shall at all times have a full set of up to date service plans for the entire site that is subject to development. These service plans shall be produced for each service by, or on behalf of the relevant network utility operator and shall include the key for all symbols used on their plans as well as the date of issue.

1.3.2.2 The following utility networks may be present at any site:

(a) Gas transmission and/or distribution networks;

(b) Electrical transmission and/or distribution networks;

(c) Telecommunication networks (above and below ground); and

(d) Water networks.

1.3.2.3 A full set of these plans should also be readily available for the Engineer to refer to when required.

1.3.3 Existing utility services

1.3.3.1 The Contractor shall, before starting any excavation work, obtain all necessary consents for excavating in the vicinity of any existing utility service. The Contractor shall be bound by the Special Restraints imposed on work methods as required by the relevant service authority.

1.4 Service Covers

1.4.1 General

1.4.1.1 During construction no rollers or compactors or any other equipment which may cause damage shall be used over service boxes. All surface openings of underground services must be maintained clear of spoil and readily accessible at all times.

1.4.1.2 After construction or rehabilitation of the pavement courses and prior to final compaction and surfacing, all surface covers shall be adjusted in level so as to be generally flush with the finished surfaces. In some cases service covers are already hidden or buried and these shall be located, from the service plans, uncovered and adjusted. Service covers shall be so located as to allow access for their intended purpose.

1.4.2 Water supply covers

1.4.2.1 Water covers include, but are not limited to, the following:

(a) Toby boxes - usually circular and found in berm areas.

(b) Fire hydrants - found in berms and carriageways (yellow).

(c) Valve boxes - usually marked "V".

(d) Air bleed boxes - similar to fire hydrant boxes (painted white).

(e) Manholes (housing large valves enclosed in chambers).

1.4.2.2 These covers shall be adjusted by the Contractor in accordance with the Standard Technical Specification (Volume 3).

1.4.2.3 The adjustments shall be made according to Standard Details and must be to the correct level as any subsequent adjustment required will be at the Contractor's expense.

1.4.2.4 The Water Services department of Council will inspect the adjustment work. A 24 hour notification to inspect is required.

1.4.3 Water supply marker posts

1.4.3.1 Marker posts are installed, in most areas, in the berms to mark the following:

(a) Hydrants.

(b) Valves.

(c) Air bleed boxes.

1.4.3.2 The Contractor shall ensure that any marker post damaged or removed during the course of the work is replaced and/or reinstated in the correct location as soon as possible at the Contractor's cost.

1.4.4 Telecommunications service covers and above-ground structures

1.4.4.1 Such structures include, but are not limited to, the following:

(a) Aluminium or glass reinforced plastic (G.R.P) cabinets.

(b) Aluminium oval shaped covers - usually in berm areas.

(c) Fibre cement manholes - usually in the berms.

(d) Manholes with steel or concrete lids - in berms and in carriageways.

(e) Cable protection up poles.

1.4.4.2 This work is to be arranged by the Contractor after liaison with the Engineer and the Contractor shall give adequate notice to the authority when they require this work to be carried out. The Contractor shall ensure that the adjustment is to correct level, as any subsequent adjustment will be at the Contractor's expense.

1.4.5 Gas service covers

1.4.5.1 Gas valve boxes include, but are not limited to, the following:

(a) Unmarked approx 100 x 100 sized lids.

(b) Marked "HCC" Gas".

(c) Marked "NGW".

1.4.5.2 These service covers will be adjusted by Natural Gas Corporation of N.Z. This work is to be arranged by the Contractor and the Contractor shall give adequate (48 hour) notice to the Authority of when they require this work to be carried out. The Contractor shall ensure that adjustment is to the correct level. Natural Gas Corporation of NZ do not charge for one-time adjustment, provided that the correct notice requirements have been met.

1.4.6 Electrical above-ground structures

1.4.6.1 Such structures include, but are not limited to, the following:

(a) Pillar boxes - usually in the berms near the boundary.

(b) Transformer cabinets.

(c) Cable protection up poles.

1.4.6.2 This work is to be arranged by the Contractor after liaison with the Engineer and the Contractor shall give adequate notice to the authority when they require this work to be carried out. The Contractor shall ensure adjustment is to the correct level and location as any subsequent adjustment will be at the Contractor's expense.

> Advice Note: Where earthing straps for transformer boxes are damaged or no longer in contact with the ground, the Contractor shall report this to the relevant electrical service provider.

1.4.7 Stormwater and sanitary sewer covers and structures

1.4.7.1 Such structures include, but are not limited to, the following:

(a) Manholes.

(b) Gully traps.

(c) Pump Station structures.

(d) Pump Station electrical cabinets.

1.4.7.2 The adjustment of manholes shall be carried out by the Contractor after liaison with the Engineer and notification to the Operations Department of Waipa District Council at least 48 hours prior to commencement of work. No debris shall be allowed to enter the sewers during this work.

1.4.7.3 For all other structures that may need adjusting, liaison should be with the Operations Department.

1.4.8 Traffic signal toby boxes

1.4.8.1 Not applicable within the Waipa District.

1.4.9 Survey standard covers

1.4.9.1 The adjustment of all survey standard covers shall be carried out by the Contractor after liaison with the Engineer.

1.4.10 Other surface openings and structures

1.4.10.1 The Contractor shall arrange for the adjustment of all other surface openings and structures. These works shall be carried out by the appropriate service authority.

1.4.11 Payment

1.4.11.1 Unless noted otherwise, the Contractor shall have allowed for all adjustments, costs and attendances.

1.5 Traffic Detector Loops

1.5.1 Not applicable within Waipa District.

1.6 Catch pits

1.6.1 Special care shall be taken to prevent catch pit chambers being filled, or catch pit grates being blocked, with any rubble, topsoil, sealing chip, asphalt, concrete or other spoil created during the works. The Contractor shall ensure that all catch pit chambers are clean and all grates are open and clear at all times, and at the end of the works the Contractor shall clean all catch pits.

Part 2: Earthworks

2.1 General

2.1.1 This part covers the clearing, excavation, and fill work associated with all aspects of the works.

2.2 Standards

2.2.1 Unless superseded by these specifications, the following standards shall apply:

(a) NZS 4431:1989 + A1 – Code of Practice for Earth Fill for Residential Development.

(b) NZTA Specification F/1 -Earthworks Construction (The sections on top soiling and grassing between road boundaries and batter slopes continuing beyond the road boundaries are superseded by sections in Part 7: Landscape Works in this Standard Technical Specification).

(c) Environment Waikato Erosion and Sediment Control - Guidelines for Soil Disturbing Activities.

2.3 Preparation for Earthworks

2.3.1 Before any earthworks are commenced, areas of cut and fill should be clearly defined. Where necessary, sufficient fencing or barriers should be provided around trees or other features to be protected. All site activities including clearing, storage, cutting and filling must be kept away from the root zone of trees (best defined as the extent of the canopy). Adequate provision should also be made for the control of erosion, surface water run-off and siltation.

2.3.2 Specifications for the work should include the following:

(a) All rubbish, vegetation and debris should be removed from earthworks areas prior to the commencement of topsoil stripping. Areas on which fill is to be placed, or from which cut is to be removed, and haul roads should be stripped of all topsoil and such unsuitable soft or organic material. Special care should be taken to ensure that organic materials and areas of old uncompacted filling are not overlooked through being overlaid by other soils.

(b) Any open air burning of vegetation should be supervised at all times and carried out in such a manner as to prevent smoke nuisance to neighbouring areas.

(c) The burning of materials that generate toxic emissions is prohibited. Burning of vegetation can result in large numbers of people being adversely affected from smoke and fumes. Any costs resulting from abatement action carried out by Council will be charged to the owner of the land. These requirements are supported by the Health Act 1956.

(d) Stripping should be carried out as a specific operation with areas being stripped in large enough increments to ensure that there is an adequate margin of stripped ground beyond any current cutting or filling operation. Particular care should be taken to ensure that overspill is not left in an uncompacted state anywhere on the site, when constructing temporary haul roads.

(e) All stripped material should be deposited in temporary stockpiles or permanent dumps, in locations where there is no possibility of the material being unintentionally covered by, or incorporated into, structural fills.

(f) Where a fill abuts against sloping ground, benches should be cut into the ground to prevent the development of a continuous surface of low shear strength.

(g) The perimeter of all sealed areas to be excavated shall be cut with suitable cutting equipment to a sufficient depth to ensure that the pavement and sealed surface outside the ripped or excavated area is not disturbed.

(h) Pervious drains or similar subsoil seepage control systems should be installed (as necessary) to lead seepage away from all springs and potential areas of ground water under or adjacent to fills in order to:

(i) Prevent saturation of the fill before construction of the fill is complete;

(ii) Prevent internal erosion (piping); and

(iii) Prevent internal ground water pressures which would detrimentally reduce shear strengths.

(i) Subsoil drains should discharge via flexible jointed pipes to an outlet approved by the Engineer, preferably a stable watercourse or a piped stormwater system. The position of all subsoil drains should be recorded on the" as-built" plan.

(j) The stripped ground surface should be prepared and then inspected by the geotechnical engineer before any fill is placed thereon.

2.4 Fill Construction

2.4.1 The quality of fill material and required control testing should be determined and specified before the placing of fill commences. Fill should be placed in a systematic and uniform manner with near horizontal layers of uniform thickness (less than 225mm) of material being deposited and compacted progressively across the fill area.

2.4.2 Before any loose layer of fill is compacted, the water content should be suitable for the compaction required and as uniform as possible. Any compacted layer which has deteriorated after an interruption in the earthmoving operation, should be rectified before further material is placed over it.

2.4.3 Fill batter faces should be compacted as a separate operation, or alternatively, overfilled and cut back.

2.4.4 Where testing shows the compaction achieved in the field to be below the specified minimum, all material represented by the test should be further compacted or removed as necessary. (Methods specified by a geotechnical engineer will be considered as an alternative to this method.)

2.5 Temporary Drainage and Erosion Control

2.5.1 During the construction period, measures should be taken to prevent excessive water logging of surface materials yet to be excavated or compacted or both, and to prevent fill material from being eroded and redeposited at lower levels. Such measures should include:

(a) The surfaces of fills and cuts should be graded to prevent ponding.

(b) Temporary drains should be constructed at the toe of steep slopes to intercept surface run-off and to lead drainage away to a stable watercourse or pipe stormwater system.

(c) Surface water should be prevented from discharging over batter faces by drains formed to intercept surface run-off and discharge via stable channels or pipes, preferably into stable watercourses or piped stormwater systems.

(d) The upper surface of fills should be compacted with rubber tyred or smooth wheeled plant when rain is impending or when the site is to be left unattended.

(e) The completed battered surfaces of fills should be compacted with sheep's-foot or similar non-smooth compaction plant to reduce run-off velocities.

(f) Silt traps and retention ponds shall be constructed where they are necessary. These should be cleaned out, as required to ensure that adequate silt storage is maintained.

(g) Temporary barriers or fences choked with brush, sacking or the like, should be used to reduce flow velocities and to trap silt.

(h) Sections of natural ground should be left unstripped to act as grass (or other vegetation) filters for run-off from adjacent areas.

(i) All earthwork areas should be retopsoiled and grassed or hydro-seeded as soon as possible after completion of the earthworks and drainage works.

2.6 Inspection and Quality Control

2.6.1 The engineer shall provide an adequate level of inspection and testing in order to enable proper evaluation of furnishing of the general quality of the finished work and the furnishing of a report as to the compliance of the work with the specifications. This is not to be construed as a guarantee or warranty but rather a record of the engineer's professional opinion based on reasonable care.

2.6.2 Visual inspection shall be made by the engineer at the following times:

(a) After any part of the existing ground has been finally stripped and prepared and before the placing of any fill on that ground.

(b) After any drain has been installed and before the drain is covered by fill.

(c) At such other times as the engineer considers necessary to enable the general standard of earthworks to be assessed and reasonably satisfied that:

(i) Fill is not placed over soft or organic material or peat;

(ii) All areas of existing ground showing seepage or potential seepage emission have relief drains provided; and

(iii) Compaction operations are systematic, the water content of fill material appears on visual inspection to be suitable and the degree of compaction appears to be consistently satisfactory.

2.6.3 During the construction of earth fills some or all of the following quantitative control tests should be made on the fill material.

2.6.4 Tests to determine whether the water content is suitable:

(a) Insitu density tests to determine whether the degree of compaction is up to the specified minimum; and

(b) Where appropriate, tests to determine the maximum dry density for the soil tested in each insitu field density test; and

(c) Such other tests as may be specified by the geotechnical engineer for control testing of fills or particular soil types, providing that the soil property tested shall be related to insitu density or water content of the fill by a laboratory investigation. Such tests include shear strength tests, cone penetrometer tests, and Proctor needle tests.

2.6.5 Once the filling work is progressing as a steady operation with uniform construction methods, and provided that:

(a) Adequate construction effort is being maintained;

(b) Adequate visual inspection is being maintained;

(c) The specification requirements are being met;

then the minimum frequency of control testing shall generally be one insitu density test (or equivalent) for each 2000 cu.m or 1m lift of fill.

2.6.6 Testing shall be more frequent than specified above, under any of the following circumstances:

(a) During the first 4000 cu.m of filling carried out on the project.

(b) On the final layer of not less than 1m depth.

(c) When soil type or conditions are variable.

(d) When the geotechnical engineer or their inspector is in any doubt about the adequacy of construction methods or soil properties.

(e) When a decision to reject work based on the judgement of the geotechnical engineer is disputed.

(f) When relatively small quantities of fill are concentrated in localised areas or placed discontinuously over a long period of time.

2.6.7 The locations of tests shall be decided by the geotechnical engineer, who should select them so as to test material likely to be furthest from the specified quality. In addition, a proportion of tests should be taken at random locations to check the average standard being obtained.

2.6.8 All field and laboratory test data should be recorded in a systematic manner that will allow the results to be identified and allow the calculations to be checked at a later date, if necessary. All control test results should have recorded the time, date, location and elevation. Test results relating to sections of fill that have been subsequently removed or reworked and recompacted should be noted accordingly.

2.7 Compaction of Natural Subgrade for Roading

2.7.1 Clause 11.3 of NZTA Specification F/1 is replaced by the following:

(a) The Contractor shall test the natural subgrade using a scala penetrometer according to Part 3, Section 2: Testing - Scala Penetrometer.

(b) The testing depth (i.e. depth of penetration) and the required CBR value shall be included in the specification within the contract documents.

(c) Recording of results shall be as per the approved quality plan.

(d) Should the test results show that the natural subgrade is up to the required CBR value, no compaction will be required.

(e) If the test results indicate otherwise, the Contractor shall use suitable compaction equipment in a reasonable attempt to improve the strength of the natural subgrade, or with the Engineer's consent, undercut to waste and backfill with suitable material.

2.8 Final Documentation

2.8.1 As-built figures

2.8.1.1 An accurate "as-built" record shall be maintained as work progresses in accordance with Volume 1, Part 2, Section 2 of this Manual.

2.8.2 Geotechnical engineer's report

2.8.2.1 At completion of construction, a geotechnical engineer's report shall be provided in accordance with Checklist 2.2 on page 589.

2.9 Material

2.9.1 Excavated material surplus to requirements or unsuitable for reuse in the works shall be removed to fill sites by the Contractor. It shall be the Contractor's responsibility to arrange fill sites and to ensure that any sites used have all of the necessary consents.

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Part 3 – Section 1: Materials

3.1.1 General

3.1.1.1 The following specifications apply to materials to be incorporated in the Works.

3.1.1.2 Other materials shall comply with details in the Project Specification or the appropriate New Zealand standard.

3.1.2 Sand

3.1.2.1 Imported sand for use in the formation of lower sub-base of pavement, imported subgrade, footpaths and paved areas and as foundation to concrete works shall be "run of pit" sand which is free of organic matter and well graded. It shall be made up of clean particles of silica or hard stone containing minimal silts, clays and pumices.

3.1.2.2 Bedding sand for use with concrete block paving shall comply with NZS 3116:2002 Concrete Segmental and Flagstone Paving. Single sized, gap graded or other sands containing an excessive amount of fines shall not be used. The sand shall be free of deleterious materials, soluble salts and other contaminants. The particles shall preferably be sharp. The sand shall have a moisture content in the range 4-8 %.

3.1.2.3 Joint filling sand shall be such that 90% passes a 1.18mm BS410 sieve and no more than 10% passes a 75 micron sieve and shall be free of deleterious materials, soluble salts and other contaminants. It shall be dry enough to be free running and shall be non-plastic.

3.1.2.4 Trench sand shall comprise "run of pit" sand as above and may have up to 6% by weight of clean loam.

3.1.3 Brown rock

3.1.3.1 This material is a non-specific rock aggregate intended for use as a subgrade improvement layer.

3.1.3.2 The Blue/Brown sub base material shall have minimum soaked CBR of 20 and a nominal maximum size.

3.1.3.3 The Blue/Brown material shall be suitably graded, moderate to highly weathered quarry rock with sufficient fines to aid compaction. A minimum of 10% by dry mass shall be unweathered (blue) material to ensure a level of durability.

3.1.3.4 The source of supply of all materials shall be nominated and the material shall be tested to ensure the CBR requirement can be achieved and test results shall be provided.

3.1.3.5 The suitability of the material will be assessed on its grading, crushing and weathering resistance and clay content relative to its use.

3.1.3.6 Evidence of these properties will be required for approval by the Engineer prior to its use.

3.1.4 WHAP aggregate

3.1.4.1 *Scope*

(a) This Specification sets out requirements for crushed general aggregate (WHAP) intended for use as sub-base material or shaping material for stabilisation purposes.

3.1.4.2 *Proportion of broken rock*

(a) In each of the aggregate fractions between the 63mm and 4.75mm sieves not less than 50% by weight shall have two or more broken faces. It shall be free of organic matter.

3.1.4.3 *Crushing resistance*

(a) The crushing resistance shall not be less than 130 kN when the aggregate is tested according to NZS 4407:1991 Test 3.10 "The Crushing Resistance Test".

3.1.4.4 *Weathering resistance*

(a) The aggregate shall have a quality index of AA, AB, AC, BA, BB or CA when tested according to NZS 4407:1991 Test 3.11 "Weathering Quality Index Test".

3.1.4.5 *Sand equivalent*

(a) The sand equivalent shall not be less than 25 when the aggregate is tested according to NZS 4407:1991 Test 3.6 "Sand Equivalent Test". The sand equivalent test may be omitted if the grading test shows less than 4% passing the 75 micron sieve.

3.1.4.6 *Grading limits*

(a) When tested according to NZS 4407:1991 Test 3.8.1 "Preferred Method by Wet Sieving" or Test 3.8.2 "Subsidiary Method by Dry Sieving" the grading of the aggregate shall fall within their respective envelopes defined below.

Table 20: Grading Limits

Test Sieve Aperture (mm)	WHAP65	% of Weight Passing WHAP40	WHAP20
63	100	-	-
37.5	55-80	100	-
19	35-65	60-80	100
9.5	20-50	35-65	45-75
4.75	10-35	20-45	25-55
1.18	2-20	2-25	2-30
0.075	6 max	7 max	8 max

3.1.5 GAP aggregate – pavement courses

3.1.5.1 The GAP aggregate shall comprise crushed aggregate and must be free of all non-mineral matter.

3.1.5.2 The crushing resistance shall be not less than 100 kN when the aggregate is tested according to NZS 4407:1991 Test 3.10 “The Crushing Resistance Test”.

3.1.5.3 An aggregate shall be considered to have met the requirement if the sample produces less than 10% fines when loaded so that the specified peak load is reached in 10 minutes. In this case, the test shall follow the standard method in all other respects. If the aggregate passes the test, it shall be reported as having a crushing resistance "greater than (the load specified)".

3.1.5.4 Weathering Resistance - The aggregate shall have a quality index of AA, AB, AC, BA, BB, CA or CB when tested according to NZS 4407:1991 Test 3.11 "Weathering Quality Index Test".

3.1.5.5 Sand Equivalent - The sand equivalent shall not be less than 25 for carriageway pavement metal when the aggregate is tested according to NZS 4407:1991 Test 3.6 "Sand Equivalent Test".

3.1.5.6 Where the GAP20 is to be used on the footpath, the sand equivalent shall not be less than 25 when tested according to NZS 4407:1991 Test 3.6 "Sand Equivalent Test".

3.1.5.7 Grading Limits - When tested according to NZS 4407:1991 Test 3.8.2 "Subsidiary Method by Dry Sieving", or Test 3.8.1 "Standard Method by Wet Sieving" where aggregates contain clay or other fine material causing aggregation of the particles, the grading of the aggregate shall fall within the respective envelope defined below.

Table 21: Grading of GAP Aggregate

Test Sieve Aperture	Percentage Passing		
	GAP 65	GAP 40	GAP 20
63mm	100		
37.5mm		100	
19mm	40-65	63-81	100
9.5mm		40-60	52-76
4.75mm		25-45	33-57
2.36mm		16-35	20-44
1.18mm		9-27	12-35
600 micron		5-20	7-25
300 micron	10 max	1-15	4-20
150 micron		10 max	12 max
75 micron		7 max	8 max

3.1.5.8 ***Grading Shape Control***

(a) The weight in each fraction shall lie within the limits defined in the following table.

Table 22: Grading Shape Control

Fractions	Percentage of Material Within the Given Fraction	
	GAP 40	GAP 20
19.00 - 4.75mm	25-49	-
9.50 - 2.36mm	14-36	19-45
4.75 - 1.18mm	7-27	11-35
2.36 - 600 micron	5-22	6-26
1.18 - 300 micron	3-18	3-21
600 - 150 micron	1-13	2-18

3.1.6 NZTA M/4 AP40 & AP20 aggregate - pavement course

3.1.6.1 All aggregate shall comply with NZTA specification M/4 2006 and/or subsequent issues.

3.1.7 Wearing course MAP 20 aggregate

3.1.7.1 ***Scope***

(a) This Specification sets out requirements for crushed general aggregate (MAP) intended for use as wearing course on unsealed roads. The specification relies on the control of the plasticity index and grading co-efficient to manufacture a product that will form a well bound upper pavement maintenance layer. A general requirement on shape seeks to ensure that material which would cause undue wear and punctures to vehicle tyres is excluded.

3.1.7.2 ***Proportion of broken rock***

(a) In each of the aggregate fractions between the 19mm and 4.75mm sieves not less than 50% by weight shall have two or more broken faces. It shall be free of organic matter.

3.1.7.3 ***Material properties***

(a) When tested according to the appropriate tests in NZS 4407:1991, the aggregate shall meet the following requirements:

(i) Crushing Resistance 100kN minimum.

(ii) Liquid Limit 25 to 35.

(iii) Plasticity Index 6 to 12.

(iv) Clay Index 4.5 maximum.

(v) Grading Coefficient 16 to 34 (where Grading Coefficient = (% passing 26.5mm sieve - % passing 2.36mm sieve) x % passing 4.75mm sieve/100).

3.1.7.4 ***Grading limits***

(a) When tested according to NZS 4407:1991 Test 3.8.1 "Preferred Method by Wet Sieving" or Test 3.8.2 "Subsidiary Method by Dry Sieving", the grading of the aggregate shall fall within the envelope defined below.

Table 23: Grading Limits

Test Sieve Aperture	% of Weight Passing
26.5mm	100
19mm	100
6.7mm	60 -80
2.36mm	40 -60
300 micron	15 -35
75 micron	10 -20

3.1.8 Cement (for stabilisation)

3.1.8.1 Cement shall comply with NZS 3122:2009.

3.1.9 Sealing chips

3.1.9.1 Sealing chips shall conform to NZTA Specification M/6 for all applications in the works.

3.1.10 Asphaltic bitumen

3.1.10.1 Bitumen for use in pavement and footpath tack coats and sealing shall conform to NZTA Specification M/1 and shall generally be 180/200 penetration grade.

3.1.11 Asphaltic concrete

3.1.11.1 Asphaltic concrete shall conform to NZTA Specification M/10 - Specification for Asphaltic Concrete.

3.1.12 Open graded porous asphalt

3.1.12.1 Open Graded Porous Asphalt shall conform to NZTA Specification P/11 "Specification for Open Graded Porous Asphalt Material".

3.1.13 Concrete

3.1.13.1 Cement, aggregates and water shall be of the qualities specified in NZS 3109:1997 - Concrete Construction. If requested, samples shall be supplied to the Engineer for testing. The following specifications shall apply for the production of the concrete:

(a) NZS 3104:2003 - Specification for Concrete Production.

3.1.13.2 Curing compounds shall conform to ASIM C309 "Specification for Liquid Membrane Forming Compounds for Curing Concrete".

3.1.14 Topsoil

3.1.14.1 Refer to Part 7: Landscape Works.

3.1.15 Grass seed

3.1.15.1 Refer to Part 7: Landscape Works.

3.1.16 Timber

3.1.16.1 Timber for edging and pegs shall be H4 treated timber. Timber for fencing shall be H4 treated for posts or other members in contact with the ground, and H3 treated for all other components.

3.1.17 Concrete block paving

3.1.17.1 Concrete blocks shall comply with NZS 3116:2002, Concrete Segmental and Flagstone Paving.

3.1.18 Reinforcement

3.1.18.1 Reinforcing bars shall conform to NZS 4671:2001 - Steel Reinforcing Materials.

3.1.19 Road marking paint

3.1.19.1 Refer Part 3, Section 15: Road Marking.

3.1.20 Signs

3.1.20.1 Refer to Part 3, Section 14: Road Signs and Street Furniture.

Part 3 – Section 2: Testing

3.2.1 General

3.2.1.1 The Scala Penetrometer shall only be employed where a significant part of the subgrade particles pass a 9.5mm sieve.

3.2.1.2 The cone is bedded into the soil with one (or more) blows. The zero point for depth and the number of blows is taken neglecting the bedding blows.

3.2.1.3 There are two methods of recording the results and all test sites must comply.

Table 24: CBR vs. Penetration Graph

CBR	Max.mm/blow	Min. blows/100mm
7	32	3
10	23	4
15	17	6

3.2.2 On carriageways

3.2.2.1 Scala tests are to be taken at the following locations and frequency:

(a) Carriageway 4m wide and less - Along centreline.

(b) Carriageway between 4m and 8m - At the kerbside wheel tracks.

(c) Carriageway 8m and wider - At centreline and kerbside wheel tracks.

3.2.2.2 As a means of compliance for an acceptable CBR in carriageways at the insitu subgrade, the scala readings are averaged for the top 600mm. At the imported subgrade or lower sub base surface, the scala readings are averaged for the full depth of the pavement layer being tested.

3.2.2.3 The test sites are to be at a maximum of 15m centres for each line or where 2 or 3 lines are required, these may be staggered at 10m intervals, giving a space of 20m and 30m for each line.

3.2.3 Footpaths

3.2.3.1 The Engineer may require tests to be carried out on the subgrade along the line of the intended footpath before works are commenced.

3.2.3.2 Scala readings are to be taken at a maximum of 30m centres and to a depth of 300mm below the final subgrade level to ensure that the appropriate CBR's are achieved at the appropriate depth.

3.2.4 Vehicle crossings

3.2.4.1 A minimum of three scala penetrometer tests randomly spread shall be taken to a depth of 300mm below the final subgrade level per crossing. One test per 5m^2 on crossings greater than 15m^2 (kerb to boundary).

3.2.5 Sub base and base course compaction

3.2.5.1 ***General***

(a) All CBR values specified on the figures and documents refer to the tenth percentile of soaked CBR value.

(b) Testing on the day on site cannot provide the soaked CBR value.

(c) To ensure compliance with specified CBR values, all readings with the Nuclear Densometer testing regime shall exceed the specified CBR values.

(d) To ensure compliance with specified CBR values, all readings with the Clegg Hammer testing regime shall exceed:

- (i) 1.15 x the specified value for stabilised pavements.
- (ii) 1.20 x the specified value for non-stabilised pavements.

3.2.5.2 ***Nuclear densometer***

(a) *General*

- (i) These are two testing regimes allowable for use of a nuclear densometer.
- (ii) In conjunction with CBR testing, the degree of compaction in the sub base and base course layer will first be tested using a CBR test rig. Nuclear densometer readings shall be taken adjacent to the insitu CBR test sites. Insitu CBR tests shall be undertaken at intervals and positions directed by the Engineer. Nuclear densometer readings shall be taken to achieve a correlation between the insitu test results and recorded dry density of the tested base course layer.
- (iii) Nuclear densometer tests shall then be carried out at the rate of one test for 100m^2 to ensure that the base course layer has been compacted uniformly and sufficiently to reach the required dry density equivalent to a CBR of at least the specified value.
- (iv) If a densometer test gives a sub-standard result, five further tests will be taken within the test area, all of which must satisfy the specified compaction to obtain a pass.

(b) *Percentage Dry Density*

- (i) The Contractor shall be responsible for carrying out laboratory tests according to NZS 4402:1986 Test 4.1.3 to determine the maximum laboratory dry density (MOD) at optimum moisture content (OMC) of the aggregate used.
- (ii) Nuclear densometer tests shall be carried out at the rate of one test per 100m^2. The compaction requirements shall be met if the mean and minimum compaction values of the tests taken comply with the values below.

Table 25: TS.3.2.1 Mean & Minimum Value of Pavement Layer Compaction as Percentage of Maximum Laboratory Dry Density

Values	Sub-base course Pavement Layer	Base course Pavement Layer
Mean Value	> 95	> 98
Minimum Value	> 92	> 95

3.2.5.3 ***Clegg hammer***

(a) Where the Clegg Hammer is to be used then it shall be the Standard Australian Digital model with a 4.5kg compaction hammer, using a drop height of 450mm.

(b) Testing is carried out on a surface that has no loose material (removed by scuffing with stiff hand-brooming). The device is held in place by foot and steadied in a vertical position with the knees.

(c) The maximum Clegg Impact Value (CIV) at the end of the 4th blow is the recorded value. The on-site CBR value shall be taken as $0.07\ (CIV)^2$.

(d) If a Clegg Hammer test gives a sub-standard result, five further tests will be taken close-by. If any further tests fail to reach the compacted limit required, the area will be reworked at the Contractor's expense until a satisfactory test result is achieved.

Table 26: Compliance Values

Material	CIV	Equivalent CBR
Sub base	24	40
Base course	34	80

3.2.5.4 ***Benkleman beam test***

(a) *General*

(i) The Contractor shall test the finished base course surface with a standard Benkelman Beam test apparatus prior to any sealing being carried out.

(ii) The beam test shall be as per NZTA Specification T/1 except that the recordings or bowl deflection shall not be recorded or used in the deflection calculation.

(b) *Test procedure*

(i) The test axle shall be a dual tyred single axle of 8.2 tonne. Readings shall be taken at the kerbside wheel track on both sides of the carriageway at a maximum interval of 15m on each side. Where the carriageway is 8m or wider, tests at 15m maximum intervals shall also be taken at the centre line.

(ii) Deflections should not exceed the following target figures:

- On carriageways where asphaltic concrete is to be placed (with the exception of where asphaltic concrete is to be placed at cul-de-sac heads only):

Table 27: Test Procedure for Asphaltic Concrete Carriageways

	Average (mm)	***90^{th} Percentile (mm)***	***Maximum (mm)***
A1. Residential cui-de-sacs and private ways: < 40 household units	1.30	1.60	2.10
A2. All other carriageways up to 10^5 ESA	1.10	1.35	1.80
A3. All carriageways between 10^5 and 10^6 ESA	1.00	1.20	1.60

- On other carriageways surfacing situations (factored by 1.5 for block paving):

Table 28: Test Procedures for Other Carriageways

	Average (mm)	***90th percentile (mm)***	***Maximum (mm)***
B1. Residential cul-de-sacs and private ways: < 40 household units	1.50	1.80	2.40
B2. All other carriageways up to 10^5 ESA	1.25	1.50	2.60
B3. All carriageways between 10^5 and 10^6 ESA	1.00	1.20	1.60

- No more than 10% of the test results shall exceed the 90^{th} percentile and no single result shall exceed the maximum.
- The developer shall provide the results from the Benkelman Beam tests (specified above) to show that the pavement complies with the requirements detailed. The organisation carrying out the tests shall have an IANZ accreditation.
- Acceptance of pavements with deflections exceeding the target figures will be at the discretion of the Manager, Road Corridor.

3.2.6 Surface texture

3.2.6.1 The method for determining surface texture shall be equivalent to or will follow NZTA Specification T/3 Sand Circle Surface Texture measurements.

3.2.7 Sealed surface roughness

3.2.7.1 ***Method of testing for surface roughness***

(a) Roughness measurements shall normally, but not exclusively, be taken only on surfacing applied to areas of new or reworked base course or as directed by the Engineer.

(b) The Contractor shall use a NAASRA roughness meter in accordance with the "Standard Operating Instructions for the NAASRA Roughness Meter".

(c) For projects where the total carriageway is under 200m, the use of an approved 2m profile beam will be acceptable.

(d) A minimum of three runs for roughness measurement shall be taken in each direction. Roughness measurements taken through rotary intersections shall not be considered as part of the average roughness.

(e) The average roughness over the project shall be no greater the 60 NAASRA and no individual reading shall exceed the maximum of 70 NAASRA. Roughness values are to be recorded for every 100m length of pavement continuously along all travelling lanes. Either an inertia laser or a response ‘type’ roughness meter can be used for determining lane roughness over the extent of the works so long as it has been validated according to AUSTROADS test method, AG:AM – T002 (2006) and can output the roughness measurements at intervals of 20m or less.

(f) The roughness count shall include the junction between the contract works and the existing pavement by including no less than 20m of old pavement at the beginning and end of each lane.

(g) The Contractor shall provide the Engineer with all the Certified Test results. The Certification shall include that the testing has been carried out in accordance with this clause.

(h) The Contractor shall be responsible for all costs in arranging and undertaking the testing and informing the Engineer of the results.

(i) The average roughness value shall be taken to be the arithmetic mean of all recorded readings excluding readings taken through rotary intersections.

(j) For the purposes of comparing with the specified Average Construction Roughness, the average roughness obtained shall be rounded to the nearest whole number.

Part 3 – Section 3: Pavement construction

3.3.1 General

3.3.1.1 This section covers areas of new or completely reconstructed road pavement and includes all pavement layers between the finished natural subgrade level up to, and including, the finished base course.

3.3.2 Imported subgrade layer

3.3.2.1 ***General***

(a) The imported subgrade material for the pavement shall be "run of pit" sand, unless otherwise specified or approved by the Engineer. The suitability of alternatives will need to be demonstrated.

3.3.2.2 ***Layers***

(a) The material shall be placed in layers not exceeding 150mm (compacted thickness) and at optimum moisture content.

3.3.2.3 ***Compaction tests***

(a) The material shall be compacted to the specified California Bearing Ratio (CBR) as measured with a standard scala penetrometer. Except that the standard of compaction shall not be less than 95% of the optimum dry density of the material as specified in Test 4.1.1 of NZS 4402:1986 "New Zealand Standard Compaction Test" or Test 4.1.3 "New Zealand Vibrating Hammer Compaction Test".

(b) Scala Penetrometer tests shall be carried out as detailed in Section 2: "Testing".

3.3.2.4 ***Surface level tolerance***

(a) The entire surface of the completed subgrade shall be made smooth, firm and uniform by blading, grading and rolling approximating the cross fall required on the final surface.

(b) The surface shall be finished so that all points are within 15mm from a 3m straight edge laid at any point on the surface.

(c) The reduced level of any point shall be within the limits 0mm above to 30mm below the designed or nominated level.

3.3.2.5 ***Material failure***

(a) Compaction shall not continue if the material shows signs of excessive weaving or heaving until the problem has been resolved.

3.3.2.6 ***Completion***

(a) The completed subgrade shall be tested to ensure the required CBR has been achieved. If the compaction of the imported subgrade layer does not meet the required criteria then the following options are available for consideration:

(i) The Contractor may choose to carry out further compactive effort to achieve the required level of compaction.

(ii) The Contractor may choose to place not more than 100mm compacted depth of the sub-base layer on the condition that the imported subgrade compaction criteria can be met following the subsequent compaction of the sub-base. If the compaction specified for the imported subgrade layer cannot be achieved by this method then the Contractor, at their expense, shall re-work both pavement layers until the problem has been resolved.

3.3.3 Lower sub base layer

3.3.3.1 *General*

(a) The material in this layer shall be "run of pit" sand unless otherwise specified or approved by the Engineer. The suitability of alternatives will need to be demonstrated.

3.3.3.2 *Layers*

(a) No lower sub-base layer shall be placed until the subgrade has been approved by the Engineer.

(b) The material shall be placed in layers not exceeding 150mm (compacted thickness) and at optimum moisture content.

3.3.3.3 *Compaction tests*

(a) The material shall be compacted to the specified CBR as tested by a standard scala penetrometer. Except that the standard of compaction shall not be less than 95% of the optimum dry density of the material as specified in Test 4.1.1 of NZS 4402:1986.

(b) Scala penetrometer tests shall be carried out as detailed in Section 2: Testing.

3.3.3.4 *Surface level tolerances*

(a) The entire surface of the completed lower sub-base shall be made smooth, firm and uniform by blading, grading and rolling.

(b) The surface shall be finished so that all points are within 15mm from a 3m straight edge laid at any point on the surface.

(c) The reduced level of any point shall be within the limits 0mm above to 30mm below the designed or nominated level.

3.3.3.5 *Material failure*

(a) Compaction shall not continue if the material shows signs of excessive weaving or heaving until the problem has been resolved.

3.3.3.6 *Completion*

(a) The completed lower sub-base shall be tested for compaction to ensure the required CBR has been achieved. If the compaction of the imported lower sub-base layer does not meet the required criteria then the following options are available for consideration:

(i) The Contractor may choose to carry out further compactive effort to achieve the required level of compaction.

(ii) The Contractor may choose to place half the sub-base layer (100mm compacted depth GAP40) on the condition that the imported subgrade compaction criteria can be met following the subsequent compaction of the sub-base. If the compaction specified for the imported subgrade layer cannot be achieved by this method then the Contractor, at their expense, shall re-work both pavement layers until the problem has been resolved.

3.3.4 Recovered material

3.3.4.1 Recovered material may be specified for use in either the lower sub-base layer or as the sub-base layer in the construction of the new pavement.

3.3.4.2 Where recovered material is to be used and there is a shortfall, this material shall be placed first and the imported material specified to make up the shortfall, placed on top, subject to suitable layer depths of each being achievable for effective compaction.

3.3.4.3 Recovered road pavement for re-use shall not contain any transition material finer than sand-silt in particle size.

3.3.4.4 The amount of transition material included in the total recovered road pavement material shall be limited to minor overcutting in recovery where the particle size of the transition material is greater than sand-silt.

3.3.4.5 The least dimension shall not exceed 75mm and the maximum dimension shall not exceed 200mm for any surfacing recovered along with the road pavement for re-use, and before placing in the pavement layer.

3.3.4.6 Other than the recovered materials consequential characteristics, the pavement layer shall be prepared as specified.

3.3.5 Sub base layer (GAP 40 or GAP 65)

3.3.5.1 Material contained in this layer shall be GAP 40 or GAP 65 unless otherwise specified.

3.3.5.2 No sub-base layer material shall be placed until the subgrade has been satisfactorily completed and approved by the Engineer.

3.3.5.3 The NZTA Specification B/2 shall be deemed to be part of this specification except as modified hereafter.

3.3.5.4 Compaction of the sub-base shall be tested according to the Section 2: Testing and shall comply with the specified criteria.

3.3.5.5 NAASRA roughness measurements will not be required.

3.3.6 Base course layer

3.3.6.1 Material contained in this layer will typically consist of crushed metal for GAP40 or NZTA M/4 AP40 or AP20.

3.3.6.2 No base course layer material shall be placed until all previous pavement layers have been satisfactorily completed and approved by the Engineer.

3.3.6.3 The NZTA Specification B/2 shall be deemed to be part of this specification except Clause 14.0 and as modified hereafter.

3.3.6.4 If required, the degree of compaction in the base course shall be tested according to Section 2: Testing and shall comply with the requirements of the Project Specification. No NAASRA roughness measurements on the unsealed surface will be required.

3.3.6.5 In addition to the requirements of NZTA B/2 and any preceding requirements of this specification, approval of the base course and pavement, as a whole, shall be subject to testing with a Benkelman beam apparatus. The required deflection criteria shall be as noted in Part 3 of Volume 2: Design Guide, unless specified otherwise.

3.3.7 Construction layer profiles

3.3.7.1 Each layer required to be constructed shall relate to the final shape as shown in Figure 34: TS 300 Terminology and Figure 36: TS 304 Normal carriageway camber and construction tolerances or on the construction figures.

3.3.7.2 In all cases, the crown shall be confined to a quarter width of the lip to lip dimension, with a uniform grade to the channel lip or to other point as shown on the figures.

3.3.7.3 Where the crown is required to be off-centre or the cross fall is not to be 3%, then the crown above the lip of channel, if not specified, shall be calculated from:

$$\boxed{\text{Crown} = 10\,Z \times CF\% - {}^{2}/_{3}\,Y \times CF\,\%}$$

Crown	=	actual crown height above lip of channel (in mm)
Z	=	distance from lip of channel to crown (in meters)
CF%	=	specified cross fall in percent
Y	=	lip to lip of channel dimension (in meters)

Equation 7: Crown construction

3.3.7.4 The cross fall on the travelling lanes shall be between 2% and 6%. The desirable cross falls are 3% for sealed surfaces and 5% for unsealed (all weather) surfaces.

Part 3 – Section 4: Ripping and Cement Stabilisation

3.4.1 Scope

3.4.1.1 This Specification applies to the treatment of those areas of pavement which are to be cement stabilised.

3.4.2 Ripping

3.4.2.1 The existing sealed surface and pavement shall be ripped and pulverised to the specified depth to allow shaping and, where required, overlaying of a nominal depth of base course as shown on the figures.

3.4.2.2 If, in the course of the work, it becomes apparent that the nominal depth of ripping is not practicable or appropriate, the Contractor shall inform the Engineer as soon as possible and shall not proceed without the Engineer's consent to a variation. Likewise, the Engineer may order a variation in the nominal depth or extent of ripping.

3.4.2.3 There shall be no claim for a variation in the rate that this work is included under as a result of a variation in the depth or nature of ripped material unless, in the opinion of the Engineer, this renders the Contractor's declared plant and methods to be impractical and the use of alternatives is consequently required.

3.4.2.4 Unless otherwise agreed by the Engineer, over break and any consequent backfilling or repair shall be the Contractor's responsibility.

3.4.3 Use of ripped material

3.4.3.1 All material to be re-used shall be broken down by the ripping and pulverising processes such that it has a particle size no greater than 75mm and a grading that makes its shaping and compaction to a dense stable practicable condition.

3.4.3.2 The Engineer may reject any material for re-use which in the Engineer's opinion is unsuitable because of its nature, condition, particle size or grading.

3.4.4 Placing, shaping and compacting of re-used material and imported base course overlay

3.4.4.1 Where the re-used material is to be subsequently overlaid with base course, it shall be shaped and compacted such that it meets the profile on the figures to a tolerance of plus 0mm to minus 20mm. Where the re-used material is to form the top of the pavement construction, the tolerances of NZTA Specification 8/2 shall apply.

3.4.4.2 Where imported base course is to be overlaid, it shall be the Contractor's decision whether or not to compact the re-used material prior to this, except that no layer of uncompacted material shall have a thickness of less than 80mm nor more than 200mm.

3.4.4.3 The base course construction, whether imported or re-used material, shall conform to the specification for base course construction given in Section 3: Pavement Construction.

3.4.5 Cement stabilisation of base course

3.4.5.1 *Preparation*

(a) The rolling and compaction of the pre-stabilised base course shall be such that the pavement shape and density approximates that required of the post-stabilised pavement in its final shape.

(b) The standard of finish required of the pre-stabilised pavement shall be such that pot-holing, ravelling and/or rutting does not occur under normal traffic loads.

3.4.5.2 *Supply, spread and mix cement into pavement*

(a) A cement spreader which has no visible dust during operation or filling, apart from that produced from the product falling to the ground, shall be used. The spreader shall be self-propelled and have the capability to electronically regulate the spread rate.

(b) The cement shall be evenly spread over the prepared pavement at the specified rate. The application rate shall be checked before cement is applied to the pavement and must not differ by more than one half of one per cent by mass from the cement percentage calculated from the given spread rate. The pavement shall be stabilised to a depth of 200mm, unless specified otherwise.

(c) The material to be treated shall not have cement spread or mixed in rain or if rain threatens. Material to be stabilised shall be within 2% of optimum moisture content.

(d) Mixing shall follow immediately behind the spreader and in no case should there be a delay of more than one hour. After spreading the cement, no traffic shall be allowed to pass over the spread cement until the mixing has been completed.

(e) Mixing shall be carried out, using either single or multi rotor machines, until the maximum particle size is no greater than 40mm. Mixing or remixing operations, regardless of equipment used, shall continue until the mixture is uniform and is free of streaks or pockets of cement.

3.4.5.3 *Compaction*

(a) The compaction of the stabilized mix shall be completed within two hours of mixing.

(b) The compaction shall be achieved by the minimum necessary number of passes of compaction plant.

(c) Areas inaccessible to rollers shall be compacted to the required density by other suitable means.

3.4.5.4 *Shaping*

(a) After compaction, the treated pavement shall be trimmed to the required shape. This process shall be one of cutting to waste and all surplus material shall be removed from site and disposed of. Shaping to final levels must be completed for all stabilised pavement on the day of stabilising.

3.4.5.5 ***Joints***

(a) *Longitudinal Joints*

(i) Care shall be taken to knit materials at all longitudinal joints and overlaps shall be provided during the mixing operation.

(ii) Where the works adjoin the existing road, surface joints are to be saw cut to give a vertical face.

(b) *Transverse Joints*

(i) All transverse and construction joints shall be either made in thoroughly compacted material, normal to the centreline of the road, with a vertical face or made by overlapping with the next mixing operation.

(ii) Where the works adjoin the existing road, surface joints are to be saw cut to give a vertical face.

(iii) All loose material will be removed from the joint before the next mix is compacted in place.

3.4.5.6 ***Curing***

(a) Upon completion of the mixing, pulverisation, compaction and shaping of the cement stabilisation, the Contractor may, with the Engineer's consent, supply and spread uniformly over the entire pavement surface, GAP20 running course aggregate at the specified rate.

(b) Pending the construction of the seal coat, the uniform spread of the running course aggregate shall be maintained at all times by dragbrooming. The traffic shall be controlled by temporary speed restrictions and during working hours it shall be channelled by suitably defined traffic lanes with frequent transverse shift of the defined lanes to obtain an even spread of traffic over the entire surface. The Contractor shall provide a programme for this traffic management.

(c) The Contractor shall maintain the pavement surface and running course in a damp condition for a minimum of three days.

3.4.5.7 ***Defects to be remedied***

(a) Any defects or damage of any nature caused by or resulting from the operations of the construction or maintenance of the pavement course shall be made good immediately.

3.4.5.8 ***Cement contamination***

(a) All practicable means shall be used to prevent cement contamination where it is likely to cause harm, nuisance or annoyance to persons or damage to property in any street or public place or in the vicinity of the site.

3.4.5.9 ***Signs***

(a) The Contractor shall ensure the appropriate signs are placed at the extents of the work to inform the public of the cement stabilisation process, e.g. "Cement Splashes - Wash Car Today".

3.4.5.10 ***Sealing, surface shape and roughness***

(a) The requirements of Section 3: Pavement Construction, Section 10: Road Surfacing and Section 2: Testing shall apply to areas subject to "Ripping and Cement Stabilization".

Part 3 – Section 5: Rip and Relays

3.5.1 Scope

3.5.1.1 This Specification applies to the treatment of those areas of pavement which are to be ripped and re-laid, or ripped, have base course added and then re-laid.

3.5.2 Ripping for relay

3.5.2.1 The existing sealed surface shall be ripped (and pulverised) so that the surfacing material can become integrated with the existing base course. Any surfacing material, which is unable to be integrated following the ripping, shall be removed off site.

3.5.3 Ripping to allow placement of additional base course

3.5.3.1 Where an additional base course overlay is to be placed on top of the existing sealed surface and pavement, the sealed surface is to be ripped sufficient to allow for the overlay to become integrated into the existing pavement and to break up the sealed surface to allow moisture movement.

3.5.4 Placement of base course after ripping

3.5.4.1 Material contained in this layer shall consist of crushed metal to GAP40 or NZTA M/4 AP40 or AP20 as specified or directed in the figures.

3.5.4.2 The base course overlay is to be placed to the depths and profiles indicated in the figures such that minimal reshaping is required.

Part 3 – Section 6: Pavement rehabilitation

3.6.1 Scope

3.6.1.1 This Specification applies to the treatment of those areas of pavement that are to be rehabilitated by dig outs, asphalt smoothing and crack sealing. These treatments, either singly or with others, will by their nature be used only on parts of the carriageway.

3.6.1.2 The areas of excavation, crack sealing and smoothing are to be marked on site and approved prior to the work commencing.

3.6.2 Dig outs

3.6.2.1 *Shallow excavation*

(a) Excavation shall be to a depth (minimum of 200mm) which removes all unsuitable weak, distressed and loose material to expose a firm level base which, with or without compaction, achieves the required CBR as follows:

(i) CBR value greater than 20 down to 300mm below base of excavation.

(ii) CBR value greater than 15 at a depth of 300mm or greater.

(b) The excavated material is to be removed and disposed of unless directed otherwise.

(c) The Contractor shall be liable for the repair of any undermining or over-break.

3.6.2.2 *Existing subgrade layer*

(a) Scala penetrometer tests shall be carried out as detailed in Section 2: Testing or as dictated by the size of the dig-out. Should the test not meet the requirements specified, the area shall be reworked until such time as these requirements are met.

(b) Compaction shall not continue if the material shows signs of excessive weaving or heaving, until the problem has been resolved.

(c) The existing subgrade shall be tested to ensure the required CBR has been achieved. If the strength of the existing subgrade does not meet the required criteria then it shall be undercut and replaced with imported subgrade material.

(d) The entire surface of the existing subgrade shall be made smooth, firm and uniform. The reduced level of any point shall be within the limits 0mm above to 50mm below the designated or nominated level.

3.6.2.3 *Imported subgrade (run of pit sand) layer*

(a) The imported subgrade material shall be "pit sand" as specified in Section 1: Materials, and shall comply with the requirements of Section 3: Pavement Construction.

3.6.2.4 *Base course in areas of dig out*

(a) No base course layers shall be placed without the Engineer's approval of the surface of the subgrade. The base course layer shall consist of GAP 40 or NZTA M4 AP40 placed in layers not exceeding 200mm thick. The base course shall be compacted to the CBR specified.

(b) The finished base course surface shall have a tight stone mosaic surface with no loose metal and be a suitable level for the application of a tack coat and an asphalt layer. A compacted integral skin of GAP 20 may be required to ensure the surface requirements are achieved.

3.6.2.5 ***Asphalt patch surfacing***

(a) After the base course surface has been approved by the Engineer, a tack coat of 180/200 cationic emulsion shall be applied at a rate of 0.3 litres per square metre residual at 15°C.

(b) The surfacing shall consist of a Mix 10 Asphalt nominally 30mm deep (compacted) and laid in accordance with NZTA Specification P/g Construction of Asphaltic Concrete Paving.

(c) The asphalt surface shall be flush with and neatly about the surrounding undisturbed chip seal surface. No depression or irregularities that would cause water to pond will be permitted in the finished surface.

3.6.2.6 ***Asphalt pre-levelling & levelling coat***

(a) The areas that require pre-levelling and/or levelling prior to the work commencing shall be marked out.

(b) The areas concerned shall be swept until all debris and loose chip have been removed. A tack coat of 180/200 penetration cationic emulsion shall be applied to the surface at a rate of 0.3 litres per square metre.

(c) The following mixes shall be used unless otherwise specified:

(i) 0-40mm depressions Mix 10.

(ii) 65mm depressions and above Mix 20 + Mix 10.

(d) Where the depth of asphaltic concrete exceeds 40mm but is less than 65mm, the asphaltic concrete shall be laid in two layers of Mix 10. Where the depth of asphaltic concrete exceeds 65mm, the Contractor shall lay a Mix 20 regulating course to within 30mm of proposed finished surface level and then finish with a layer of Mix 10.

(e) The asphalt layers shall be placed in one continuous run after the application of the tack coat and compacted by mechanical means. The edges shall be feathered so that there is no appreciable edge above or below the existing sealed surface.

(f) The surface shall be smooth and conform to the cross falls dictated by the existing surrounding sealed surface. Under no circumstances will surface irregularities that may hold water be permitted.

3.6.2.7 ***Measurement of asphalt***

(a) Where Mix 10 and Mix 20 Asphaltic Concrete Pre-levelling and/or levelling Course are to be measured in tonnes, the following requirements shall be met.

(b) Prior to delivery on site, the Mix 10 and Mix 20 asphaltic concrete regulating course delivery truck must be weighed at a weighbridge with a current certificate of accuracy from an A.P. accredited agency. The Certificate of Compliance shall be in accordance with regulation 15F of "Weights and Measures - 1987".

(c) If there is excess asphaltic concrete from any delivery then the truck must return to the same weighbridge utilised prior to delivery for the net weight of asphaltic concrete used on site to be calculated.

(d) All dockets are to indicate:

   (i) Time and date of dispatch of asphaltic concrete delivery truck.

   (ii) Time and date of weighing of delivery vehicle upon return to weighbridge.

   (iii) Weight of vehicle upon departure from weighbridge.

   (iv) Weight of vehicle upon return to weighbridge.

   (v) Net weight of asphaltic concrete delivered to site.

(e) Dockets shall be forwarded to the Engineer as soon as practicable after the delivery of the asphaltic concrete to site.

(f) Prior to the work, the Contractor shall submit for approval a conversion table showing the equivalent tonnage per cubic metre of each type of material to be used.

3.6.3 Crack sealing

3.6.3.1 *Preparation and cleaning*

(a) All cracks shall be pressure cleaned with raised and protruding edges trimmed off and loose material removed. The larger cracks (greater than 5mm) shall be gouged, where necessary, to remove wedged in or non-compressible debris or, when instructed by the Engineer, cracks shall be saw cut. Old filler material in cracks previously treated shall be removed as directed by the Engineer.

(b) The joint cavity shall then be dried thoroughly either by a combination of forced air and heat or by drying naturally.

3.6.3.2 *Inspection*

(a) All prepared cracks shall be inspected by the Engineer immediately prior to the sealing work commencing. Any sealant applied without the Engineer's prior approval shall be removed and the crack again prepared for sealing as set out above.

3.6.3.3 *Crack treatment*

(a) The bonding surfaces shall be primed with a primer compatible with both the existing material and the crack filler. The primer may be sprayed or brushed on and shall be completely dry before the filling material is poured.

(b) The filler material shall be poured or jetted into the crack so that the final level is approximately flush with the road surface. Excess material shall be struck off using a stripper to form a "bandage" which extends 30mm each side of the joint. The primer shall extend 15mm wider than the bandage.

(c) Traffic shall be kept off the treated cracks for a period of time sufficient to allow the sealant to cure.

(d) The finished surface shall be dusted with fine sand, limestone dust, crusher dust or cement to prevent "pickup" by vehicles.

(e) The depth of the filler shall be not less than the width of the crack nor greater than three times the crack width.

3.6.3.4 ***Sealant***

(a) The filler material shall be Techniflex PMB4, Samifilla, or material with similar specifications and shall be heated on site to the temperature recommended by the manufacturer in a suitable container fitted with a thermometer and a means of mechanical agitation and temperature control.

(b) The temperature shall be strictly controlled to avoid damage caused by overheating and to avoid unsatisfactory behaviour of the sealant due to pouring at temperatures lower than those specified by the manufacturer.

(c) Once the sealant has reached the pouring temperature, it shall be discharged into the cracks as soon as possible, and, in any case, before a period of two hours at the pouring temperature has elapsed.

(d) Sealant which has been heated and allowed to cool, or has been heated for more than two hours at pouring temperature, shall not be reheated but shall be rejected and removed from the site.

Part 3 – Section 7: Grader laid asphalt pre-levelling

3.7.1 Scope

3.7.1.1 This Specification describes the work required to lay Mix 10 and Mix 20 asphaltic concrete by grader as a pre-levelling treatment prior to a resurfacing.

3.7.2 Grader type

3.7.2.1 The grader shall be of a type and size that can cope with the requirements of the work. The grader shall be fitted with smooth (i.e. treadless) tyres to ensure that no imprints are left in the asphalt surface.

3.7.3 Limits of asphalt pre-levelling

3.7.3.1 The limits of the areas to be pre-levelled and the type of mix to be used shall be determined with regard to depth and size of area and the specified requirements and shall require the approval of the Engineer.

3.7.4 Preparation

3.7.4.1 The carriageway surface shall be swept clean to ensure all loose chips and debris has been removed.

3.7.5 Use of mix types

3.7.5.1 The following mixes shall be used unless otherwise stated in the Project Specification:

(a)	0-20mm depressions	Mix 10
(b)	20-45mm depressions	Mix 10
(c)	45mm & above depressions	Mix 20

3.7.6 Laying of asphalt

3.7.6.1 ***Tack coat***

(a) A tack coat of 180/200 penetration cationic emulsion shall be applied to the surface at the rate specified.

3.7.6.2 ***Application of pre-levelling course***

(a) All pre-levelling coats shall be laid in layers not exceeding 50mm in depth.

(b) The edges shall be feathered out to the minimum depth of asphalt possible without segregation taking place. Where two or more layers are required, the next layer shall be laid immediately after compaction of the lower layer has been completed.

(c) Where a paver-laid final levelling layer is specified, the surface of the final compacted grader laid layer shall not be less than 30mm below the final surface level.

(d) Compaction of each layer shall take place immediately after laying using the appropriate compaction equipment.

3.7.6.3 ***Final levelling surface requirement***

(a) The surface of the final pre-levelling coat shall be homogenous, smooth and have no signs of areas of possible water ponding. The overall surface shall correspond in level and shape to the existing surrounding surface. The interface between the final levelling coat and surrounding surface shall be as smooth as practical and shall not be a hindrance to water run-off.

3.7.6.4 ***Tolerance***

(a) The acceptable tolerance for the final surface of the levelling coat, however placed, shall be plus zero minus 6mm when measured by a 5m straight edge placed at any position on the final levelled surface.

3.7.6.5 ***Measurement requirements for tonnage***

(a) Where the asphalt is to be paid for on a per tonne basis, Volume 3, Part 3, Section 6, Clause 3.6.2.7 - Pavement Rehabilitation shall apply.

Part 3 – Section 8: Concrete works

3.8.1 General

3.8.1.1 The specification covers all concrete work for paths, vehicle crossings, various kerbs, kerb, and channel and cut downs for vehicle crossings. These shall all be formed to the dimensions shown in the Standard Cross Sections and Details.

3.8.1.2 The strength of concrete as defined in NZS 3109:1997 shall be as follows:

(a) 28 day in place minimum strength of 20 Mpa for all the above works.

3.8.2 Formwork

3.8.2.1 Formwork shall generally comply with the requirements of NZS 3109:1997 as amplified below.

3.8.2.2 Formwork shall be used wherever necessary to support and confine the concrete and shape it to the required dimensions. Joints and linings shall be sufficiently tight to prevent loss of water from the concrete.

3.8.2.3 All timber for formwork shall be of an approved quality and kind, and for kerbs and channels shall be ex 40mm material, provided that 15mm timber or other suitable material may be used on short radius curves. Formwork shall be of sufficient depth to fully support all vertical faces and where supporting exposed surfaces, shall be "long lengths, thicknessed and dressed smooth on one face and both edges.

3.8.2.4 Timber strips for chamfers shall be machined all round to be true to shape and form and they shall be kept in perfect order. Alternatively, the chamfer or bull nose may be formed with a specific floating tool.

3.8.2.5 Steel forms, where used, shall be of approved design, and shall be maintained in perfect condition. The joints between lengths shall be secured accurately during concreting to maintain a good line in the finished work.

3.8.2.6 Forms shall be designed to be easily removable without jarring the green concrete, and shall be kept thoroughly clean and treated to prevent adhesion of concrete. Forms for curved kerbs shall be brought to a true curve by springing the timber evenly round.

3.8.2.7 The shape, strength, rigidity, mortar tightness and surface smoothness of re-used forms shall be maintained at all times. Warped or bulged timber is not permitted. Timber that has been used shall have the surfaces which are to be in contact with the concrete thoroughly cleaned and treated before being used again.

3.8.3 Concrete mix and proportions

3.8.3.1 Concrete mixes shall be proportioned to be workable and capable of being thoroughly consolidated by the means of compaction available and produced to provide the specified strength of concrete. The concrete may be either ordinary grade, high grade or special grade as defined in NZS 3109:1997.

3.8.3.2 The concrete used shall be either made on the site, or supplied ready mixed. In each case, the concrete production shall be in accordance with NZS 3104:2003 - Specification for Concrete Production.

3.8.4 Placing concrete

3.8.4.1 The Contractor shall give due notice to the Engineer of the time it is intended to place any concrete and no concrete shall be placed until consent has been obtained from the Engineer.

3.8.4.2 Concrete shall not be placed on frozen ground nor shall it be placed in unfavourable conditions which may be detrimental to the quality and finish of the concrete. Unfavourable conditions shall be deemed to include low temperatures (below 5°C with temperatures descending, or below 2°C with temperature ascending), excessively hot dry conditions, excessively wet conditions or any conditions making it impractical to work and finish the concrete adequately.

3.8.4.3 Immediately prior to placing the concrete, the foundations shall be lightly damped and formwork shall be cleaned out. In all cases, surplus water shall be removed before concrete is placed.

3.8.4.4 The concrete shall be placed so that the coarse aggregate will not be separated from the rest of the material and it shall be thoroughly worked and consolidated into all parts of the formwork so that no voids or cavities are left. All concrete shall be handled from the mixer or from the agitator or truck mixer to the place of final deposit as rapidly as is practicable by methods which shall prevent segregation.

3.8.4.5 Unless otherwise approved, in no case shall more than 30 minutes elapse between discharge of concrete from the mixer or agitator truck and final placement. Under no circumstances shall partially hardened concrete be placed in the work.

3.8.4.6 Where a channel is finished with a sand/cement mortar coat, the mortar shall be placed within two hours of placing the concrete, provided that when hot dry conditions are prevailing, the allowable time shall be reduced to one hour.

3.8.4.7 If, for any reason, a delay of more than two hours occurs, an approved PVA bonding agent shall be used to ensure that the mortar is adequately bonded to the concrete.

3.8.4.8 Before fresh concrete is placed upon or against any concrete which has already hardened, the surface of the hardened concrete shall be thoroughly roughened and cleaned and cleared of all laitance, loose or foreign matter.

3.8.5 Reinforcement

3.8.5.1 All reinforcement other than ties and stirrups shall be deformed unless otherwise detailed.

3.8.5.2 The length of lapped splices (without hooks) shall be 40 bar diameters in length.

3.8.5.3 Steel reinforcement, at the time concrete is placed, shall be free from loose flaky rust, mud, oil or other coatings that will destroy or reduce the bond.

3.8.5.4 Reinforcement shall be accurately placed, adequately supported and secured against displacement prior to or during concrete placement.

3.8.5.5 The minimum cover to all main reinforcing steel shall be 50mm unless otherwise specified.

3.8.6 Curing of concrete

3.8.6.1 Strict attention shall be paid to adequate curing which is an important factor in attaining the required strength for the concrete.

3.8.6.2 From immediately after placement, concrete shall be protected from premature drying, excessively hot or cold temperatures and mechanical injury, and shall be maintained with minimal moisture loss for the period necessary for hydration of the cement and hardening of the concrete.

3.8.6.3 All concrete surfaces not in contact with formwork shall be cured by the application of a curing compound conforming to ASTM C309 "Specification for liquid membrane-forming compounds for curing concrete".

3.8.6.4 In cold or wet weather, concrete shall be protected from the elements during the curing period by covering with sacks or other approved material.

3.8.7 Machine laid kerb and channel

3.8.7.1 Contractors who intend to construct the kerbs and channels by using an extrusion machine will be required to use an approved ready mixed concrete. The concrete provided shall be designed so that after placement it will accurately retain its shape and present a good surface. No subsequent cement washing will be permitted. The machine shall be capable of providing well-compacted concrete with the absence of entrapped air.

3.8.7.2 The machine shall not be used to pour curves with radii less than 5m. For these curves the Contractor shall use formwork as specified.

3.8.7.3 A properly shaped screed shall be used in forming cut-downs.

3.8.8 Finished work

3.8.8.1 Methods shall be used that will provide a smooth, clean and even surface on the exposed faces of all concrete work, and will obtain the required finish directly on the structural concrete without the use of mortar renderings, provided that, if specific prior approval of the Engineer is obtained, the channel may be finished with a layer of mortar separately applied to its surface. In such cases, the mortar shall consist of not more than two parts of approved sand to one of cement. It shall be nominally 6mm in thickness and shall be placed before the initial set of the concrete, and, in any case, within two hours of placing the concrete.

3.8.8.2 Alternatively a mortar layer to the above consistency may be applied in conjunction with the laying of the kerb and channel when the kerb and channel is laid by machine and the machine is designed for such use.

3.8.8.3 The top and face of the kerb and the channel surface shall be floated over with a steel tool before the concrete has finally set. No depressions which may hold water will be permitted. Only workers expert in this particular type of work are to carry out the finishing.

3.8.8.4 The surface finish of all kerb and channel, whether machine laid or hand laid, shall be uniform in colour, texture and shape.

3.8.9 Backfilling against concrete work

3.8.9.1 Backfilling against the kerb and channel or any other concrete structure shall take place as soon as practicable after the concrete has reached sufficient strength with particular emphasis at curves, corners, intersections and pedestrian kerb crossings.

3.8.9.2 Care shall be taken to ensure that no damage is done to the path, crossing, kerb and channel or other concrete structure when placing and compacting the backfill.

3.8.10 Final surfaces - for footpath and vehicle crossing areas

3.8.10.1 All final path and vehicle crossing surfaces shall be true to the lines and levels specified.

3.8.10.2 Design considerations excepted, the final surface shall not vary by more than 5mm when checked with a 3m straight edge. No finished surface shall hold water.

Part 3 – Section 9: Kerb and channel, catch pits and subgrade drainage

3.9.1 Kerb and channel within existing pavement

3.9.1.1 *General*

(a) Attention is drawn to the Standard Cross Section Details and to Section 8: Concrete Works.

3.9.1.2 *Kerb and channel removal*

(a) Prior to the work commencing, the lengths of kerb and channel that are to be removed shall be marked on site and agreed with by the Engineer.

3.9.1.3 *Saw cutting*

(a) Prior to removal, the kerb and channel shall be saw cut vertically to ensure a clean break. The existing sealed surface shall be saw cut parallel to and at a distance of 500mm, or greater if required, from the existing channel lip. The seal shall also be cut perpendicular to the kerb from the point of kerb removal to the parallel seal cut line.

(b) If the kerb and channel to be removed abuts against any berm seal (e.g. sealed footpath), the sealed surface shall be saw cut at a distance behind the kerb face suitable for reinstatement.

3.9.1.4 *Excavation to pavement depth*

(a) Refer to Standard Details for excavation dimensions.

(b) After saw cutting, the kerb and channel and pavement shall be excavated to the proposed pavement depth or deeper, if required. The sides of the excavated area shall be trimmed to be as near as possible to vertical.

(c) Care shall be taken to ensure that undermining and/or over break does not occur during excavation.

(d) All waste material including the old kerb and channel shall be removed from the site and disposed of.

3.9.1.5 *Subgrade preparation*

(a) The exposed subgrade (at the required depth), shall be tested using a standard scala penetrometer. The prepared subgrade shall be compacted to the CBR specified.

(b) If the material fails this initial test it shall either be:

(i) Further compacted, if the material is suitable, to improve the CBR value; or

(ii) Excavated and removed from site, then backfilled with pit sand and compacted to the subgrade level.

(c) All pit sand backfill shall be compacted in lifts of not more than 100mm.

(d) The subgrade area either insitu or imported shall be trimmed and shaped to accommodate the specified lines and levels given and compacted to provide uniform support for the pavement course.

(e) All tree roots found in the subgrade or pavement area during excavation shall be removed. They will be severed 0.5m behind the back or front of the kerb and be removed off site. Any root greater than 50mm in diameter shall be cleanly saw cut. No such roots shall be cut without the prior approval of the Engineer if they are within the drip-line of the tree.

3.9.1.6 *Kerb & Channel foundation*

(a) After the subgrade has been satisfactorily completed to line and level, a compacted layer of GAP 40, 75mm deep shall be placed. Compaction shall be to refusal.

(b) The surface of the GAP 40 shall be smooth and uniform, suitable for the placing of the kerb and channel concrete.

3.9.1.7 *Kerb and Channel placing*

(a) Refer to Section 8: Concrete Works for the placement of kerb and channel.

3.9.1.8 *Carriageway reinstatement*

(a) After the kerb and channel concrete has hardened, the carriageway shall be reinstated to marry into the existing carriageway and new kerb and channel lip.

(b) If not already achieved during the kerb base construction, the carriageway shall be excavated to a minimum depth of 225mm at the channel face. The excavation base shall be flat and level up to the edge of the saw cut seal. All excavated faces shall be vertical.

(c) The subgrade shall be compacted to a CBR of at least 10.

(d) The specified base course metal (either GAP40 or NZTA M4 AP40) shall be placed on the prepared subgrade in layers not exceeding 150mm and compacted to refusal. The depth of base course is dependent on the surfacing, either asphalt or chip seal, but, in no circumstances, will it be less than 175mm (i.e. 50mm of asphalt surfacing).

3.9.2 Kerb and Channel in new pavement

3.9.2.1 As per 3.9.1 except all references to carriageway protection and reinstatement (i.e. saw cutting of carriageway, vertical face of excavation in carriageway, etc.) shall not be required for this activity.

3.9.3 Catch pits

3.9.3.1 *General*

(a) Refer Figure 76: TS 347 Berm sump details, Figure 77: TS 348 Catchpit details, Figure 78: TS 349 Double sump catchpit design and Figure 79: TS 351 Vertical entry catchpit.

(b) The precast components shall comprise either:

(i) *Manufacturer*

- 675 x 450 x 1650 Catch pit Flat Top — Hynds/Humes

- 675 x 450 x 1650 Catch pit Top (Back Entry) Hynds/Humes
- 225 dia x 1200mm Socketed Culvert Pipe Class X Hynds/Humes
- 675 x 450 x 1650mm Rectangular Catch pit Barrel Humes
- 675 x 450 Cast Iron Grate and Frame Humes/Surecast
- 300 dia Cast Iron Grate to suit socket of 225 dia culvert pipe.
- 610 x 310 Galvanised Web Grate and Frame Hygrade/Humes

(c) The construction specification as described in Part 4, Section 2 shall apply.

(d) Catch pits shall be accurately positioned so that the grate and kerb block fit neatly into the kerb and channel. Rectangular pits shall be oriented with the longer side parallel to the kerb.

(e) Catch pit leads shall be of the size and material detailed on the plans or specification and shall, discharge, where detailed.

(f) The connection of the lead into the catch pit shall be constructed as detailed in Part 4.

(g) Alternative oil trap details may be permitted providing they achieve a similar result. Details must be submitted for approval prior to construction.

3.9.4 Subgrade drainage

3.9.4.1 *General*

(a) Refer Figure 54: TS 321 Location of subgrade drainage.

(b) Subsoil drains are required as shown on the Figures or directed by the Engineer. They shall be placed behind the kerb unless shown or directed to be in front of the kerb. The subsoil drains shall consist of an approved filter drainpipe 100mm to 150mm diameter or equivalent in a trench backfilled with an approved filter material around the conduit. The conduit shall have a grade not less than 1 in 200 to discharge into the catch pit.

(c) Related Standard: Pipe Subsoil Drain Construction NZTA F/2:2000.

3.9.4.2 *Additional subsoil drainage*

(a) Where directed, any permanent wet spot in the subgrade shall be drained to below the kerb drainage system. Where the wet area is below the level of the subsoil drain, it shall be drained using approved filter drainpipes connected to the nearest stormwater system.

3.9.4.3 *Other requirements*

(a) NZTA F/2 filter material shall not be used as a filter material in close proximity to HDPE slotted pipe. Unless directed elsewhere in these documents, pea-metal shall be for backfilling around HDPE slotted pipe. Where backfilling a subsoil drain with filter material to all sides of the pipe, the minimum cover shall be 100mm. Where strip drain is approved backfill with permeable sand.

(b) The invert of subsoil conduits at the catch pit shall not be less than 100mm above invert of catch pit outlet (catch pit outlet invert is 1m below top of kerb).

Part 3 – Section 10: Road sealing

3.10.1 General

3.10.1.1 ***Specification***

(a) The NZTA Specification P/3 "Specification for First Coat Sealing", NZTA Specification P/4 "Specification for Resealing", and the NZTA Specification M/6 "Specification for Sealing Chips" shall be deemed to be part of this Specification except that:

(i) All references to the basis of payment contained within these NZTA Specifications are deleted.

(ii) Reference to the Contractor's obligation with respect to the foreshortening of the maintenance requirements of the seal coat (NZTA P/3, P/4 - relevant Clause "Protection and Repairs of the Seal Coat") is deleted.

3.10.1.2 ***Application rates***

(a) In all cases, the spraying and chipping rates specified are for tendering purposes only. Actual application rates, cutback percentage, and the percentage of adhesion agent will be specified by the Contractor and forwarded to the Engineer with design calculations for consent acceptance at least 24 hours prior to application.

3.10.1.3 ***Weed control***

(a) Immediately prior to surfacing exposed base course, a 300mm wide strip adjacent to the channel must be sprayed with an approved sterilizing weed killer.

3.10.1.4 ***Sealing of channel lip***

(a) For both first and second coat chip seal, the bitumen application shall extend over the channel lip, but not by more than 25mm.

3.10.2 Two coat seal (first coat with wet locking coat)

3.10.2.1 A two coat chip seal shall be applied to the prepared base course surface.

3.10.2.2 The first layer shall consist of the supply and spraying of NZTA P/3 180/200 penetration grade bitumen cut back to suit, plus 1 part per hundred (p.p.h) adhesion agent, at a rate of 1.2 litres/m^2 residual (measured at 15°C) and the supply, spreading and rolling of NZTA M/6 Grade 3 chip at a spread rate of 75 m^2/m^3. It is essential that the spreading of the first chip layer be carefully controlled so that the chips are evenly spread and no more than one chip thick over the entire surface. Handwork to correct spreading inconsistency will be required.

3.10.2.3 The second layer shall consist of the supply and spraying of NZTA P/3 180/200 penetration grade bitumen cut back to suit, plus 1 p.p.h. adhesion agent, at a rate of 0.8 litres/m^2 residual (measured at 15°C) and the supply, spreading and rolling of NZTA M/6 Grade 5 chip at a spread rate of 150 m^2/m^3.

3.10.3 Two coat seal and open graded porous asphalt overlay

3.10.3.1 ***Two coat seal (first coat with wet locking coat)***

(a) A two coat chip seal as described in Clause 3.10.2 of this Specification shall be applied to the prepared base course surface.

3.10.3.2 ***Open graded porous asphalt overlay***

(a) The friction mix overlay shall be placed no sooner than 14 days after the application of the two coat chip seal. Prior to laying the open graded porous asphalt, the new first coat chip seal shall be repaired as necessary to ensure that a robust waterproof membrane is present over the full area of the surface. Particular attention must be paid to the joint at the kerb edge.

(b) The friction mix overlay shall be laid in accordance with clauses relevant in NZTA P/11P "Specification for Open Graded Porous Asphalt". The thickness of the friction course shall be a minimum of 30mm except at the lip of kerb and channel where it shall be 15mm thick, tapered from a point 600mm from the channel lip.

(c) A tack coat of NZTA M/1 quick breaking cationic bituminous emulsion shall be applied and sprayed at an application rate of 0.3 litres/m^2 residual (measured at 15°C).

3.10.4 Two coat seal and asphaltic concrete

3.10.4.1 ***Two coat seal (first coat with wet locking coat)***

(a) A chip seal as described in Clause 3.10.2 shall be applied to the prepared base course surface to provide a robust waterproof surface.

3.10.4.2 ***Asphalt concrete***

(a) The asphalt concrete shall be placed no sooner than 14 days after the application of the two coat chip seal. Asphaltic concrete shall be laid in accordance with clauses of NZTA P/9 "Specification for the Construction of Asphaltic Concrete Paving". Asphaltic concrete sealing shall consist of the supply and spraying of NZTA M/1 Tack Coat with a quick breaking bituminous emulsion at an application rate of 0.3 litres/m^2 and the supply, spreading and rolling of NZTA M/10 Asphaltic Concrete or an alternative mix such as SMA approved by the Manager, Road Corridor.

3.10.5 Reseal (chip seal and dry locking coat)

3.10.5.1 ***Application***

(a) This treatment shall be applied on carriageways to produce a uniform texture on surfaces that have an existing (old) seal coat or a combination of an existing (old) seal coat with asphalt patches or levelling (which have been texturised) or base course repairs (which have been two coat sealed).

(b) The resealing shall not be applied until 14 days after the asphalt patching or levelling has been texturised or the base course repairs have been two coat sealed. The asphalt repairs shall not be texturised until 14 days after being completed.

3.10.5.2 ***Chip seal and dry locking coat***

(a) The reseal shall consist of supply and spraying of NZTA M/1 180/200 penetration grade bitumen cut back to suit, plus 1 p.p.h. Adhesion agent, at the rate of 1.3 litres/m^2 residual (measured at 15°C) and the supply, spreading and rolling of NZTA M/6 chip. Final seal design of chip sizes and bitumen application rates shall be done by the contractor and submitted for acceptance by the Engineer.

(b) If specified, a dry locking coat of M/6 Grade 5 or 6 chip shall then be supplied in accordance with NZTA Specification P/4, and spread at a rate of 300 m^2/m^3.

3.10.6 Second coat seal

3.10.6.1 ***Preparation***

(a) Prior to a second coat seal being applied, any faults in the existing surface shall be repaired in accordance with relevant clauses of this manual.

3.10.6.2 ***Application***

(a) The chip seal is to be constructed in accordance with the requirements for a reseal in Clause 3.10.5.

3.10.7 Requirements after chip sealing

3.10.7.1 ***Traffic control***

(a) Unless otherwise authorised a temporary speed restriction of 30 km/h shall be used for 48 hours after the completion of rolling or until after the first sweep, whichever is the later.

3.10.7.2 ***Removal of surplus chip***

(a) All surplus chip shall be removed within 48 hours of the completion of rolling when the sealed surface is open to traffic. For sites that are not open to normal traffic, sweeping may be delayed but must be completed within 48 hours of opening the road to normal traffic.

(b) All surplus chips shall be removed from grass berms, driveways, parking areas and footpaths.

3.10.7.3 ***Protection and repairs of the sealcoat***

(a) The contractor will be responsible for the maintenance and repair of the seal surface for the duration of the specified maintenance period. In any case, this maintenance period shall be until the 1st day of October following sealing date or a period of 6 months – whichever is longer.

3.10.8 Service Cover Adjustments

3.10.8.1 *General*

(a) To ensure maximum bearing capacity for setting steel six (6) packing plates for each ring (under each manhole cover ring) must be evenly spaced around the circumference. Ends to be visible on inspection.

(b) 50x6mm plates or multiples of to ensure total adjustment depth.

(c) 5m straight edge to be used at all times to ensure finished levels tie in with surrounding surfaces.

Table 29: Service cover packing plates

Chip Size	Average Least Dimension. (ALD) mm	Allow extra 6mm (TOTAL) mm
Grade 2	11	17
Grade 3	9	15
Grade 4	7	13
Grade 5	5	11
Grade 6	4	10
Mix 10	25*	31*
Mix 15 & AC NAS 14	37*	43*
Mix 20 & AC NAS 20	50*	56*
* Adjustment to be confirmed with contractor on site.		

3.10.8.2 *Concrete*

(a) 20MPA ready-mix concrete only to be used and must include fibre reinforcing. Pre-bag mix concrete must not be used.

3.10.8.3 *Manhole damage*

(a) To be repaired and notified.

3.10.8.4 *Quality assurance*

(a) As part of quality assurance, ready-mix delivery documents and all materials to be listed. Labour and time shall be recorded for each value box, manhole etc. Road name, street number, intersection etc. shall be included.

3.10.8.5 *Traffic management and health and safety*

(a) Traffic management and health and safety will be strictly enforced.

Part 3 – Section 11: Berm features

3.11.1 Scope

3.11.1.1 This Specification describes the work required to construct, reinstate or repair footpaths, vehicle and pram crossings, grass berms and planted areas and traffic island infill.

3.11.2 Alignments, lines and levels

3.11.2.1 The edge lines of kerbs, footpaths and vehicle crossings shall be perfectly straight between tangent points, and on curves, shall sweep round without kinks, flats or angles in a smooth, true arc to the radius shown or directed. Design levels and alignments shall be strictly adhered to and the grade from level peg to level peg shall be even, provided always that at changes of grade, the angle between the grades shall be eased so as to form a vertical curve or other form of smooth transition.

3.11.2.2 The entire berm area shall fall at an even grade, where possible, from the property boundaries to the kerb and channel.

3.11.3 Break out, removal and disposal of existing berm features

3.11.3.1 All existing berm features which are to be removed shall be broken up and lifted out so as to cause minimum damage to the surrounding features.

3.11.3.2 The outer limits of these marked areas shall be saw cut, except in the case of paving blocks or grass verges, before the damaged features are removed to provide a tidy interface between existing and replacement work.

3.11.3.3 Where salvaging of materials is specified, care shall be taken to ensure that as little damage as possible is done to units which are to be recovered, e.g. catch pits, gratings, frames, stormwater piping etc. and such units shall be neatly stacked on the site so as not to obstruct any footpath, vehicle crossing or roadway until they are taken off site.

3.11.3.4 All spoil, broken path, concrete, etc., not for reuse, shall be removed from site and disposed of.

3.11.4 Excavation to pavement depth

3.11.4.1 Initial excavation shall be to the pavement depth as shown in the Standard Cross Sections and shall expose the subgrade.

3.11.4.2 The width of all excavation shall be no wider than necessary to construct or reinstate the various berm features. Specific restrictions on excavations are shown in the Standard Cross Sections and Details.

3.11.4.3 Where excavation adjoins existing berm features or carriageways, care shall be taken so as not to undermine the existing surfacing while material is being removed. The sides of the excavated area shall be trimmed to slopes that are as steep as possible without being unstable or causing undermining.

3.11.5 Subgrade preparation

3.11.5.1 *Testing*

(a) The exposed subgrade (excavated to trial subgrade level or pavement depth) shall be tested by using a scala penetrometer for compliance with the following CBR values:

(i) In footpath and traffic island infill – CBR value >7 (3 blows per 100mm).

(ii) In vehicle crossing and kerb and channel areas – CBR value >10 (4 blows per 100mm).

3.11.5.2 *Test failure*

(a) If the material fails this initial test then either:

(i) The existing subgrade shall be further compacted if the material is suitable, to improve the CBR value, or if this is not applicable; or

(ii) The unsuitable material shall be excavated and removed from site and replaced with pit-sand compacted up to the trial subgrade level.

3.11.5.3 *Remedy*

(a) When treatment ii) is required, the excavation shall extend 100mm past either side of the edge-boards or the outer limits of the construction area.

(b) The depth and extent of this subgrade excavation shall be as instructed by the Engineer.

Advice Note: Small pockets of material may require treatment rather than the entire subgrade area.

(c) All pit-sand backfill shall be compacted in lifts of not more than 100mm.

(d) The subgrade area, either existing or reinstated, shall be trimmed and shaped to accommodate the specified lines and levels given and compacted to provide uniform support for the pavement course:

(i) All tree roots found in the subgrade or pavement area during excavation shall be removed. They will be severed 200mm outside of the final edge alignments, removed from site and disposed of. Any root greater than 50mm in diameter is to be cleanly saw cut. No such roots shall be cut without the prior approval of the Engineer if they are within the drip line of the tree.

3.11.6 Timber edging for seal, asphalt and paving block paths and vehicle crossings

3.11.6.1 All footpaths and vehicle crossing edges shall be contained by either a concrete kerb or edging or by timber edge boards that shall form part of the finished work.

3.11.6.2 Edge boards shall be held firmly in place with wooden pegs (50 x 25mm) or battens nailed to the outer edge at 1m centres and at every joining board. The pegs shall be in minimum lengths of 225mm or longer so as to be driven down into solid unyielding ground. Batter stakes may be used as pegs, driven down into firm ground and trimmed to correct lengths.

3.11.6.3 All pegs shall sit 15 to 25mm below the top level of the edge boards.

3.11.6.4 Edge boards shall be joined with 400mm long boards (either edge board off-cuts or 75 x 25mm timbers) which will span the joint evenly and are nailed firmly in place. The top of the joining boards shall sit 15 to 25mm below the top level of the edge board.

3.11.6.5 The spacing of wooden pegs shall be adjusted so that a peg is positioned alongside every joining board.

3.11.6.6 All timber edging shall be backfilled outside the construction area, as necessary, to protect the timbers from being damaged or distorted from alignment and level during the preparation and compaction of the pavement course.

3.11.6.7 All edge boards shall be set out using string lines and shall be true and straight at the completion of the work.

3.11.6.8 If directed by the Engineer, existing timber edging in good condition shall be adjusted for level, re-pegged and incorporated in the new footpath or vehicle crossing.

3.11.6.9 At all times, excavation for timber edging replacement, installation or adjustment shall be the minimum required to provide an adequate workspace.

> Advice Note: Where the path edge adjoins the existing kerb, the top of the kerb will be treated as the top of an edge board.

3.11.7 Pavement course for all berm features

3.11.7.1 The pavement course shall be constructed of bedding sand and/or GAP metal (NZTA-AP metal on occasions) and shall form a compacted pavement depth conforming to the Standard Cross Sections.

3.11.7.2 Where existing metal paths or vehicle crossing areas are to be upgraded on the same alignment and basically required to be "built up", less added metal may be required to achieve the specified pavement depth provided that the existing metal is considered suitable by the Engineer.

3.11.7.3 For chip seal and asphalt paths, the final pavement surface shall have a tight stone mosaic surface, with no loose metal, suitable for the application of either a tack coat and an asphalt layer or a chip seal surfacing, as appropriate. A skin of GAP 20 may need to be added to GAP 40 areas and compacted into place to achieve this.

3.11.7.4 All pavement courses shall be compacted to refusal in lifts of not more than 100mm.

3.11.8 Pre-emergent weed spray

3.11.8.1 The whole of the footpath and vehicle crossing pavement course shall be treated with a pre-emergent chemical approved by the Engineer and used at the strength and rate of application as recommended by the manufacturers.

3.11.8.2 All safety precautions, in particular, the use of protective clothing, face masks, gloves, etc., shall be rigidly adhered to during mixing and spraying as required by the manufacturer's labels and literature accompanying the chemicals used.

3.11.8.3 Consideration of the public over and above their protection in the safety aspects shall be maintained at all times. Spraying near schools shall not be carried out when children are likely to come into close proximity of the spraying.

3.11.8.4 Care shall be taken when applying weed killers to ensure that no harm is done to any vegetation on adjoining private property or to the area of berm to be grassed, and those applying it shall be held responsible for any claims for damage to gardens and/or lawns, etc. caused by this operation.

3.11.9 Chip seal surfacing – footpaths and vehicle crossings

3.11.9.1 A two coat chip seal surfacing shall be carried out as a minimum surfacing standard. The surfacing shall be constructed with 180/200 penetration grade cut back bitumen and Grade 3 and 5 chip.

3.11.9.2 The prepared pavement shall be swept to remove all loose metal and debris before sealing takes place.

3.11.9.3 180/200 penetration grade cut back bitumen shall be sprayed at an application rate submitted by the Contractor and consented to by the Engineer. An adhesion agent shall be added to all bitumen brews.

3.11.9.4 Grade 5 Sealing Chip complying with NZTA Specification M/6 - Specification for Sealing Chip shall be used and spread at a rate directed by the Engineer.

3.11.9.5 A higher chip application rate will be required in high pedestrian areas, especially near commercial zones, to prevent people from tracking binder into buildings and damaging floorings.

3.11.9.6 Attention to rolling is required to ensure good chip adhesion.

3.11.9.7 The Contractor will be required to monitor the site and organise the pickup of excess chip once the seal coat has "settled down". All excess chips shall be removed from adjoining grass berm areas and from the kerb and channel.

3.11.10 Concrete footpaths and vehicle crossing

3.11.10.1 Concrete surfacing shall be carried out in accordance with the relevant clauses of the Section 8: Concrete Works.

3.11.10.2 Where concrete paths are to be constructed steeper than 1 in 10, a permanent non-skid surface should be provided (broom finish or similar).

3.11.10.3 For cross section details refer Standard Details -"Cross Section Details for Footpaths, Vehicle Crossings, and Depressed Kerb & Channel".

3.11.11 Crack control

3.11.11.1 In concrete paths, crack control lines shall be formed or cut at vehicular crossing/footpath edges and along the path at a maximum spacing of 5m. All crack control lines shall be 25mm deep.

3.11.12 Asphalt surfacing

3.11.12.1 The prepared pavement shall be swept to remove all loose metal and debris prior to the application of a tack coat. The tack coat shall be applied to all surfaces against which the asphalt material will be placed generally at an application rate of 0.25 litres/m^2.

3.11.12.2 Asphalt Mix shall be laid to the compacted depths shown in Figure 43: TS 310 Cross section details for vehicle crossings and depressed kerb and channel. The final surface shall be flush with the top of the edge boards and graded uniformly between them.

3.11.12.3 No depressions or irregularities that would cause water to pond will be permitted in the finished surface.

3.11.12.4 All asphalt shall be laid in accordance with NZTA Specification P/9 - Construction of Asphaltic Concrete Paving, except that plant appropriate to the size of the area being surfaced shall be used.

3.11.13 Asphalt overlay

3.11.13.1 Where asphalt smoothing or overlay is required, the existing chip seal/asphalt surface shall be swept to remove all loose metal and debris prior to the application of the tack coat. Mix 5 shall be used to smooth irregularities up to a compacted depth of 20mm.

3.11.13.2 Mix 10 shall be used to compacted depths of 20 - 25mm, Mix 15 for 26 – 50mm and Mix 20 for 51mm and greater compacted depths.

Part 3 – Section 12: DELETED

Part 3 – Section 13: Road openings

3.13.1 General

3.13.1.1 All excavation and trenching work within the road corridor, it must be carried out in accordance with the National Code of Practice for Utilities' Access to the Transport Corridors that was compiled and published by the NZ Utilities Advisory Group. The code can be found on their website http://www.nzuag.org.nz/national-code/CodeMarch09.pdf

3.13.1.2 Work within the road reserves, under control of Council, shall comply with NZTA COPTTM Level 1.

3.13.2 Variations from code

3.13.2.1 The following local variations from the code apply. Paragraph numbering refers to the numbering in the National Code of Practice for Utilities' Access to the Transport Corridors:

(a) 5.6.2: Preferred lay positions in Greenfield sites are shown in Figure 16: DG 302 Location of services in streets of Volume 2 of this manual.

(b) 5.7: Minimum depths of services should be agreed between the parties at the time of application. No service should be laid with less than 450mm cover at the shallowest point, and this may need to be increased depending on location and nature of the service.

(c) 5.9: Proposals to attach services to any bridge or structure owned by the Corridor Manager must be made at least 2 months in advance of intended construction to enable the structural requirements to be fully assessed. The cost of any Engineering Design or investigation works to assess the viability of the proposal shall be a charge on the Utility Operator.

(d) 5.11: Cabinets and other above ground structures must be located so that they do not affect visibility at corners or intersections, and are reasonably safe from accidental damage. Adjacent property owners must be consulted before placing a cabinet or other structure in a position that could potentially restrict access to properties or otherwise impact upon the reasonable utilisation of the property. Cases where agreement cannot be reached with property owners and where no practicable alternative is available, should be referred to the Corridor Manager for resolution.

(e) 5.12: Chambers and underground chambers should be oriented with the longer side parallel to the kerb to minimise occupation of the available corridor.

(f) 6.4.5 to 6.4.8: The requirements for backfilling layer depths and materials are shown in Figure 74: TS 344 Trench reinstatement. Material specifications are in Volume 3, Part 3, Section 1 of this Manual.

(g) 6.5.3: Steel plates are not to be used in the carriageway except with the specific approval of the Road Corridor Manager. They may be used on vehicle crossings and footpaths.

(h) 6.11: If proposed works are likely to damage traffic detector loops, the Road Corridor Manager must be advised at least 48 hrs. prior to the works so that appropriate adjustments to the signals can be made. Reinstatement of the loops will be carried out by Council's contractor at the cost of the Utility operator.

(i) 6.12: A Resource Consent is required when any works are liable to affect Protected Trees and Significant Tree & Bush Stands as identified in Appendix 13 and 14 of Council's District Plan. Work adjacent to other street trees must comply with Schedule D.

(j) 6.15: Utility Operators and their contractors may use generic traffic management plans for typical situations found on local roads. Such plans shall be submitted to the Road Corridor Manager and, if approved, will be valid for 12 months, after which they shall be reviewed, amended, if required, and resubmitted. Site-specific traffic management plans will be required for any work that affects the traffic lanes on an arterial road and in any other situation that the Road Corridor Manager deems that a generic plan is not suitable.

(k) 6.25: The minimum Public Liability Indemnity shall be $2,000,000.00.

(l) 9.4.1: Council have a process for submitting and processing of Road Opening Notices. Initial contact should be made to Council's Contracts Engineer.

(m) The appropriate schedule of fees can be obtained from Council.

(n) 10.8: Traffic Management plans must recognise the 40km/hr. speed zones at many schools within Waipa District.

(o) No trenching of services is permitted across existing concrete carriageways, entrances or footpaths.

Part 3 – Section 14: Road signs and street furniture

3.14.1 Sign design and construction

3.14.1.1 All signs are to be constructed and installed in accordance with:

(a) *NZTA specifications*

(i) The latest version of the appropriate NZ Transport Agency Specifications covering sign formats, in particular:

- NZTA Manual for Signs & Markings Part I: Traffic Signs (MOTSAM).
- NZTA C20 "Standard for Manufacture & Maintenance of Traffic Signs, Posts and Fittings".
- NZS 5414:1977 "Specification for the Construction of Traffic Signs".
- Road Sign Manufacturers Association (RSMA) Compliance Standard for Traffic Signs.
- Land Transport Rule Traffic Control Devices 2004 and subsequent amendments.

3.14.1.2 Waipa District Council specification or individual requirements will supersede standards set out in the above documents.

3.14.1.3 All backs of signs are to be coloured "aircraft grey" No. 693 as referred to in BS 381C : 1996, or similar with a semi-gloss finish, unless otherwise stated. Slate grey (as per NZTA Specifications) is an approved alternative. Any uncertainty should be checked with the Engineer.

3.14.1.4 All signs except" Rebound" plastic RG17s are to have an aluminium substrate.

3.14.1.5 All stop (RG5), Give way (RG6), Keep Left (RG17) and street name plates are to be of Class 1 Wide Observation Angle (VIP or similar) reflectorised sheeting.

3.14.1.6 All other regulatory, warning and information signs are to be Class 1 High Intensity grade reflectorised sheeting.

3.14.1.7 All parking signs are to be non-reflective.

3.14.1.8 Where the MOTSAM gives the option for square or radiused corners, radiused corners are to be supplied.

3.14.1.9 Mounting, unless specified otherwise, all signs shall be mounted to posts using 10mm galvanised bolts. A nylon washer is to be used on the front side of the sign to reduce the risk of damage to the reflective sheeting. Likewise, the bolts are to be tightened in a manner that will not damage the sheeting.

3.14.2 Typical sign installation and location

3.14.2.1 *Regulatory and parking signs*

(a) Regulatory signs are to be located in accordance with the NZTA Manual of Traffic Signs & Markings Part I. The following guidelines are additional to the above document:

(i) Height of Sign (except Keep Left, Bus Stop, Parking) in berm areas:

- 3m to top of sign (behind kerb line).
- 2m to top of sign (in traffic island).

(ii) Height of Sign (Keep Left) in islands:

- 250mm between bottom of sign and top of adjacent kerb.
- 15m from traffic island nose.

(iii) Height of sign (Bus stop & Parking):

- 2.7m to top of sign.

(iv) Longitudinal Offset (except Keep Left):

- 5m (± 1m)" from tangent to intersecting road kerb line (behind kerb line).
- 3m from island nose (in traffic island).

(v) Keep Left:

- 15m from traffic island nose.

(vi) Mobility:

- 1m back from front of park.

(vii) Lateral offset:

- Poles shall not be closer than 500mm from kerb line. Sign shall not be closer than 350mm from kerb face.
- In centre of traffic island with a maximum offset of 1m from island kerb face.

(viii) With the exception of Parking Signs, which are installed on NB50, all regulatory signs shall be installed on NB65 poles.

Advice Note: Tolerance to accommodate possible site constraints.

3.14.2.2 *Parking signs*

(a) Parking signs shall be as detailed in NZTA Manual of Traffic Signs & Markings, Part I (RP-4 or RP-4.1).

3.14.2.3 *Warning signs*

(a) Warning signs are to be located in accordance with the NZTA Manual of Traffic Signs & Markings, Part I. The following guidelines are additional to this document:

(i) Height of Sign:

- 3m to top of sign (except Diverge Sign and Chevron Boards).

(ii) Height of Sign (Chevron Board):

- 750mm to top of sign. (Consideration should be given to road vertical alignment when determining sign height).

(iii) Height of Sign (Diverge Sign):

- 250mm between bottom of sign and top of adjacent kerb.

(iv) Offset (Diverge Sign):

- 1.5m from traffic island nose.

(v) Lateral offset (except chevrons in roundabouts):

- Sign to be 500mm from kerb line.
- In centre of traffic island.

(vi) Lateral offset (chevrons in roundabouts):

- 1m from kerb face and perpendicular to sight line of approaching vehicles approximately 50m from intersection.

3.14.2.4 ***Information signs***

(a) Information signs are to be located in accordance with the NZTA Manual for Traffic Signs and Markings, Part I. The following guidelines are additional to this document:

(i) Height of Sign (No Exit):

- 3m to top of sign.

(ii) Height of Sign (Free Turn):

- 250mm between bottom of sign and top of adjacent kerb.

(iii) Height of Sign (Route Sign) (in place of chevrons sign in roundabouts):

- 750mm to top of sign or minimum of 250mm between bottom of sign and top of adjacent kerb; 100mm if the area is not planted.

(iv) Offset (Free Turn):

- 15m from traffic island nose.

(v) Lateral offset (except Route sign):

- Sign to be 500mm from kerb line in centre of traffic island.

(vi) Lateral offset (Route sign):

- Sign to be 500mm from kerb face. If no kerb, sign to be 1.5m from the edge of seal.

3.14.2.5 ***Signs on cycle ways or shared walkway/cycle ways***

(a) All signs installed adjacent to cycle ways shall have a minimum clearance to the bottom of the sign of 2.2m. Mounting heights specified elsewhere shall be increased as needed to achieve this clearance.

3.14.3 Street name signs

3.14.3.1 ***Design***

(a) Street name signs are to be designed in accordance with the following specification:

(i) Letter Height(except abbreviations - see 3.14.3.2):

- 125mm for secondary streets.
- 150mm for primary streets.

(ii) Letter Styles:

- NZTA 'Transport' series. Signs to include both upper & lower case letters.

(iii) Letter Spacing:

- Medium spacing from AS 1744:1975 condensed to 80%. All lettering to have 60mm clearance at both ends of the sign.

(iv) Background Depth:

- 200mm for secondary streets.
- 225mm for primary streets.
- 250mm for street names with numbers.

(v) Blade Profile:

- 90° cuts at both ends.

(vi) Colours:

- Te Awamutu Urban Area: White reflectorised lettering on green reflectorised background.
- All Other Areas: White reflectorised lettering on blue reflectorised background.
- All reflectorisation to be Class 1 wide observation angle reflective sheeting.

(vii) "No Exit" Supplements:

- Separate plate attached (taped) to the bottom edge of the street nameplate. Blade height 75mm.

(viii) Arrows:

- White reflectorised triangular arrow at the end of nameplates as required in Figure 58: TS 327 Location of street name signs (collector/arterial), Figure 59: TS 328 Location of street name signs (local/collector or arterial) and Figure 60: TS 329 Location of street name signs (local/local).

(ix) Attachment to Pole:

- As detailed in Figure 80: TS 358 Attachment of street name sign blades to poles.

(x) Poles to be NB50.

3.14.3.2 ***Legend***

(a) The following are the abbreviations to be used on all street nameplates:

(i) Avenue - Ave

(ii) Close - Cl

(iii) Court - Ct

(iv) Crescent - Cres

(v) Drive - Dr

(vi) Lane - Lane

(vii) Parade - Pde

(viii) Place - Pl

(ix) Rise - Rise

(x) Road - Rd

(xi) Street - St

(xii) Terrace - Tce

(xiii) Way - Way

(b) These abbreviations are to have a letter height of 50mm and 75mm for secondary and primary streets respectively.

3.14.3.3 ***Location of street name signs***

(a) Street name signs are to be located in accordance with the following specification. If there is a utility pole in the proposed location, then the signs may be attached to it. (See Note 3 Figure 80: TS 358 Attachment of street name sign blades to poles).

(i) Height of Name Sign:

- 3m between footpath & top of upper blade.

(ii) Lateral Offset:

- Minimum 500mm, maximum 1500mm between closest part of name sign and kerb or seal edge. (Refer also to (b)).

(iii) Number of Signs:

- To be in accordance with Figure 58: TS 327 Location of street name signs (collector/arterial), Figure 59: TS 328 Location of street name signs (local/collector or arterial) and Figure 60: TS 329 Location of street name signs (local/local).

(iv) Double-sided Signs:

- All signs to be double-sided (except those on medians or at the head of "T" intersections).

(v) Median Island Low Level:

- 750mm to top of sign or minimum of 250mm.

(vi) Street Name Signs:

- Between bottom of sign and top of adjacent kerb, 100mm if the area is not planted.

(b) The following is in addition to this location specification:

(i) Part of the sign blade should be located within 1500mm of the kerb face but provide at least 500mm clearance to the kerb face or seal edge.

(ii) Where it is not possible to locate the pole such that the sign complies with (i) above and the footpath is not obstructed, the sign may be reverse mounted.

(c) Poles shall be either NB50 or NB65 steel poles, as appropriate to the type of sign required. All poles shall be galvanised, powder coated white, and capped with powder coated top caps.

3.14.4 Amenity signs for public amenities

3.14.4.1 *Design*

(a) Directional signs are to be in accordance with the following specification:

(i) Letter height:

- 125mm.

(ii) Letter styles:

- As for Street Name signs.

(iii) Letter spacing:

- As for Street Name signs.

(iv) Background depth:

- 175mm.

(v) Blade profile:

- 90° cuts at both ends.

(vi) Colours:

- Blue reflectorised lettering on a white reflectorised background - all reflectorisation to be Engineering Grade.

(vii) Arrows:

- Blue reflectorised triangular arrow at the end of sign plates. Refer to Figure 58: TS 327 Location of street name signs (collector/arterial), Figure 59: TS 328 Location of street name signs (local/collector or arterial) and Figure 60: TS 329 Location of street name signs (local/local).

3.14.4.2 *Location*

(a) Directional signs are to be located in accordance with the following specification:

(i) Height of sign blade:

- 3m between footpath and top of blade.

(ii) Lateral offset:

- As for Street Name signs.

(iii) Number of signs:

- Maximum of two directional signs per facility; and
- Amenity signs must be attached below existing street name signs.

3.14.5 Arterial direction (AD) and information signs

3.14.5.1 *General*

(a) All signs shall be designed and constructed in accordance with the manuals and standards listed in Clause 3.14.1 and the following:

(i) All backs of signs to be coloured "aircraft grey" no. 693 as referred to in BS381 C or similar with a semi-gloss finish.

(ii) All signs shall have an Aluminium Substrate.

(iii) Signs shall be Class 1 wide observation angle (VIP or equivalent) reflective sheeting.

(iv) Face of sign shall be rivet less.

3.14.5.2 *Attachment*

(a) Signs are to be attached to posts or overhead gantries using Signfix or equivalent brackets as approved by the Engineer. The Contractor shall be responsible for determining sign mounting requirements.

3.14.5.3 *Location*

(a) Signs shall have 0.5m offset from kerb or 1.5m from edge of seal.

(b) Sign locations are to be confirmed on site by the Engineer prior to installation.

(c) Signs to be angled for oncoming traffic in accordance with the sign reflective sheeting manufacturer's specification. Any discrepancy should be checked with Engineer.

3.14.5.4 *Height*

(a) Signs located above carriageways shall have a minimum clearance of 5m.

(b) Signs located in or above footpaths shall have 2.5m minimum clearance from the bottom of the sign to the footpath.

(c) Signs on grassed/planted areas shall have 2m minimum clearance to the bottom of the sign.

(d) Direction signs located in roundabout splitter island shall be 50mm above ground level.

3.14.6 Poles

3.14.6.1 *CBD areas*

(a) Poles are to be either NB50, NB65, NB80 or NB100 Steel Poles as appropriate to the type and size of sign required – see Figure 58: TS 327 Location of street name signs (collector/arterial), Figure 59: TS 328 Location of street name signs (local/collector or arterial) and Figure 60: TS 329 Location of street name signs (local/local).

Table 30.

(b) Poles are to be powder coated and installed as shown in Figure 81: TS 360 N.B. 100, 80, 65, 50 pole foundations.

(c) Poles in this area are to be powder coated "Brunswick Green" (as per HB Fuller Power Coatings Colour no. 2425C or similar as approved by Engineer) within the Cambridge CBD Area and "White" in the Te Awamutu CBD Area.

(d) All steel poles are to be capped with powder coated top caps to match pole.

3.14.6.2 *All other areas*

(a) Poles must be D4S 100mm x 100mm Radiata Pine treated to H4 in accordance with NZS 3602:2003.

(b) Poles are to be painted with an exterior Acrylic Undercoat and two top coats of exterior Acrylic Gloss White paint and installed as shown in Figure 58: TS 327 Location of street name signs (collector/arterial), Figure 59: TS 328 Location of street name signs (local/collector or arterial) and Figure 60: TS 329 Location of street name signs (local/local).

Table 30: Poles in Areas Other than in a CBD

Sign Type	Pole Type	Pole Length	Height to Top of Sign
Street Name	100x100 timber	3.7m	3m
Tourist Sign	"	"	"
Route Markers	"	"	"
Truck Bylaw	"	"	"
No Stopping	NB50	3.25	2.7

Sign Type	Pole Type	Pole Length	Height to Top of Sign
Bus Stop	"	"	"
Taxi Stand	"	"	"
Loading Zone	"	"	"
Parking	"	"	"
Disabled Parking	NB50	"	"
Keep Left	Quick Fix	750mm	250mm**
Splitter Island	"	"	"
Chevron Arrow	100x100	1.1m	750mm
Route Shield	"	"	"
Low Level Street Name	"	"	250mm**
ADS Sign (on 2 poles):			
0< m^2 < 1.20	"	To suit	Refer 1.5 ADS signs
1.20 ≤ m^2 < 2.00	"	"	
2.00 ≤ m^2 < 3.00	"	"	
3.00 ≤ m^2 ≤ 4.00	"	"	
Any sizes above 4.00 m^2 will require a specific design.			

* Installation height in traffic islands is 2m

** Dimension is the clearance between the bottom of the sign and the top of the adjacent kerb.

3.14.7 Overhead gantries

3.14.7.1 Gantry design will depend on proposed size of sign and hence loading and ground clearance.

3.14.7.2 Sign mounting uprights to be at no greater than 900mm centres.

3.14.7.3 Overhead gantries have the option of a single piece welded or a bolted outreach arm.

3.14.7.4 Installation of all overhead gantries shall be carried out in accordance with the standard figures unless stated otherwise.

3.14.7.5 Gantries to be galvanised in accordance with standard technical specification for hot dip galvanising after fabrication. All mount bolts shall be galvanised.

3.14.8 Edge marker posts

3.14.8.1 All edge marker posts are to be constructed in accordance with the NZTA M:14 1993 Specification for Edge Marker Posts and any subsequent NZ Transport Agency specifications covering edge marker post format. They are to be located in accordance with the NZTA Manual for Traffic Signs and Markings, Part I.

3.14.9 Armco barriers

3.14.9.1 All Armco barriers are to be constructed in accordance with the NZTA M-16P Specification for W-Section Highway Guardrails, NZTA P/15P Fabrication & Assembly of Standard Guardrails and Handrails for Highway Bridges & Bridge Approaches, AS/NZS 3845:1999, and NZTAM/23 Road Safety Barrier Systems.

3.14.10 Timber bollards, low level timber barriers and removable bollards

3.14.10.1 All bollards and barriers are to be constructed and installed in accordance with Figure 64: TS 334 Timber bollards, Figure 65: TS 335 Lockable removable bollards or Figure 82: TS 361 Low level timber barrier as appropriate.

3.14.11 Pedestrian barrier rails and handrails

3.14.11.1 Pedestrian barrier rails and handrails are to be constructed and installed in accordance with Figure 66: TS 336 Pedestrian handrail and Figure 67: TS 337 Pedestrian barriers as appropriate.

3.14.12 Flugal flag pole

3.14.12.1 Flugal flagpoles are to be constructed and installed in accordance with Figure 69: TS 339 Roadmarking and signage details for school kea crossings, Figure 70: TS 340 Flugal flag and Figure 71: TS 341 Flugal flag pole.

3.14.13 Parking meter poles

3.14.13.1 Parking meters are not required within the Waipa District.

3.14.14 Cycle barriers and racks

3.14.14.1 All cycle barriers and racks are to be constructed and installed in accordance with Figure 66: TS 336 Pedestrian handrail and Figure 68: TS 338 Bike rack - ribbon style.

3.14.15 Installation details for posts/poles

3.14.15.1 Installation of quick fix posts are to be as detailed in Figure 61: TS 330 Knock down sign installation - collar type.

3.14.15.2 Supply and installation of flexible post sockets. Flexible post shall be Ezidrive PF1 (Poly Flex) or equivalent approved by Engineer. (Colour: White). Refer to Figure 83: TS 362 Knock down sign installation polyflex (PF1).

3.14.15.3 Installation of 3.7m fitting/system steel tube poles is to be as detailed in Figure 62: TS 331 Installation of road sign poles.

3.14.15.4 Installation of timber poles for chevron and low-level street name signs is to be as detailed in Figure 63: TS 332 Installation of chevron or route and low level road name sign.

3.14.15.5 Where installation and/or reinstatement work is required within the footpath, the footpath must be saw cut around the perimeter of the excavation and replacement surfacing placed to tie into and match existing surrounding surfacing.

3.14.16 Attachment of signs/poles

3.14.16.1 ***NB50 steel poles***

(a) All street name signs on NB50 powder coated steel poles are to be attached as detailed in Figure 80: TS 358 Attachment of street name sign blades to poles. All other signs are to be bolted on to the pole with two 6mm dia. galvanised bolts to sign/sheeting manufacturer's specification.

3.14.16.2 ***NB65 steel poles***

(a) All signs on NB65 powder coated steel poles are to be attached with two 10mm dia galvanised bolts to sign/sheeting manufacturer's specification.

3.14.16.3 ***School Patrol signs***

(a) Posts are to be Type II bollards painted white, set so tops are 1.00m above ground level, set in concrete base (400 x 400 x 500mm deep). Bracket is to be attached using two 120 x 10mm dia. galvanised coach bolts. Brackets for lollipop signs are to be manufactured and installed in accordance with Figure 84: TS 363 School patrol signs.

3.14.17 Painting of barriers

3.14.17.1 All painting of Armco and timber barriers is to be completed with two finish coats of water based commercial grade paint (colour to be specified by the Engineer). All dirt, grime and loose and flaky paint are to be removed from the surface prior to painting. It may be necessary to spot undercoat as required. All painting is to be carried out according to the manufacturer’s specifications.

3.14.18 Seats

3.14.18.1 Seats are to be Street Furniture NZ Ltd "McKillop" seats or similar.

3.14.18.2 All steel work to be galvanised and powder coated. Colour to be confirmed by Engineer.

3.14.18.3 Seat posts are to be installed in 20 Mpa concrete footing 500 x 500 x 600mm deep.

3.14.18.4 All surrounding surfaces are to be reinstated to match existing.

3.14.19 Litter bins

3.14.19.1 Bins are to be installed in accordance with Figure 85: TS 364 Concrete base details for steel litter bins.

3.14.20 Steel bollards

3.14.20.1 Bollards are to be steel or aluminium tubing to the specified size.

3.14.20.2 All steel bollards and caps are to be galvanised and power coated once all fabrication work is complete. Colour to be confirmed by Engineer.

3.14.20.3 Bollards are to be cast in concrete footing 250mm x 250mm x 350mm deep.

3.14.20.4 Surrounding surfaces are to be reinstated to match existing. Bollard caps are to be of a dome style, powder coated to match bollard. The cap is to be fastened to the bollard with a minimum of 4mm rivets.

Part 3 – Section 15: Road marking

3.15.1 General

3.15.1.1 This section covers all aspects of road marking, as well as the supply and fixing of reflective and/or non-reflective road studs and delineators, and the removal of road marking as required.

3.15.1.2 The latest version of NZ Transport Agency Specifications shall be deemed to form part of the Technical Specifications, except as modified or qualified hereafter:

(a)	NZTA M/6	Specification for Sealing Chip.
(b)	NZTA M/7	Specification for Road marking Paint - White & Yellow.
(c)	NZTA M/7	Notes to Specification for Road marking Paint.
(d)	NZTA M/12	Specification for Raised Pavement Markers.
(e)	NZTA M/20	Specification for Long Life Road marking Materials.
(f)	NZTA M/20	Notes to Specification for Long Life Road marking Materials.
(g)	NZTA M/24	Specification for Audio Tactile Profiled Road Markings.
(h)	NZTA P/12	Specification for Pavement Marking.
(i)	NZTA P/12	Notes to Pavement Marking.
(j)	NZTA P/14	Specification for Installation of Raised Pavement Markers.
(k)	NZTA P/22	Specification for Reflectorised Pavement Marking.
(l)	NZTA T/8	Specification for Road marking Applicator Testing.
(m)	NZTA T/12	Specification for Long-Life Pavement Marking Material Applicator Testing.

3.15.1.3 The latest versions of the following publications are also to be read as part of this specification.

(a)	TCD Rule	Land Transport NZ - Traffic Control Devices Rule 2004 - Schedules.
(b)	NZTA	Guide to Urban Road marking.
(c)	NZTA MOTSAM	Manual of Traffic Signs and Road marking - Part II.
(d)	RTS 4	Guidelines for Flush Medians.
(e)	NZTA COPTIM	Code of Practice for Temporary Traffic Management.
(f)	NZRF Manuals	Industry 'Best Practice'.

3.15.2 Setting out and timing

3.15.2.1 The Contractor is to set out the proposed road marking in accordance with the approved figures, and any location marking out provided by the Engineer, with modifications as necessary to make the "lines" pleasing to the eye. Road marking layout on plans shall take priority where they differ from the NZTA "Manual of Traffic Signs and Markings".

3.15.2.2 The Engineer's approval of the set out is required prior to marking. In order to achieve this with least delay, the contractor shall liaise with the Engineer and give at least 48 hours' notice of when the setting out will be ready for Council to approve or amend.

3.15.2.3 Road marking, which has been applied without approval of the set out and needs amending (in Council's opinion), shall be removed at no cost to Council.

3.15.2.4 On new surfaces, marking of centreline, limit lines, and other intersection markings such as Give Ways is to be completed within 48 hours of completion of surfacing. For roads that are not open to traffic, such as new subdivisions, these markings are to be completed before the road is opened to the public. Other markings on new surfaces are to be completed within 7 days of surfacing. For other works, such as line removals or maintenance remarks, timing will be specified by the Engineer.

3.15.3 Paint types

3.15.3.1 Unless specified otherwise by the Engineer, all road marking shall be carried out with one of the following paint types. All paint shall have type approval to NZTA M/7 Class A. All technical data pertaining to the paint and reflective beads shall be supplied as part of the tender documentation including information on product life cycle, including verification of NZTA M/7 type approval.

(a) Local roads - Alkyd paint, or similar.

(b) Collector roads - Waterborne/Acrylic paint or similar.

(c) Arterial roads - Long Life or Waterborne/Acrylic paint or similar.

(d) New markings - Alkyd paint, or similar.

3.15.3.2 The road hierarchy is as defined in the Waipa District Plan.

3.15.3.3 Lead-based road marking paints are not permitted to be used in Waipa District Council.

3.15.3.4 ***Alkyd paint***

(a) Alkyd paint shall be applied in accordance with NZTA P/12 and NZTA M/7, with the following amendments:

(i) Clause 13.1 (a) NZTA P/12:2000 - replace with:

- "The finished dry film thickness shall be 180 microns or greater as defined by the equation in NZTA P/12:2000".

3.15.3.5 ***Waterborne/acrylic paint***

(a) Waterborne paint shall be applied in accordance with NZTA P/12 and NZTA M/7, with the following amendments:

(i) Clause 13.1 (a) NZTA P/12:2000 - replace with:

- "The finished dry film thickness shall be 300 microns or greater as defined by the equation in NZTA P/12:2000".

(b) All waterborne/acrylic markings are to be reflectorised.

3.15.3.6 ***Chlorinated rubber***

(a) Chlorinated Rubber or similar paint shall be applied in accordance with NZTA P/12 and NZTA M/7, with the following amendments:

(i) Clause 13.1 (a) NZTA P/12:2000 - replace with:

- "The finished dry film thickness shall be 220 microns or greater as defined by the equation NZTA P/12:2000".

(b) All chlorinated rubber markings are to be reflectorised.

3.15.3.7 ***Long life***

(a) Where long life or thermoplastic materials are specified, they shall be supplied and applied in accordance with NZTA M/20 specification. The type of long life material proposed to be used and details of type approval to NZTA M/20 specification shall be submitted with any tender or proposal.

3.15.3.8 ***New markings***

(a) New markings will be painted with alkyd or similar paint as per 3.15.3 of this section with the following amendments: Clause 13.1 (a) NZTA P/12:2000 - replace with:

(i) "The finished dry film thickness shall be 250 microns as defined by the equation in NZTA P/12:2000".

(b) The Contractor may use waterborne or acrylic paint for new markings where the Contractor deems it more efficient to do so, but payment will be based on use of alkyd paint. Alkyd paint must be used on sites that are to be remarked with thermoplastic/long life products at a later date.

3.15.3.9 ***Reflectorisation***

(a) When markings are specified to be reflectorised, this shall be carried out in accordance with NZTA P/22 specification.

3.15.4 T/8 & T/12 certifications and staff competence

3.15.4.1 All road marking equipment used for applying paint and glass beads shall have current NZTA T/8 certification.

3.15.4.2 All road marking equipment used for applying long life or thermoplastic shall be certified as complying with NZTA T/12 certification.

3.15.4.3 The senior operator of each road marking crew must have at least a minimum qualification approved by the Industry Training Organisation (ITO). At least one person in each road marking crews shall be a qualified Traffic Controller (TC) in accordance with Code of Practice for Temporary Traffic Management.

3.15.5 Raised pavement markers (RPM)

3.15.5.1 All reflectorised pavement markers are to be glass faced (long life) or equivalent with NZTA M/12 type approval. Alternative products will be considered by the Engineer but must be supported with the appropriate technical data.

3.15.5.2 All pavement markers are to comply with NZTA M/12 (and NZTA M/12 notes).

3.15.5.3 Installation of raised pavement markers shall comply with NZTA P/14, the MOTSAM (latest edition), and any subsequent NZTA document (e.g. RTS 4 "Guidelines for Flush Medians"). Further to this, the Engineer may require specific RPM layouts in certain locations.

3.15.5.4 Where 'Active' RPMs are specified, these shall incorporate solar panels and LED lights so that they do not rely on reflected light. A suitable device is the Solarlite S Series marketed by Integrated Traffic Solutions. Other devices that deliver similar results may be acceptable but prior approval for their use must be sought from the Engineer, accompanied by full technical data.

3.15.6 Removal of road marking

3.15.6.1 When redundant road markings require erasure, the Engineer will specify the method to be used.

3.15.6.2 ***Removal***

(a) When 'removal' is specified, the road marking material (paint or thermoplastic) shall be removed from the road surface. Typical methods include grinding, sandblasting (wet or dry) and ultra-high-pressure water cutting but other methods will be considered. Care shall be taken so that damage is not caused to the underlying road surface and that 'ghosting' of the marking does not occur. Once complete, the surrounding area shall be swept clean of all sand, paint chips or other debris. This material shall be suitably disposed of by the Contractor. The Contractor is to ensure that no solid matter can enter any waterway or stormwater system as a result of the removal operation. This could require the placement of filters or similar on catch pits, etc.

(b) Details of methodology, including materials to be used, equipment, staff skills and qualifications and quality assurance shall be supplied with tenders or proposals.

3.15.6.3 ***Paint blackout***

(a) When short term or semi-permanent erasure is adequate, the redundant markings may be specified to be over painted with black paint. The paint material shall be one of the paint types specified in Clause 3.15.3 and should ideally be the same type as the underlying marking. The colour of the paint should be a near match with the colour of the adjacent road pavement. The 'Blackout' shall overlap the edges of the redundant marking. The edge of the overlap should be irregular to minimise the amount of 'ghosting' of the old marking - particularly in wet conditions.

3.15.6.4 ***Cold applied plastic blackout***

(a) Permanent erasure of markings may be specified to be carried out with cold applied plastic (CAP) material. Existing long life markings or multi-layered paint markings should be ground off before applying CAP Blackout. The base coat shall be a two component cold plastic designed and formulated for use as a road marking material and generally complying with NZTA M/20 specification. The CAP shall be pigmented to a grey or charcoal colour that is close to the colour of the existing road surface. The product shall be mixed and applied in accordance with manufacturer's instructions. Where the area to be blacked out abuts markings that are to remain, the edge of the blackout shall be masked off, otherwise an irregular edge to the blackout is desirable to minimise any ghosting effect.

(b) While the plastic material is still wet, crushed stone or grit shall be evenly broadcast onto the base.

(c) The grit shall be a sound crushed mineral or synthetic aggregate with 95% passing a 6.7mm BS sieve and no more than 15% passing a 2.36mm BS sieve. The CAP material thickness and grit size shall be matched so that approximately 60% of the grit depth is embedded into the plastic material.

(d) The aggregate shall have a maximum of 2% weak materials when tested using the Australian Weak Particles Test (AS 1141.32:1995).

3.15.7 High friction or coloured aggregate surfacing

3.15.7.1 ***Overall requirements***

(a) High friction or coloured aggregate surfacing is to be applied at locations specified by the Engineer. Both surfacing types generally use a specialised aggregate bonded to the road surface in an epoxy or polyurethane resin so are included in the same specification.

(b) Proprietary surfacing systems shall be applied in accordance with the manufacturer's specification and by the manufacturer's approved applicators.

(c) The Document that relates to this section is:

(i) NZTA -M/6:2002 Specification for Sealing Chip.

(d) All technical documentation regarding the proprietary product or system to be used shall be submitted at the time of tender.

3.15.7.2 ***Binder***

(a) The binder shall be a suitable epoxy, polyurethane or other approved proprietary product compound. When used in conjunction with coloured aggregates, the binder shall be pigmented to the same colour as the aggregate. Thermo plastic binders shall not be used. The cured binder shall be flexible so that it does not crack or delaminate under traffic loadings on non-rigid pavements.

(b) The binder shall be capable of holding the aggregates so they do not become embedded or dislodged under heavy braking.

3.15.7.3 ***High friction aggregate***

(a) The aggregate shall be calcined bauxite or equivalent which has a PSV greater than 70 when tested in accordance with BS 812: Part 114.

(b) The grading of the aggregate shall be as follows:

(i) Less than 5% retained on 4.75mm BS sieve.

(ii) Less than 5% passing 1.18mm BS sieve.

(c) The aggregate shall be clean and free of foreign matter. The aggregate shall comply with NZTA M/6 strength, shape and weathering resistance requirements.

3.15.7.4 ***Coloured aggregate***

(a) The aggregate shall be a chemically inert, semi translucent, synthetic aggregate that complies with shape, strength and weathering requirements of NZTA M/6 specification and is coated with colouring compound(s) to produce the specified colour. A suitable product is Synthite® manufactured by Omnicrete Pty Ltd. However, alternative materials or methods that achieve similar results may be proposed.

(b) The grading of the aggregate shall be as follows:

(i) Less than 5% retained on 4.75mm BS sieve.

(ii) Less than 5% passing 1.18mm BS sieve.

(c) The aggregate and binder system shall be designed to achieve a high level of colour retention and resistance to both traffic abrasion and weather such that colour is substantially intact and effective for at least 5 years from initial installation. The aggregate shall have a minimum PSV value of 50 when tested in accordance with BS 812: Part 114. The surfacing must be capable of being cleaned by high-pressure water jet to remove dirt grime and debris in order to restore the colour.

3.15.7.5 ***Surface preparation***

(a) The surface shall be clean of any dust, detritus or loose matter. Any oil visible on the surface shall be removed by washing with a detergent solution, followed by flushing with clean water or other suitable systems.

(b) The surface is to be completely dry before application of the binder.

(c) All existing road marking, pavement markers, catch pits and kerbing shall be suitably masked so that only the road surfacing is coated.

(d) The suitability of application to the pavement at the sites specified shall be discussed with the Engineer using the manufacturer's guidelines.

3.15.7.6 ***Mixing, batching and application***

(a) The Contractor shall follow the manufacturer's guidelines for the mixing, batching and application rates of product unless otherwise directed by the Engineer.

3.15.7.7 ***Curing and aftercare***

(a) All masking's are to be removed together with the binder adhering to it. During the curing period, no disturbances or trafficking of the treated surface will be permitted.

(b) The cure time shall be to the manufacturer's recommendations as required under the particular site conditions.

(c) Before trafficking, excess chip shall be removed. The Contractor will be required to remove any subsequent chip that may have eroded off the treatment.

3.15.7.8 ***Performance***

(a) The minimum performance requirements are:

(i) SCRIM Value - shall be at least 0.7 ESC or as specified.

(ii) Aggregate Retention - a visual assessment of the surfacing shall be performed to assess the level of coverage and retention. Aggregate retention shall be assessed by determining coverage on any 300mm x 300mm area. The surface shall be rejected if any three locations have less than 95% chip coverage.

(iii) Texture Depth - the surfacing shall be rejected if any three locations have a mean profile depth of 1.0mm or less (105mm sand circle if determined in accordance with NZTA T/3 specification).

(iv) Cracking/Delamination/Sliding - the surfacing shall be rejected if there are any of the above conditions present at the end of the 3 month defect liability period.

3.15.7.9 ***Cleaning***

(a) When cleaning of existing high friction or coloured surfacing is required, a high-pressure water jet or other suitable means shall be used to remove all dirt, grime, debris, etc. from the surface. Care must be taken to avoid damage to the surfacing.

3.15.8 DELETED – NOT APPLICABLE.

3.15.9 Temporary markings

3.15.9.1 When specified, temporary markings may be required that can easily be removed when no longer needed. Such markings shall be capable of withstanding normal road traffic and weather conditions for a period of at least 3 months or longer, if specified. When no longer required, the markings shall be removed without causing damage to the underlying road surface.

3.15.9.2 Full details of materials proposed for temporary markings, their method of application and removal and typical properties shall be supplied with any tender or proposal for use. All materials shall be handled and applied in strict accordance with manufacturer's specifications and datasheets. In particular, all environmental precautions must be adhered to.

3.15.9.3 Typical methods of temporary marking include 'removable paint' and self-adhesive road marking tape.

3.15.10 Non-standard markings

3.15.10.1 *Cycle symbols*

(a) The cycle symbol shall be set out as per Traffic Control Devices Rule diagram M2-3 scale to be 1200mm or 800mm high as required.

3.15.10.2 *Cycleway 'end'*

(a) Cycleway 'End' shall be painted at the end of cycle lanes along with a cycleway symbol, where directed. 'End' shall be 600mm high x 900mm long.

3.15.10.4 *Speed cushions*

(a) The approach faces of speed cushions shall be painted with reflectorised white triangles approximately 600mm high x 600mm base width. If necessary, the width of the triangles shall be varied so that there are at least three triangles on each speed cushion and the depth varied to be the full depth of the tapered approach face of the speed cushion.

3.15.10.5 *Pedestrian platforms*

(a) The faces of raised pedestrian crossing platforms and full width speed control devices shall be marked with white reflectorised cross-hatching as dimensioned in Traffic Control Devices Rule Diagram M4-2.

Part 3 – Section 16: Lighting

3.16.1 Scope

3.16.1.1 This section sets out the requirements for the installation of:

(a) Carriageway lighting including underground cabling, LV pillars, columns, consumer services and earthing.

(b) Pedestrian facility lighting including footpath lighting, belisha beacons, floodlights and warning globes.

(c) Installation of lighting cabling, including control methods in accordance to the requirements and specifications of the lines company.

3.16.2 Specifications, regulations and codes of practice

3.16.2.1 The work shall be undertaken in compliance with all statutory requirements including and not limited to the following:

(a) Relevant Statutory Acts, Regulations and Bylaws.

(b) Health and Safety in Employment Act 1992 and associated regulations.

(c) Electricity Regulations 2010.

(d) The Electricity Act 1992.

(e) Electrical Code of Practices.

(f) New Zealand Radio Interference Regulations and Interference Notices.

(g) Ministry of Health Code of Practice for the Safe Management of PCB's.

3.16.2.2 The following specifications related to the work involved with road lighting and under verandah lighting:

(a)	NZTA M/19:1999	Tubular Steel Lighting Columns.
(b)	NZTA M/19:2002	Notes Tubular Steel Lighting Columns.
(c)	NZTA C/24:1991	Maintenance of Highway Lighting.
(d)	NZTA C/24:1991	Notes Maintenance of Highway Lighting.
(e)	AS/NZS 1158	Lighting for Roads and Public Spaces (set).
(f)	AS/NZS 1170	General Structural Design and Design Loadings for Buildings.
(g)	AS/NZS 2312:2002	Guide to Protection of Structural Steel against Atmospheric Corrosion by use of Protective Coatings.
(h)	AS/NZS 3000:2007	Electrical Installations.
(i)	AS/NZS 4676:2000	Structural Design Requirements for Services Utility Poles.
(j)	AS/NZS 4677:2010	Steel Service Utility Poles.
(k)	AS/NZS 670598	Luminaires for Road and Street Lighting.

3.16.3 Safety

3.16.3.1 The maximum safety, consistent with good practice and the Health and Safety Act must be afforded to personnel engaged on construction work.

3.16.3.2 All work must be carried out in accordance with the NZ Electricity Regulations. All personnel working on road lighting equipment shall either be registered personnel or covered by an Employer license as defined in the Electricity Act 1992 and have current competency and safety tuition as defined in the Electricity Regulations 1997.

3.16.3.3 Permission for electricity shutdowns will only be given where the work is otherwise unsafe or not technically feasible. If shutdowns are necessary, at least 7 days' notice shall be given and the network owner's requirements fully complied with.

3.16.3.4 A cable location service is available from Waipa Networks at the cost to the developer.

3.16.4 Circuit cabling

3.16.4.1 All new street lights shall be supplied via underground cabling with internally run concealed circuits. Cable routes, conductor sizes, installation of all cabling and wiring, and control methods shall all be in accordance with the specifications and requirements of the Network Owner.

3.16.4.2 All new installations shall be installed so that the Network Owner's ripple control system activates the lighting circuits. No other system will be considered.

3.16.4.3 Voltage drops in street lighting circuits shall not exceed the requirements of the Network Owner.

3.16.5 Road lighting equipment

3.16.5.1 Where lighting columns or circuits are being relocated, extended or upgraded, the existing supply, protective devices and switching control may be reused if it is in compliance with this specification.

3.16.5.2 All materials supplied shall be new. All fittings and materials used shall be consistent throughout the installation and where there is an addition to an existing system, the new fittings and materials shall match the existing.

3.16.5.3 ***Column supply and installation***

(a) All columns should be of the types and heights as specified and indicated on the figures.

(b) Unless specified elsewhere, all road lighting columns shall be ground planted, galvanized steel, octagonal section poles (Oclyte or similar), with elliptical out reaches complying with NZTA M19 Specification.

(c) Embedment depths and/or footings shall comply with manufacturer's recommendations, section 6.0 AS/NZS 4676:2000 and NZTA M/19:1994. A tolerance of ± 50mm in embedment depth is allowable. Columns shall be installed so that centreline of the columns is vertical within ± 0.5° and the outreach arm is perpendicular to the road. The column shall be oriented so that safe and convenient access to the gear access opening is available. Column foundation excavation shall be backfilled with suitable material, either insitu or imported.

(d) Concrete backfill is not to be used unless specifically approved by the Engineer. If concrete backfill is used, a cable duct must be provided to allow cabling to enter the column base. The duct shall be of sufficient diameter to allow for an additional cable.

(e) Columns are to be earthed in accordance with the Network Owner's requirements. A separate earth pin and CAD welded connection with earthing cable is required.

3.16.5.4 ***Column and outreach specification***

(a) All columns and outreach arms are to be steel or aluminium meeting the requirements of AS/NZS 4676:2000, AS/NZS 4677:2010 and NZTA M/19:1999.

(b) Seismic resistance (earthquake design) to be in accordance with NZS 4203:1992. The complete installation, including all fixings, shall withstand normal operating loads plus acceleration forces of not less than 1.0 g in a horizontal direction and through the centre of gravity of the item fixed.

(c) The column shall be an 'Importance Class II', as defined in AS/NZS 4676:2000 section 1.6.3.

(d) Ground planted columns shall be further protected to 100mm above finished level (ground or concrete) with a continuous coating of Altex Devran 201 minimum 50 microns thick and Altex Devthane 379 minimum 125 microns thick. Coating is to extend 300mm up the inside of the column.

(e) Steel columns and outreach arms shall be galvanised. Decorative paints or coatings shall comply with Protection and Coating Systems on on page 263.

(f) Columns are to have an opening for access to control gear no smaller than 100x150mm fitted with a suitable cover or door. The opening shall be positioned 500-1200mm above ground level. The cover shall be secured by 6 or 8mm tamper proof Allen key bolts or similar. Door bolts are to be coated with long life anti corrosive grease to ensure ease of operation in the future.

(g) Columns shall be ground planted unless specifically directed otherwise.

(h) Minimum Lamp mounting height shall be 5.5m above road surface level.

3.16.5.5 ***Location of lighting columns***

(a) The column placing is to comply with AS/NZS 1158 except where modified below:

(i) As proposed on the lighting plans.

(ii) No closer than 600mm behind the front face of the kerb. No closer than 300mm from the edge of any footpath.

(iii) Columns must be placed so that a minimum corridor width of 1.8m is available for pedestrians between adjacent structures.

(iv) All columns in a street shall be at the same offset from the kerb in order to provide an aesthetically pleasing appearance.

(b) The final location of columns must be confirmed with the Engineer, before cabling and trenching is carried out. Where the work is upgrading or extension of existing lighting, the column positions shall be pegged in advance of the work and adjacent property owners notified in writing of the proposed works.

3.16.6 Cables

3.16.6.1 Underground cable installations shall be provided to all street lighting columns except for lights specified to be installed on existing power poles. Cable route and conductor sizes shall be designed and installed in accordance with the Network Owner's requirements.

3.16.6.2 All column installations shall be provided with approved internal termination junction boxes for terminating lighting circuits. These are to be located at the gear openings of each column. Underground tee jointing will not be permitted.

3.16.6.3 Cables installed vertically on power poles shall be enclosed in high impact PVC conduits from below ground level. Orange high impact conduit is not permitted.

3.16.6.4 ***Trenching***

(a) All trenching or thrusting shall be carried out in accordance with Volume 3, Part 3, Section 13: Road Openings and Reinstatement.

(b) In existing streets, thrusting must be used under existing carriageways, vehicle entrances, footpaths, etc., to minimize the disruption to the public and damage to the road pavement/seal.

(c) Cable routes are to be straight and parallel to the road boundary line, unless obstructions make this impracticable, in which case consent for an alteration must be obtained from the Engineer. In new streets, the location of the cables should be as detailed in plan Figure 16: DG 302 Location of services in streets in Volume 2, Part 3 of this Manual.

(d) Trenching/thrusting for LV cables should be deep enough to provide 600mm cover below final ground level after all cables are installed. Trenching for EHV cables should provide 800mm of cover. Trenches must be sufficiently wide to permit installation, thermal backfill, and cable protection as appropriate.

(e) Trenches near walls or embankments should not be deeper than a line projected at 45° from the bottom of the wall or foundation. This is necessary to avoid damage to the structure by movement of the ground caused by the trench excavations.

3.16.6.5 ***Luminaires, lamps and associated gearing***

(a) *Luminaires*

(i) All luminaires shall comply with AS/NZS 1158. The luminaire housing shall be of high-pressure die-cast aluminium only.

(ii) All luminaires are to be LED’s and selected from the latest Auckland Transport Code of Practice Street Lighting list of preferred models.

(iii) A long life identification label that clearly indicates replacement luminaire wattage shall be firmly fixed to the luminaire in a location easily seen from ground level.

(iv) All coatings to luminaires are to match those specified for columns.

(v) All light sources are to be LED technology.

(b) *Tilt Angle*

(i) All luminaires shall be installed with the specified tilt angle. Where existing brackets or outreaches have a different tilt angle to that specified for new lights, suitable tilt wedges shall be installed so that the existing luminaires have the same tilt angle as any new fittings.

(c) *Wiring*

(i) Tough plastic sheathed cable (TPS) stranded 1.5mm^2 twin earth, complying with AS/NZS 5000.2:2006 "Electric cables – Polymeric insulated – for working voltage up to and including 450/750 V" shall be used to connect between fuse panel and each luminaire, be continuous and without joints.

(d) *Luminaires Containing PCB's*

(i) Existing luminaires shall be checked for materials containing polychlorinated biphenyls (PCB's). Any PCB's found shall be removed safely, stored, and disposed of to the full requirements of the Ministry of Health.

(e) *Protection and Coating Systems*

(i) All columns and luminaires shall have a protective coating system complying with AS/NZS 4677:2010.

(ii) They may also have a decorative coating. The decorative coating shall be compatible with the protective coating. Generally galvanised steel components may have a paint based decorative coating and an aluminium powder coated decorative system. The painting system shall comply with the following requirements or an alternative system approved.

Table 31: Protection and Coating Systems

Substrate Type	Manufacturer	Specification No:
Galv Steel	Altex	TG-203-0532
Aluminium	Altex	TG-203-0532.1
Cast Steel	Altex	TG-203-532.2

(iii) All coating systems shall be applied in strict accordance with the manufacturer's recommendations.

3.16.7 Pedestrian facility lighting

3.16.7.1 *General*

(a) The general layout of lighting at pedestrian facilities is shown on Figure 72: TS 342 Pedestrian belisha and floodlighting and Figure 73: TS 343 Specific street lighting and warning globe detail. All materials supplied shall be new. All fittings and materials used shall be consistent throughout the installation and where there is an addition to an existing system, the new fittings and materials shall match the existing. The requirements of Clause 3.16.5 Road Lighting Equipment apply except as follows in this section.

(b) All columns are to be 100mm diameter steel tube with 2mm wall thickness and of the length specified on the figures. They are to be hot dipped galvanized after fabrication and then polyester powder coated in the appropriate colour.

(c) All pedestrian lighting poles specified to be 'fold-down' poles shall have the following:

(i) Hinge located 150mm from existing ground level.

(ii) Suitable “plug” arrangement for the disconnection of the light while knocked down.

3.16.7.2 ***Pedestrian crossing belisha & floodlights***

(a) Columns are to be black with 300mm high intensity white reflective material attached to create alternate bands of black and white approximately 300mm wide for the full height of the pole.

(b) Floodlights are to be "Coronet" area lighting head CT65/1 modified for reduced side glare on a cast heat sink arm. Lanterns are to be high-pressure sodium, with wattage varying with carriageway width, refer to table below.

Table 32: Pedestrian Crossing Belisha & Floodlights

Carriageway Width	Column Height	Floodlight Wattage
10m	4m	70
15m	4.5m	110
20m	5m	150

(c) Orange belisha beacons are to be constructed from orange impact resistant polyethylene 300mm in diameter fitted in a "Regency 100" clamping system. The lamp holder is to be an Edison porcelain screw fitted with a 150-watt rough service lamp.

(d) A flasher unit capable of handling 600 watts is to be supplied and wired to all belisha beacons at a site so that they flash in synchronisation. The flashing frequency shall be 40 - 60 flashes per minute.

(e) Where specified, a waterproof "key switch" shall be installed to allow manual daylight operation. The Engineer will confirm this requirement and placement at each site as applicable.

3.16.7.3 ***Warning globes***

(a) Warning globes are generally installed in mid-block pedestrian refuge islands that do not incorporate a marked pedestrian crossing.

(b) Columns are to be powder coated white and have a 2m high intensity white reflective material stripe as shown on Figure 73: TS 343 Specific street lighting and warning globe detail. Column height is to be 4m above ground level unless specified otherwise.

(c) White beacons are to be constructed from white impact resistant polyethylene type "Regency" RY25.1.400PE or similar approved. The beacon must be 400mm in diameter with a "Regency 100" clamping system. The lamp is to be an 80-watt mercury vapour complete with gear. The floodlight is to be a Coronet as specified for pedestrian crossing floodlights but fitted with a 80-watt mercury vapour lamp or metal halide lamp or similar approved lamp.

3.16.8 Alternatives and preferred suppliers

3.16.8.1 Nomination of a particular manufacturer, reference or source of supply shall be taken, (unless specifically noted otherwise) to indicate the type and quality of fittings or materials required.

3.16.8.2 Alternatives will be considered, at the discretion of the Engineer, which:

(a) Improve efficiency of system without significant loss in performance.

(b) Reduce on-going maintenance of the system, both in energy efficiency and physical maintenance.

3.16.8.3 Application for use of alternative products should be made 2 weeks prior to construction. The submission shall be provided with sufficient information as to the intended performance and benefit of the alternative product or systems.

3.16.8.4 Consistent use of products is intended to reduce the overall maintenance costs and issues related to street lighting.

3.16.8.5 An 'Approved Suppliers List' for suppliers of street lighting equipment/hardware is used to ensure the quality, performance of equipment/hardware and consistency of materials and supply.

3.16.8.6 The list and requirements of the suppliers can be obtained through the Engineer and application made to be added to the listing.

3.16.9 Existing luminaires, columns and control gear made redundant

3.16.9.1 The contractor shall give the current Waipa District Council Street Light Maintenance contractor an opportunity to acquire any surplus Luminaires, columns and associated spare parts made redundant, for the purpose of utilising them as maintenance spares. Any materials required by the Maintenance Contractor shall be delivered by the Contractor. The Contractor shall be responsible to dispose of any redundant "not wanted" materials including capacitors containing PCB's. Refer to clause "Luminaires Containing PCB's".

3.16.10 Inspection, testing and commissioning

3.16.10.1 All necessary labour, services, and facilities are to be arranged and provided for the carrying out of site inspections and tests to demonstrate that any component or system included in the installation meets the specified requirements, including the requirements of the Network owner. In particular, voltage readings at a minimum of three circuit end points of the installation shall be taken to verify that the voltage drop does not exceed the set standard.

3.16.10.2 All such tests may be witnessed and checked by, and may be requested by, the Engineer, who shall be given seven (7) days' notice of them taking place.

3.16.10.3 All instruments used during tests shall be provided by the Contractor and shall be verified as being calibrated or otherwise checked by an approved testing authority prior to the carrying out of the tests or at any other stage during testing as required by the Engineer.

3.16.10.4 Testing shall be carried out such that it results in no damage to new or existing components. Any non-compliance shall be remedied prior to connection to the network.

3.16.11 Connecting of service

3.16.11.1 Once the new installations are completed, they shall be connected up to the existing system in accordance with the Network Owner's requirements.

3.16.12 As-built records

3.16.12.1 During the progress of the work, the contractor shall maintain accurate records of the location and depths of cables and locations of columns.

3.16.12.2 Immediately following connection of the new lighting system to the network and prior to permanent livening of the system, as-built details shall be supplied as follows:

(a) A plan showing the size, location, and depth of all cables. Cable location accuracy shall be ± 200mm in plan and ± 100mm in depth.

(b) Street light column location data. Where possible, this is to be a CAD figure in DXF format showing the street light columns and property boundaries. The format is detailed in Volume 4, Part 9, Appendix 7. Otherwise a marked plan showing the column locations is to be provided. Columns shall be located to an accuracy of ± 1m.

(c) Street Light Data Collection Form. This form is Volume 3, Part 3, Appendix 2. One form is required per light type. All details requested must be supplied.

3.16.12.3 In the case of new subdivisions, this data must be supplied before the 224(c) certificate is released and in the case of work contracted by Waipa District Council final payment will not be released until this data is provided.

Part 3 – Section 17: Traffic Signals (Not Applicable in Waipa District)

Part 3 – Section 18: As-built plans and asset details

3.18.1 Scope

3.18.1.1 This section sets out details of the completed works that are to be supplied by contractors or developers to Council on completion of the work.

3.18.2 As-built plans

3.18.2.1 Upon completion of construction work, copies of "As-Built" plans and data recording information about the completed works shall be provided to Council. Responsibility for providing the plans and associated data shall lie with:

(a) The Developer, in the case of land development (urban and industrial sub-division).

(b) The Contractor, in the case of works constructed for Council under contract to Council.

3.18.2.3 Plans presented in fulfilment of this requirement shall be shown as "As-Built" in the amendments part of the figure title block and signed off as 'approved for issue' by a person having responsibility for the quality assurance aspect of the as-built information.

3.18.2.4 The plans are required in one of two formats:

(a) Conventional hard copy plans of the size and scales listed in Volume 1, Part 2, Clause 2.2.1. These may be a copy of the construction figures hand annotated with as-built details, clearly marked as "AS-BUILT" and certified. Significant variations from the original design should have an amended plan issued, and therefore only minor variations and items such as sub-soil drains may be hand annotated. These plans must be in good condition suitable for scanning for archive purposes.

(b) Where as-built plans are prepared using computer aided design software, DXF or DWG format, export files of the hard copy plans should be supplied. The specification for the format is laid out in Volume 4, Appendix 7.

3.18.2.5 As-Built plans and associated data shall be sent to:

(a) In the case of subdivisions:

The Manager
Development Engineering
Private Bag 2402
Te Awamutu 3840

(b) E-mail electronic files to : as-builts@waipadc.govt.nz and include in the sub-heading: Council Subdivision Consent Number, Subdivision name and stage number.

(c) In the case of Council contracts, send to the Engineer's Representative for forwarding to the appropriate Council asset manager.

3.18.2.6 ***As-built details***

(a) The plans shall show the following details:

(i) A plan view of the site showing the location of kerb and channel, catch pits, footpaths, lighting columns, culverts and drainage, subsoil drainage, other drainage structures e.g. soakage devices, locations of service ducts and other below ground features.

(ii) For all service ducts, a location diagram with measurements from reference points to the ends of the ducts and to any angles in the alignment.

(iii) Details of any structures.

3.18.3 Data sheets

3.18.3.1 Contractors and Developers shall complete data sheets for the following classes of assets:

(a) Pavement.

(b) Surfacing.

(c) Street Lights.

3.18.3.2 The information required is shown on Appendices 1-5 of Part 3.

3.18.4 Asset values

3.18.4.1 Council is legally required to maintain an asset valuation register for all infrastructure assets. Asset values are recorded at what is termed the 'component' level and each asset is depreciated according to rules applicable to particular component types. Assets are entered into the asset register at 'purchase cost'. Asset values are regularly revised taking into account asset condition and assessed remaining life. The asset value information required in the lists of asset data provides the 'purchase cost' for this asset accounting requirement.

3.18.4.2 The spread sheets are designed to facilitate data entry of asset values at the 'component level'.

3.18.4.3 Generally, each asset will have a direct cost as well as some indirect costs.

3.18.4.4 Direct costs include Materials and Installation/Construction cost.

3.18.4.5 Indirect costs include such items as Professional fees for design and construction supervision, Resource consents, Insurance and Traffic control.

3.18.4.6 To determine asset values, indirect costs need to be apportioned pro rata to direct costs using a methodology represented by the following formula.

$$\textit{Asset Value} = \textit{Asset Direct Cost} + \left[\textit{Sum Indirect Costs} \times \frac{\textit{Asset Direct Cost}}{\textit{Sum Asset Direct Costs}}\right]$$

Equation 8: Asset Value Determination

3.18.4.7 The component level direct cost will often align with items on a measure-and-value type construction contract. Care is needed to ensure the values of contract variations are attributed to relevant assets rather than being loaded as a general overhead to all assets.

3.18.4.8 The information required is shown on the Appendices 1-5 of Part 3.

3.18.4.9 All values shall be exclusive of GST.

.

Part 3 – Section 19: Traffic and pedestrian safety

3.19.1 General

3.19.1.1 Where any work is in or affects, any road, footpath, vehicle access, service lane, car park or other area that the public has the right to access, the Contractor shall maintain safe, readily negotiable passage across or around the work site for all types of traffic, including pedestrians and cyclists. Access to public and private property shall be maintained at all times unless prior arrangements, acceptable to all parties, have been made.

3.19.2 Traffic management

3.19.2.1 ***Temporary traffic management***

(a) Temporary Traffic Management (TTM) must be established on every site where a public road or footpath is affected, either directly by the works or the contractor's access to or from a site.

3.19.2.2 ***Traffic management plans***

(a) A Traffic Management Plan (TMP) must be prepared and implemented in accordance with the NZ Transport Agency's (NZTA) Code of Practise for Temporary Traffic Management (CoPTTM) including the local roads supplement for roads carrying less than 55vpd. This plan must be prepared by a qualified Site Traffic Management Supervisor (STMS) and submitted to the Engineer for approval. A copy of the approved plan must be held on site and be available for checking by a traffic management auditor.

(b) TMP's for complex projects or those that cover an extended time period may need several layout plans for various stages of the work. Revised or additional TMP's should be submitted if there is a significant change in circumstances.

3.19.2.3 ***Traffic management levels***

(a) All roads under Waipa District Council control are Level 1 but arterial roads will require more than the minimum requirements of CoPTTM. In particular, the first sign a driver encounters when entering a site on an arterial road must be a Level 2 sign. Repeater signs are required, solid medians and painted flush medians, if these can be safely located. In some circumstances, attenuator vehicle/s will be required. In all situations, it is the responsibility of the persons preparing and implementing the TTM to ensure that the site is safe for both traffic and workers. Regular monitoring and fine-tuning of the TTM to suit circumstances is encouraged.

3.19.2.4 ***Generic traffic management plans***

(a) For work that is repeatable and has minor effect on traffic, contractors are encouraged to submit generic TMP's for typical work activities. Once approved, these plans may be implemented throughout the Local Authority area. Contractors working in more than one District or City must have their generic TMP's approved by each.

(b) The STMS or Traffic Controller (TC) must ensure that the TTM is appropriate for the site and make any adjustments to the generic TMP that are necessary. All generic TMP's are to be reviewed and submitted for pre-approval at a maximum of 12 monthly intervals and at any other time a significant change is identified, as necessary.

3.19.2.5 ***Site specific traffic management plans***

(a) For any site where either:

(i) A reduction in the number of traffic lanes on arterial roads is proposed; or

(ii) A major intersection such as a roundabout or signals is involved; or

(iii) There is no suitable generic TMP applicable;

a site specific TMP shall be prepared and submitted for approval at least 5 working days before work commences.

3.19.2.6 ***State highways***

(a) When the Contractor is planning to carry out an activity within the state highway road reserve (boundary to boundary) an Approval to Work on the State Highway (ATWOSH) application and an accompanying Traffic Management Plan is required to be submitted for approval to the NZTA Network Consultant.

3.19.2.7 ***Arterial roads***

(a) Apart from emergency works, no work that interferes with traffic flow on arterial roads shall be carried out during the peak traffic periods of 7.30am - 9.00am and 4.00pm - 5.30pm, Monday to Friday, or during major public events without specific approval from the Engineer.

3.19.3 Temporary road closures

3.19.3.1 The Contractor may apply for a temporary closure of a road or part thereof in order to carry out the works. Council has a statutory process to follow that requires 42 days public notice so contractors must ensure that applications are received 8 weeks in advance of the requested closure date.

3.19.3.2 The application must demonstrate that either:

(a) The closure is essential to allow the works to be built safely; or

(b) Or that a closure will allow the works to be completed more efficiently, taking into account the direct construction costs, the costs of delays to road traffic and the costs of increased travel distance.

3.19.3.3 If permission for a temporary road closure is given, the contractor shall prepare and submit a Traffic Management Plan for approval that includes:

(a) A suitable detour around the closure.

(b) Access for public having legitimate purpose or business in the affected area.

(c) Access to public and private property unless prior arrangements suitable to all parties have been made.

(d) Immediate access to any emergency services and provision to curtail or cease work if necessary.

(e) Suitable arrangements for the regular refuse and recycling collections, by either allowing the collection vehicles to access the site or taking the refuse and recyclables to one end of the job for collection. In the latter case, any recycling crates must be returned to the location they were collected from:

(i) Alternative routes for public bus services affected, including temporary bus stops.

(ii) Advance notification to all affected parties including on site signage for at least 5 days prior to the closure.

3.19.3.4 The Engineer will arrange further publicity for significant closures.

3.19.4 School sites

3.19.4.1 Special attention is to be paid to works outside or adjacent to school or preschool institutions. Ideally such works will be done outside school hours but no work shall be undertaken within 200m of a school between 8.30am and 9.15am or 2.45pm and 3.15pm on school days. Currently, there are no 40 km/hr. school zones within Waipa District.

3.19.5 Bus routes

3.19.5.1 If a work site is on a regular bus route and is likely to disrupt bus operations, the Contractor shall ensure that Waikato Regional Council and the bus operator are advised of the works at least 72 hours prior to commencement and shall co-operate with making any changes needed to provide an alternative route or bus stops.

3.19.6 Cyclists and pedestrians

3.19.6.1 The contractor shall ensure that both pedestrians and cyclists have safe access past the site. In particular:

(a) No TTM signs are to be placed in marked cycle lanes.

(b) Provision must be made for pushchairs, mobility scooters, etc. including kerb ramps if there is no suitable crossing.

(c) Particular care must be taken near schools and preschools.

(d) The surface shall be reasonably smooth and usable in all weather conditions.

3.19.7 Special parking areas

3.19.7.1 If 'Special' parking areas such as marked Bus Stops, Taxi Stands, Loading Zones or metered parking bays are affected by the works, these shall be identified in the TMP and suitable alternative facilities provided, if required, by the Engineer.

3.19.8 Audits

3.19.8.1 The Engineer may carry out random audits of any site in accordance with CoPTTM procedures and the results will be forwarded to the Contractor. Any site scored as "Dangerous" will be immediately closed down until the necessary improvements have been made. As required by CoPTTM a 'Notice of Non Conformance' will be issued for a Dangerous site.

3.19.8.2 The on-site Traffic Controller or STMS will be advised about any site scored as "Needs Improvement". The improvements are required to be implemented by the next working day.

Appendix 1 – RAMM Data

(One set of forms to be completed for each road section)

Road Number ______________________

Subdivision ______________________

SP Number ______________________

End Reference ______________________

Width ______________________

Base course Layer (Layer 1)

Date Completed ______________________

Depth ______________________

Metal Grading ______________________

Quarry ______________________

Metal Type Basalt/Greywacke

Sub base Layer (Layer 2)

Date Completed ______________________

Depth ______________________

Metal Grading ______________________

Quarry ______________________

Metal Type Basalt/Greywacke

Subgrade (Layer 3)

Test Date ______________________

CBR ______________________

Type ______________________

Stabilised Yes/No

Method (Agent) ______________________

Depth ______________________

Undercut (Layer 4)

Location ______________________

Length ______________________

Width ______________________

Depth ______________________

Backfill Material ______________________

Appendix 2 – Surfacing Details: Asphaltic Concrete

Membrane Seal

Road Name

Chainage Start

Description Start

Chainage End

Description End

Width

Area Sealed

Aggregate Size

Aggregate Source

(Company & Quarry)

Binder Type & Grade

Cutter Type

Quantity pph

Spray Temperature °C

Litres at Spray Temp

Residual Application Rate l/m²

Sealing Notes

Surfacing

Date

Material

Binder Type & Grade

Binder Rate

Aggregate Size

Aggregate Source

(Company & Quarry)

Contractor

Mix Temperature in Material °C

Surfacing Notes

Appendix 3 – Surfacing Details: Chip Sealing

Chainage Start	
Description Start	
Chainage End	
Description End	
Date	
Material	
Width	
Area Sealed	
Aggregate Grade	
Aggregate Source (Company & Quarry)	
Binder Type & Grade	
Cutter Quantity	
Cutter Type	
Adhesion Quantity	
Additive Type	
Flux Quantity	
ALD	
Spray Temperature	°C
Litres at Spray Temperature	
Residual Application Rate	l/m²
Sealing Notes	

Appendix 4 – Street Lighting Data Collection Form

(One form per light type)

Light Number ______________________

Date of Inspection ______________________

Street Name and Number ______________________

Lantern Data

Make ______________________

Model ______________________

Lamp Description ______________________

Tilt Angle (deg) ______________________

Year Installed ______________________

Date Lamp Changed ______________________

Column Data

Mounting Height (meters) ______________________

Type of Pole or Mounting Arrangement — Concrete / Steel / G. Fibre / Wall / Timber
Other: ______________________

Outreach Length — Curved / Mitred / Elliptical / Other
Other: ______________________

Offset from Kerb (in meters) ______________________

Foundation Type — Ground Planted / Frangible / Bolted
Other: ______________________

Lighting Control

Control Type — Photocell / Relay
Other: ______________________

Origin of Power Supply — Transformer / O/H Line / St./Junct./Box

Cable Size and Type ______________________

Charge (Total Wattage) ______________________

Starter Type ______________________

Appendix 5 – Asset Valuation Data

Subdivision Name or Project Title	
Developer or Contractor Name	
WDC Subdivision Reference or Contract Number	
Road Name(s)	
Date of Practical Completion	

Indirect Costs	**Qty**	**Unit**	**Rate**	**Amount**
Design	1	LS		$
Supervision	1	LS		$
Traffic Control	1	LS		$
P & G Items	1	LS		$
Cost Fluctuations	1	LS		$
Other	1	LS		$
Total Indirect Costs				$

Direct Costs	**Qty**	**Unit**	**Rate**	**Amount**
Road Formation (incl. berms & topsoil)	1	LS		$
Stormwater – see Part 4				
Sub base (Solid Measure)	1	m^3		$
Base course (Solid Measure)		m^3		$
Surfacing		m^2		$
Kerb & Channel		m		$
Footpath (incl. driveways)		m^2		$
Permanent Signs (list by type)				
▪ e.g. Give Way		ea		$
▪ e.g. RG 17 Keep Left		ea		
▪ e.g. Street Name Plated		ea		
Road Marking		LS		
Street Lights		ea		
Total Direct Costs				$
Total Indirect + Direct Costs (must equal project or contract cost)				**$**

N.B. All costs exclude GST

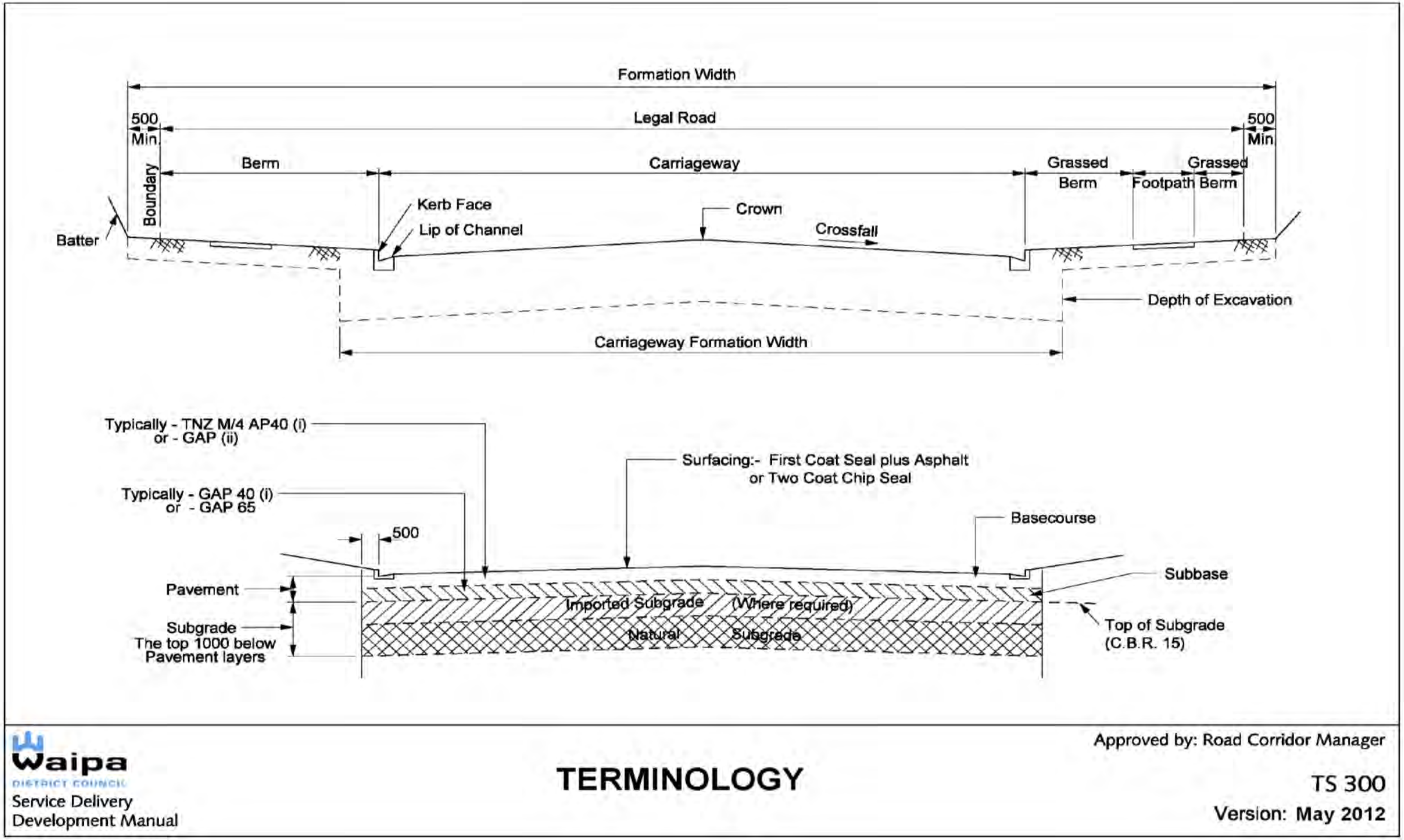


Figure 34: TS 300 Terminology

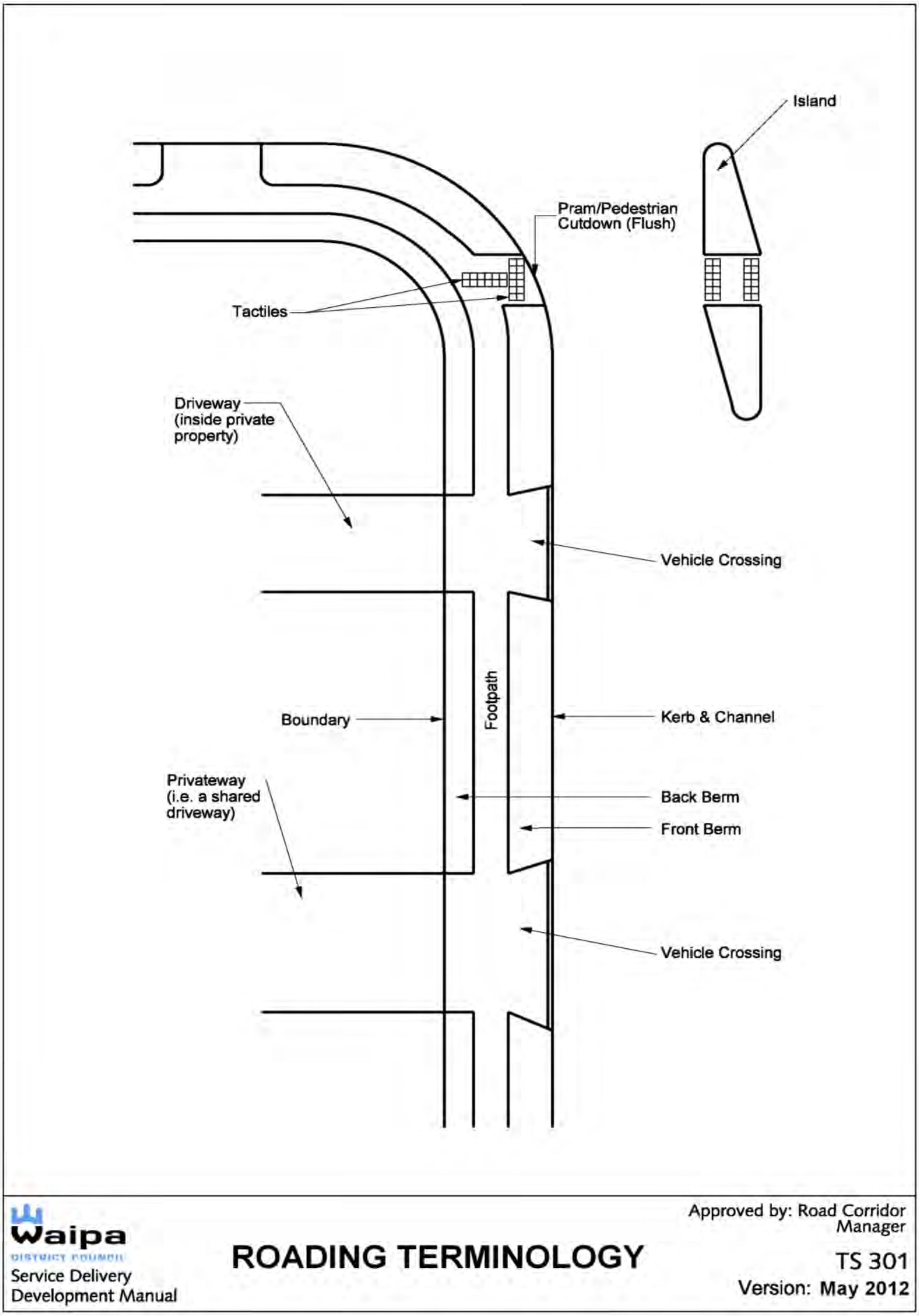
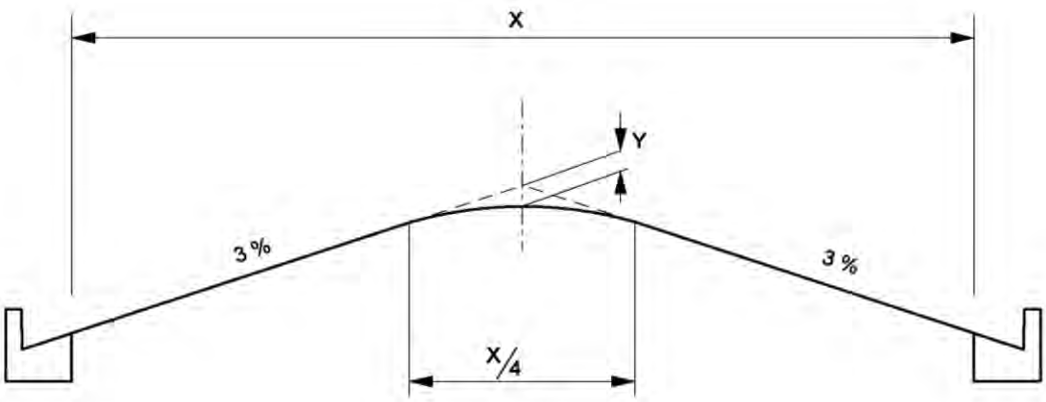


Figure 35: TS 301 Roading terminology



Y (in mm) = 2 X (where X is in metres)

e.g. X= 7.9 (8.5 carriageway)

∴ Y = 2 x 7.9

= 16mm

Crown Height above lip of channel (in mm) = 13X (where X is in metres)

NORMAL CARRIAGEWAY CAMBER

TABLE OF LEVEL TOLERANCES FOR FLEXIBLE PAVEMENTS

At top of Layer	Centreline and near Pavement edge	At Channel edge	Deviation from 3m straight edge or camber board
Surface			1: 12mm 2: 8mm
Basecourse	- 5mm to + 15mm	1: 0mm to + 10mm 2. -5mm to + 5mm	12mm
Sub-base	- 25mm to + 5mm	- 25mm to + 5mm	15mm
Subgrade	- 30mm to 0mm	- 30mm to 0mm	15mm

1: Chip sealed surface

2: Asphalt surface (minimum 25mm thick)

Construction levels are based on lip of channel, appropriate crossfall and designed pavement layer thickness

Waipa District Council
Service Delivery Development Manual

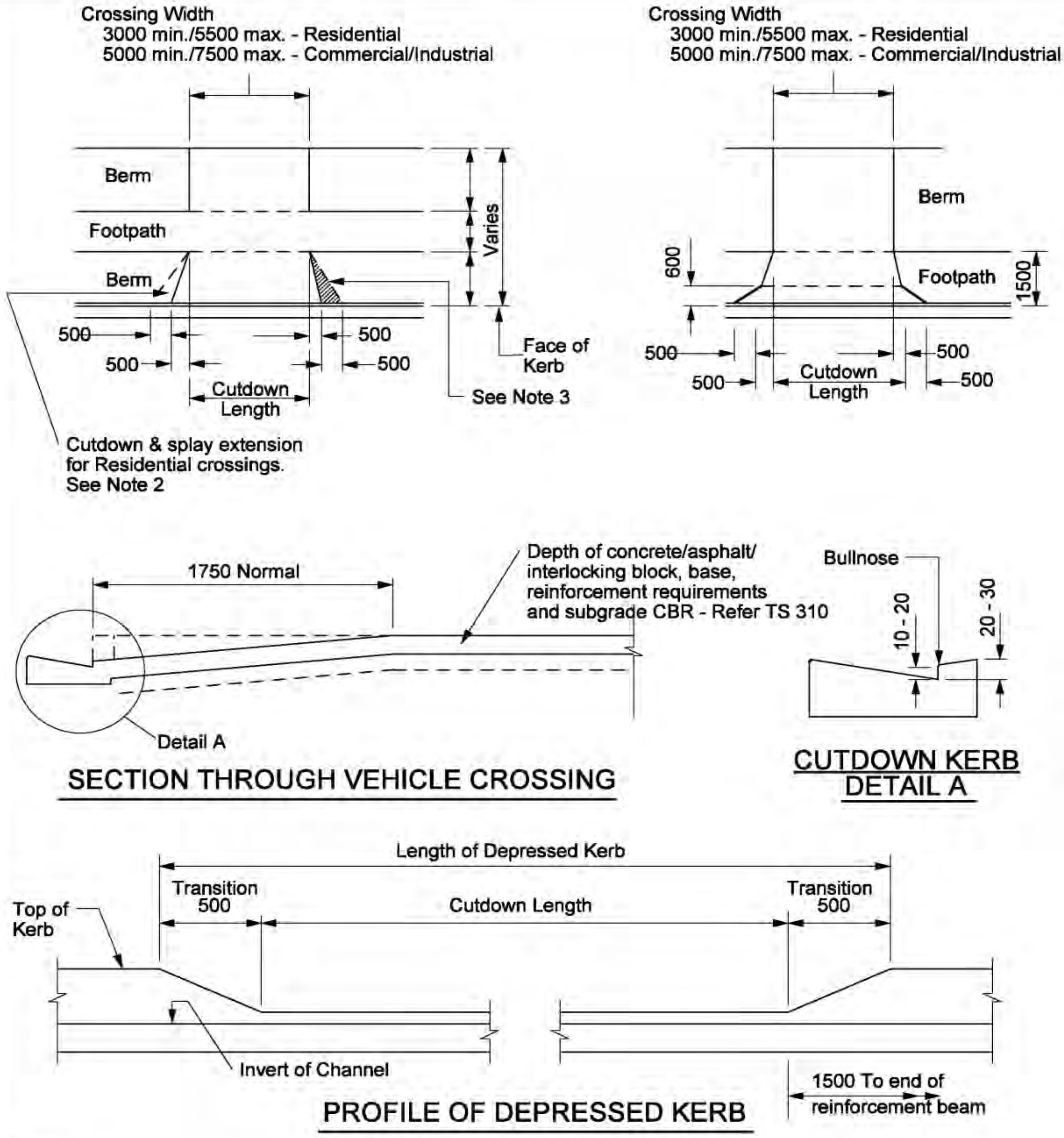
NORMAL CARRIAGEWAY CAMBER AND CONSTRUCTION TOLERANCES

Approved by: Road Corridor Manager

TS 304

Version: May 2012

Figure 36: TS 304 Normal carriageway camber and construction tolerances



NOTES:

1. When commercial and industrial crossings are constructed, the reinforcement beam is to extend 1500 either side of cutdown.
2. Cutdown and splay extension to be constructed where the carriageway width is less than 9000 and the crossing width is less than 4000.
3. This area is to be formed and surfaced to the Commercial/Industrial standard for all Commercial/Industrial vehicle crossings. This may be extended to where footpath commences.
4. The footpath within the crossing area shall be surfaced with the same material as the footpath either side.

Waipa District Council
Service Delivery Development Manual

VEHICLE CROSSINGS WITH KERBED ROADS

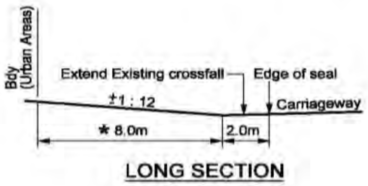
Approved by: Road Corridor Manager

TS 306

Version: May 2012

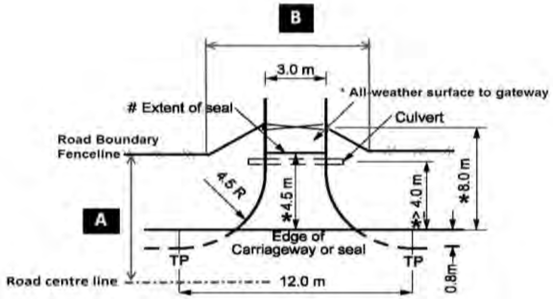
Figure 37: TS 306 Vehicle crossings with kerbed roads

RESIDENTIAL < 2 HA



Fence Opening

A	B
4	8.5
5	8.5
6	7.7
7	6.9
8	6.1
9	5.3
10	4.5



* Minimum requirement in Rural Areas.
# Seal to extend to property boundary in Urban Areas.

NOTES

1.0 GENERAL

1.1 ALL WORKS SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE FOLLOWING NOTES AND TO THE SATISFACTION OF THE RELEVANT COUNCIL. Additional requirements to those shown on this drawing may be necessary for a particular location and will be determined on site.

1.2 The Contractor shall be responsible for traffic control while undertaking work within the road reserve. All signage shall be in accordance with Transit New Zealand's COPTTM, or Local Road Supplement, as specified by the relevant Council

1.3 The Contractor shall be responsible for the cost of repairs to any underground utility services damaged during construction. Any damage shall be rectified to the satisfaction of the Utility Owner.

1.4 A Residential Vehicle Entrance is deemed to be adequate to accomodate a 5m long car turning into a property at a radius of 7.5m.

1.5 The centreline of entrance formation meets carriageway not <70°.

2.0 LOCATION

2.1 Each entrance shall be located to provide clear sight distance in both directions in accordance with Vol 5. Pt 3 Clause 13.0.

2.2 Separation distances shall be as indicated on DCS 302

3.0 CULVERT

3.1 If an entrance crosses a public drain the Contractor shall notify the relevant authority who will advise the correct culvert diameter.

3.2 If the entrance crosses a watertable or small drain (less than 2m wide by 1m deep), a 300mm diameter minimum Reinforced Concrete Rubber Ring Joint (R.C.R.R.J.) Class X pipe shall be installed.

3.3 Any unsuitable bedding material including vegetation, topsoil and peat shall be removed and replaced in accordance with pipe manufacturers specifications.

3.4 All culverts shall be laid straight at a constant grade, a minimum of 4.0m from the edge of carriageway. Socket end shall always be uphill

3.5 Culvert shall extend minimum of 0.5 beyond toe of the entrance fill slope. The existing drain / watertable may require redirection to accommodate the clear distance required from the existing edge of seal.

4.0 SUBBASE

4.1 A CBR >10 must be achieved on the sub-grade level before the placement of sub-base material. If this CBR cannot be achieved, Council's roading consent staff will advise how to proceed. This may involve an additional depth of pavement construction, or the installation of geosynthetics.

4.2 Pit sand, brown rock or similar material shall be placed, trimmed and compacted to provide 150mm depth of subbase if required. The subbase shall be placed from the edge of the carriageway to the gate or cattlestop.

5.0 BASECOURSE

5.1 Clean good quality G.A.P. 40 basecourse metal shall be placed, trimmed and compacted to provide 100mm depth of basecourse from the carriageway to the gate or cattlestop.

5.2 The basecourse material shall be trimmed to provide a crown in the centre of the entrance to ensure adequate surface drainage. The crossfall shall be -5% from the crown.

6.0 SURFACING

6.1 If the entrance is off a metal surfaced road, NO additional surfacing over the basecourse material will be required.

6.2 Each entrance off a sealed road shall be surfaced with a two coat bitumen/chip seal as a minimum surfacing standard. The surfacing shall be constructed with 180/200 grade bitumen and Grade 3 and 5 chip.

6.3 Cement concrete surfacing is not permitted.

Waipa DISTRICT COUNCIL
Service Delivery
Development Manual

ENTRANCEWAYS WITHOUT KERB OR KERB AND CHANNEL AND FOR RURAL ZONES

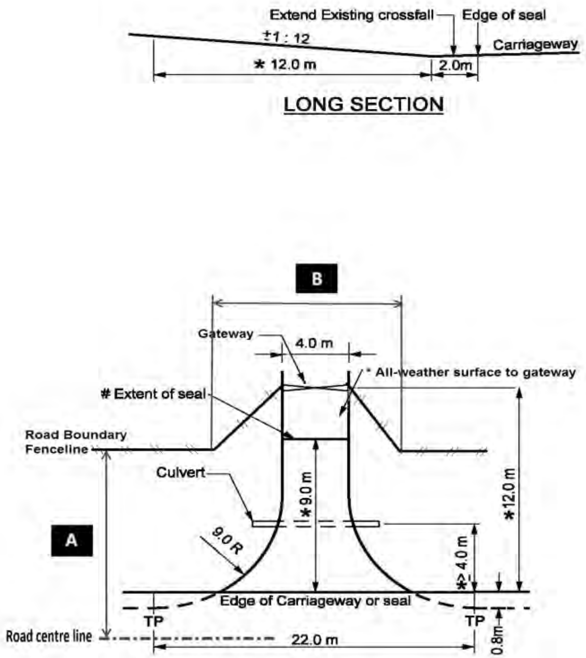
Approved by: Road Corridor Manager

TS 307.1

Version: January 2014

Figure 38: TS 307.1 Entranceways without kerb or kerb and channel and for rural zones: Residential < 2 ha

LIGHT COMMERCIAL 2 HA - 20 HA



Fence Opening

A	B
4	19
5	16
6	13
7	11
8	9.5
9	8.5
10	7.5
11	6.5
12	6
13	5.5
14	5
15	4.5

★ Minimum requirement in Rural Areas.
\# Seal to extend to property boundary in Urban Areas.

NOTES

1.0 GENERAL

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1.2 The Contractor shall be responsible for traffic control while undertaking work within the road reserve. All signage shall be in accordance with Transit New Zealand's COPTTM, or Local Road Supplement, as specified by the relevant Council

1.3 The Contractor shall be responsible for the cost of repairs to any underground utility services damaged during construction. Any damage shall be rectified to the satisfaction of the Utility Owner.

1.4 A Residential Vehicle Entrance is deemed to be adequate to accomodate a 5m long car turning into a property at a radius of 7.5m.

1.5 The centreline of entrance formation meets carriageway not <70°.

2.0 LOCATION

2.1 Each entrance shall be located to provide clear sight distance in both directions in accordance with Vol 5. Pt 3 Clause 13.0.

2.2 Separation distances shall be as indicated on DCS 302

3.0 CULVERT

3.1 If an entrance crosses a public drain the Contractor shall notify the relevant authority who will advise the correct culvert diameter.

3.2 If the entrance crosses a watertable or small drain (less than 2m wide by 1m deep), a 300mm diameter minimum Reinforced Concrete Rubber Ring Joint (R.C.R.R.J.) Class X pipe shall be installed.

3.3 Any unsuitable bedding material including vegetation, topsoil and peat shall be removed and replaced in accordance with pipe manufacturers specifications.

3.4 All culverts shall be laid straight at a constant grade, a minimum of 4.0m from the edge of carriageway. Socket end shall always be uphill

3.5 Culvert shall extend minimum of 0.5 beyond toe of the entrance fill slope. The existing drain / watertable may require redirection to accommodate the clear distance required from the existing edge of seal.

4.0 SUBBASE

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6.3 Cement concrete surfacing is not permitted.

Waipa District Council
Service Delivery Development Manual

ENTRANCEWAYS WITHOUT KERB OR KERB AND CHANNEL AND FOR RURAL ZONES

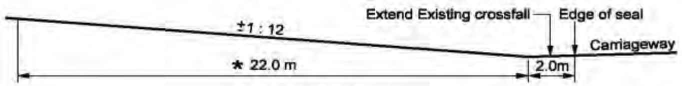
Approved by: Road Corridor Manager

TS 307.2

Version: January 2014

Figure 39: TS 307.2 Entranceways without kerb or kerb and channel and for rural zones: Light commercial 2 ha – 20 ha

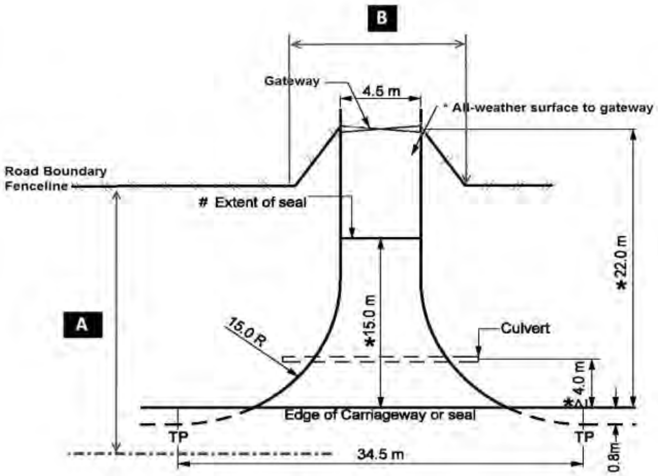
HEAVY COMMERCIAL > 20 HA



LONG SECTION

Fence Opening

A	B
3	25
4	23
5	21
6	19
7	17
8	15
9	13
10	11
11	10.2
12	9.4
13	8.7
14	7.9
15	7.1
16	6.3
17	5.6
18	4.8



* Minimum requirement in Rural Areas.
# Seal to extend to property boundary in Urban Areas.

NOTES

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3.5 Culvert shall extend minimum of 0.5 beyond toe of the entrance fill slope. The existing drain / watertable may require redirection to accommodate the clear distance required from the existing edge of seal.

4.0 SUBBASE

4.1 A CBR >10 must be achieved on the sub-grade level before the placement of sub-base material. If this CBR cannot be achieved, Council's roading consent staff will advise how to proceed. This may involve an additional depth of pavement construction, or the installation of geosynthetics.

4.2 Pit sand, brown rock or similar material shall be placed, trimmed and compacted to provide 150mm depth of subbase if required. The subbase shall be placed from the edge of the carriageway to the gate or cattlestop.

5.0 BASECOURSE

5.1 Clean good quality G.A.P. 40 basecourse metal shall be placed, trimmed and compacted to provide 100mm depth of basecourse from the carriageway to the gate or cattlestop.

5.2 The basecourse material shall be trimmed to provide a crown in the centre of the entrance to ensure adequate surface drainage. The crossfall shall be -5% from the crown.

6.0 SURFACING

6.1 If the entrance is off a metal surfaced road, NO additional surfacing over the basecourse material will be required.

6.2 Each entrance off a sealed road shall be surfaced with a two coat bitumen/chip seal as a minimum surfacing standard. The surfacing shall be constructed with 180/200 grade bitumen and Grade 3 and 5 chip.

6.3 Cement concrete surfacing is not permitted.

Waipa DISTRICT COUNCIL
Service Delivery
Development Manual

ENTRANCEWAYS WITHOUT KERB OR KERB AND CHANNEL AND FOR RURAL ZONES

Approved by: Road Corridor Manager

TS 307.3

Version: January 2014

Figure 40: TS 307.3 Entranceways without kerb or kerb and channel and for rural zones: Heavy commercial > 20 ha

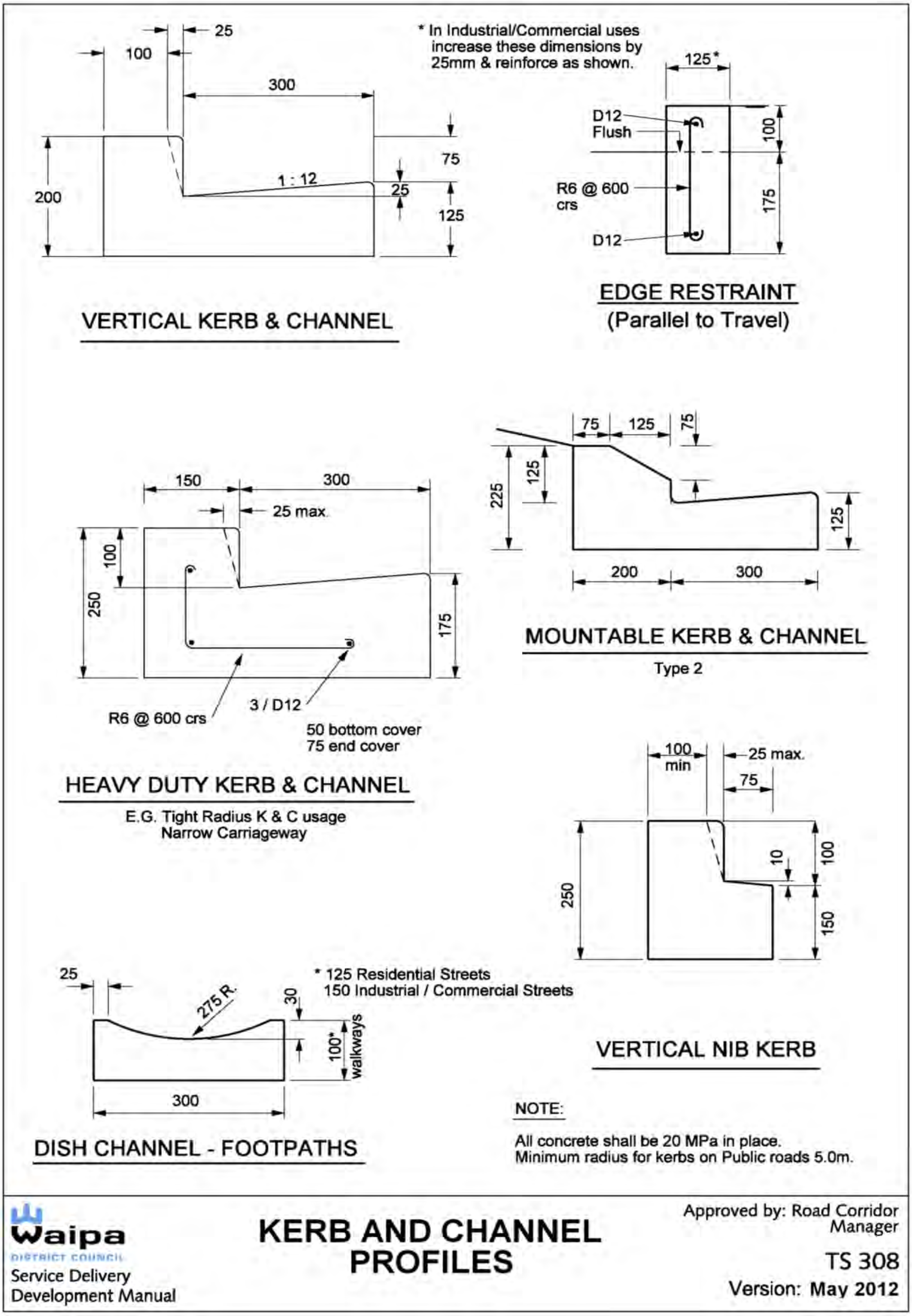


Figure 41: TS 308 Kerb and channel profiles

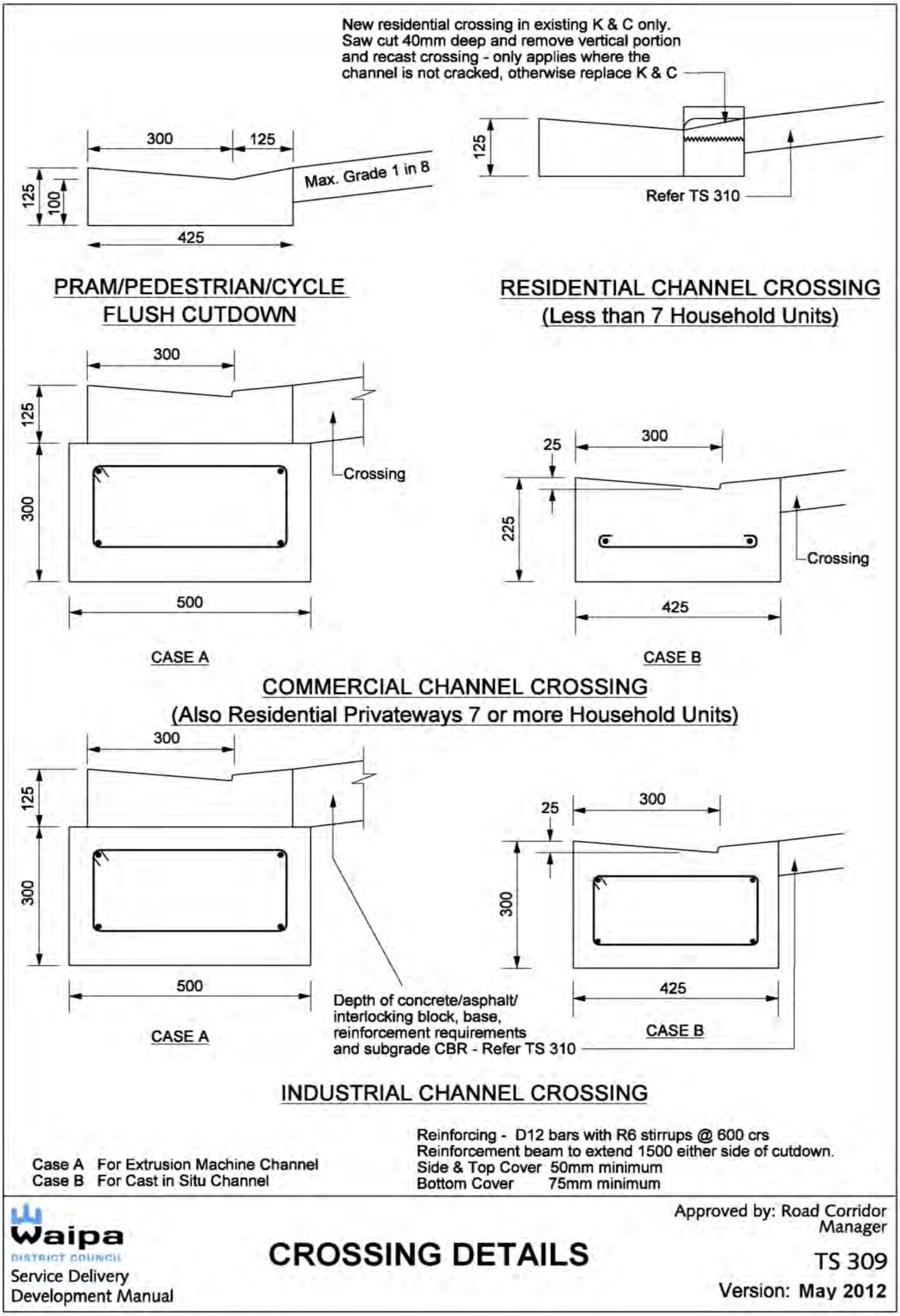


Figure 42: TS 309 Crossing details

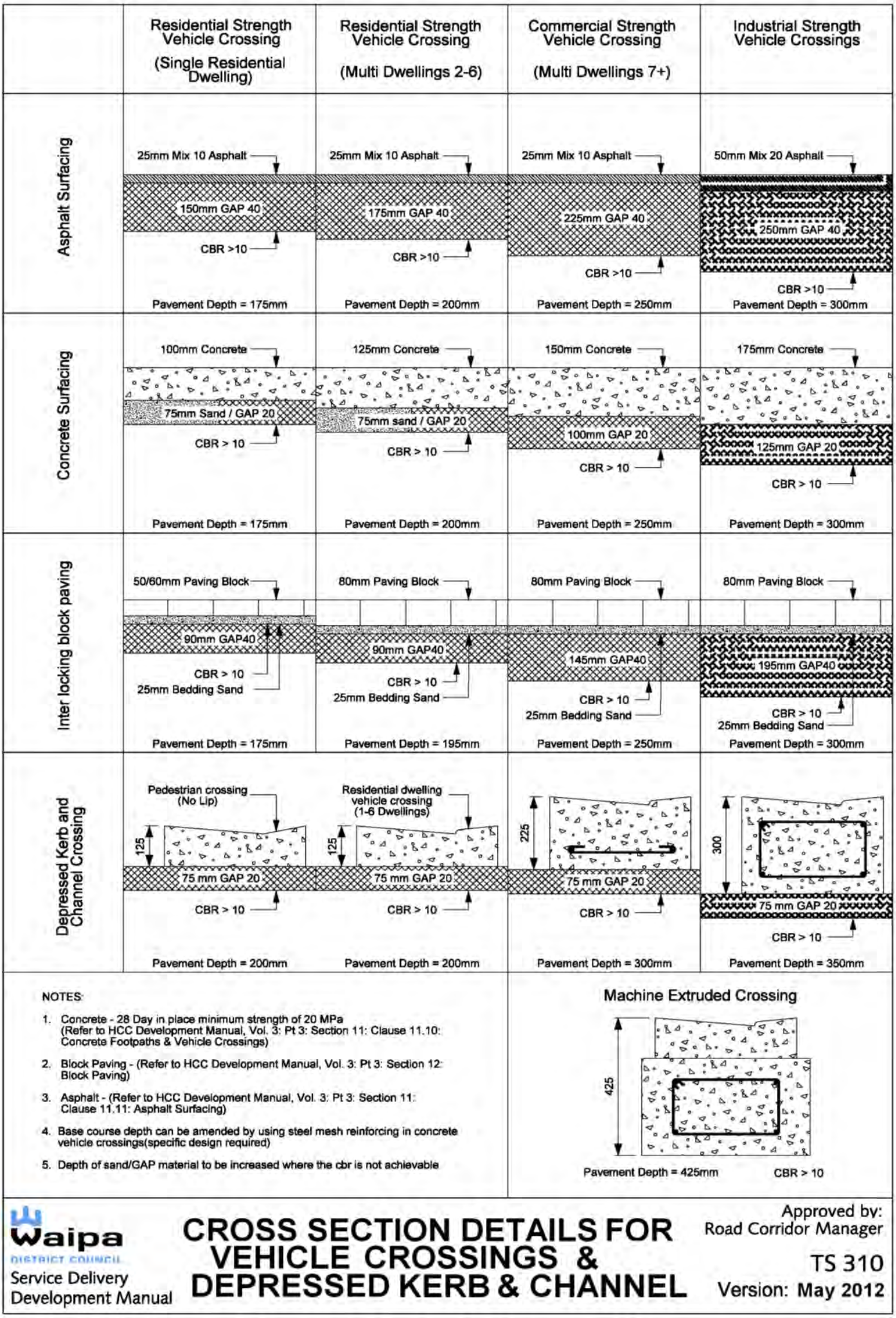


Figure 43: TS 310 Cross section details for vehicle crossings and depressed kerb and channel

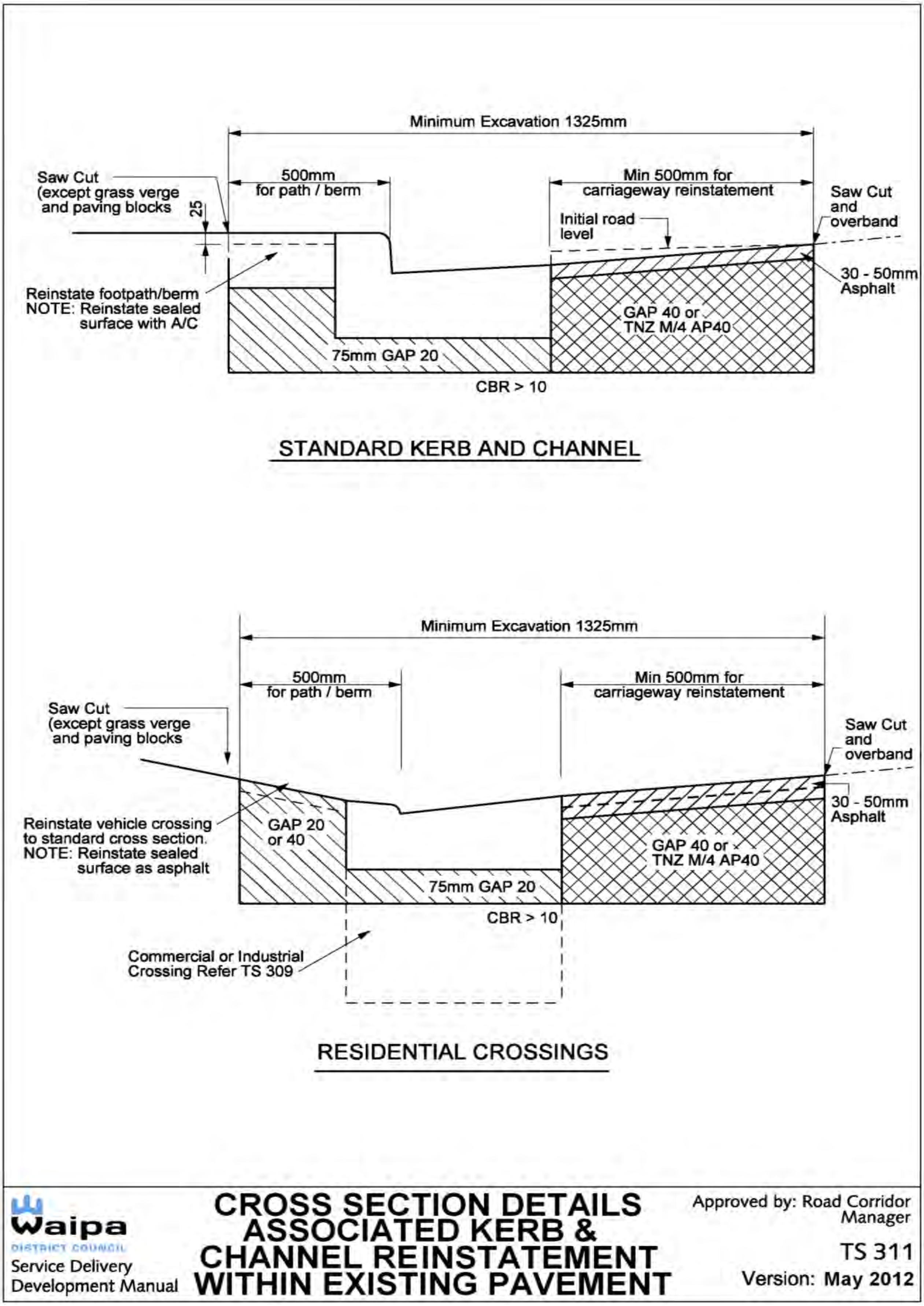


Figure 44: TS 311 Cross section details associated kerb and channel reinstatement within existing pavement

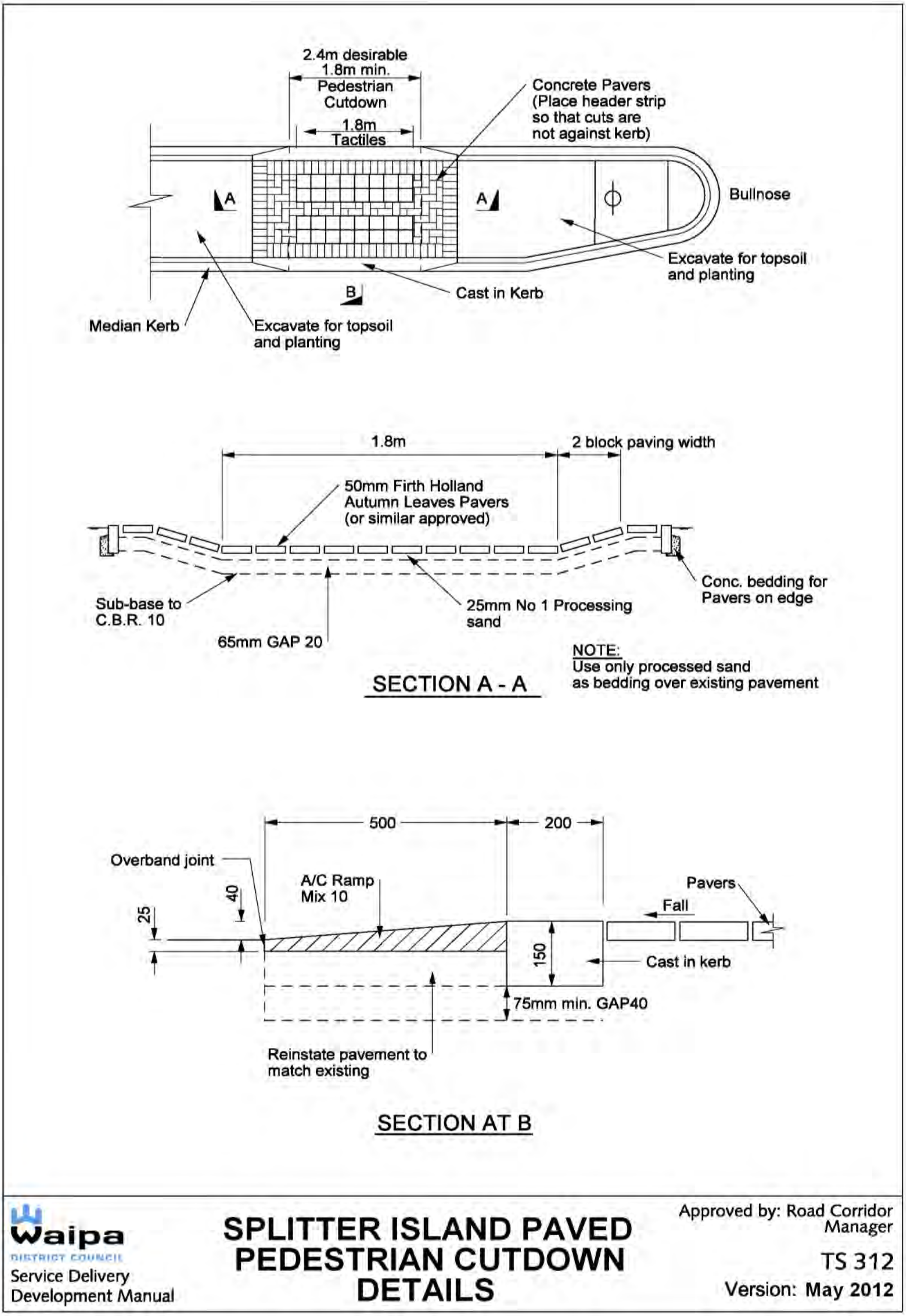


Figure 45: TS 312 Splitter island paved pedestrian cutdown details

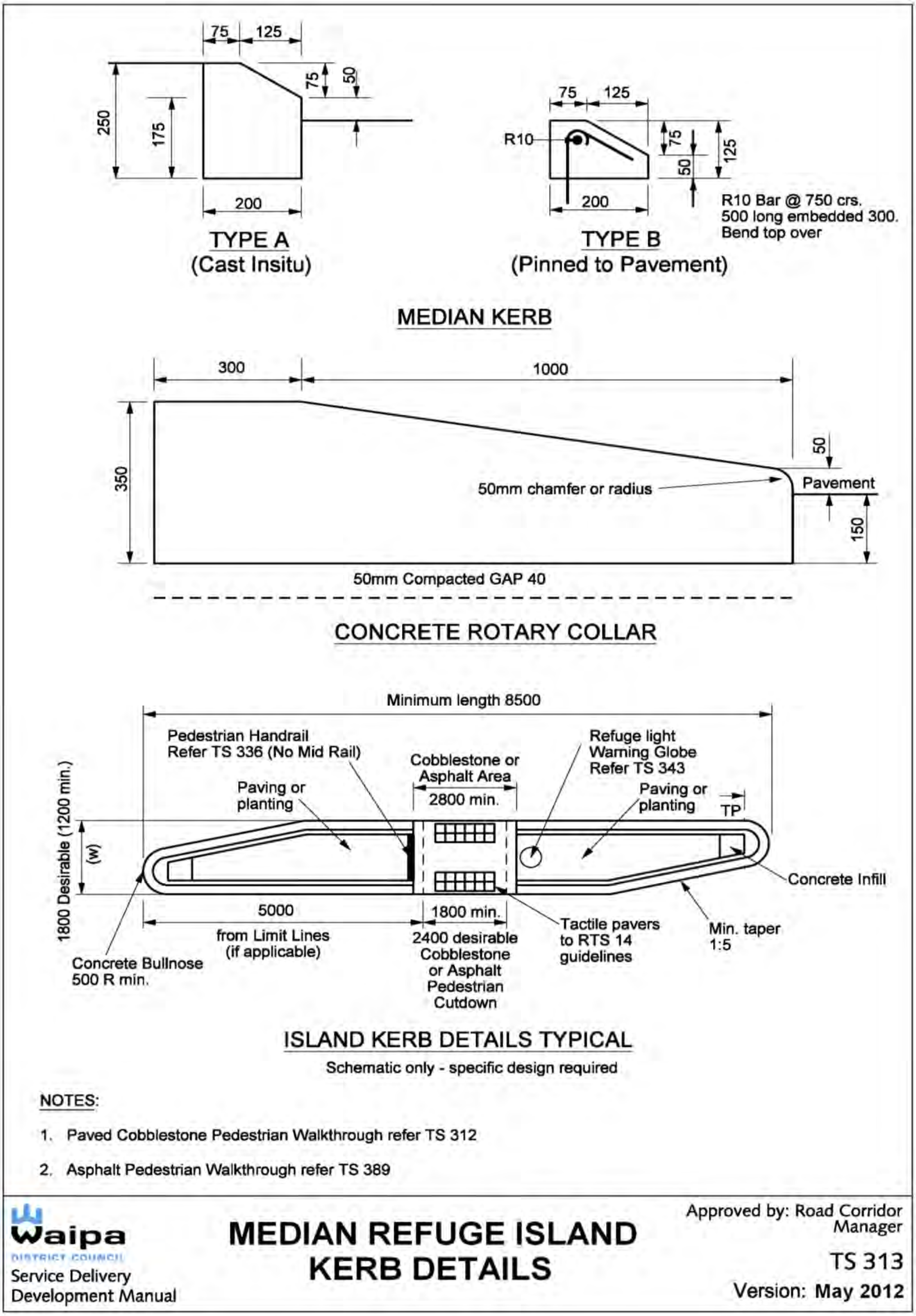


Figure 46: TS 313 Median refuge island kerb details

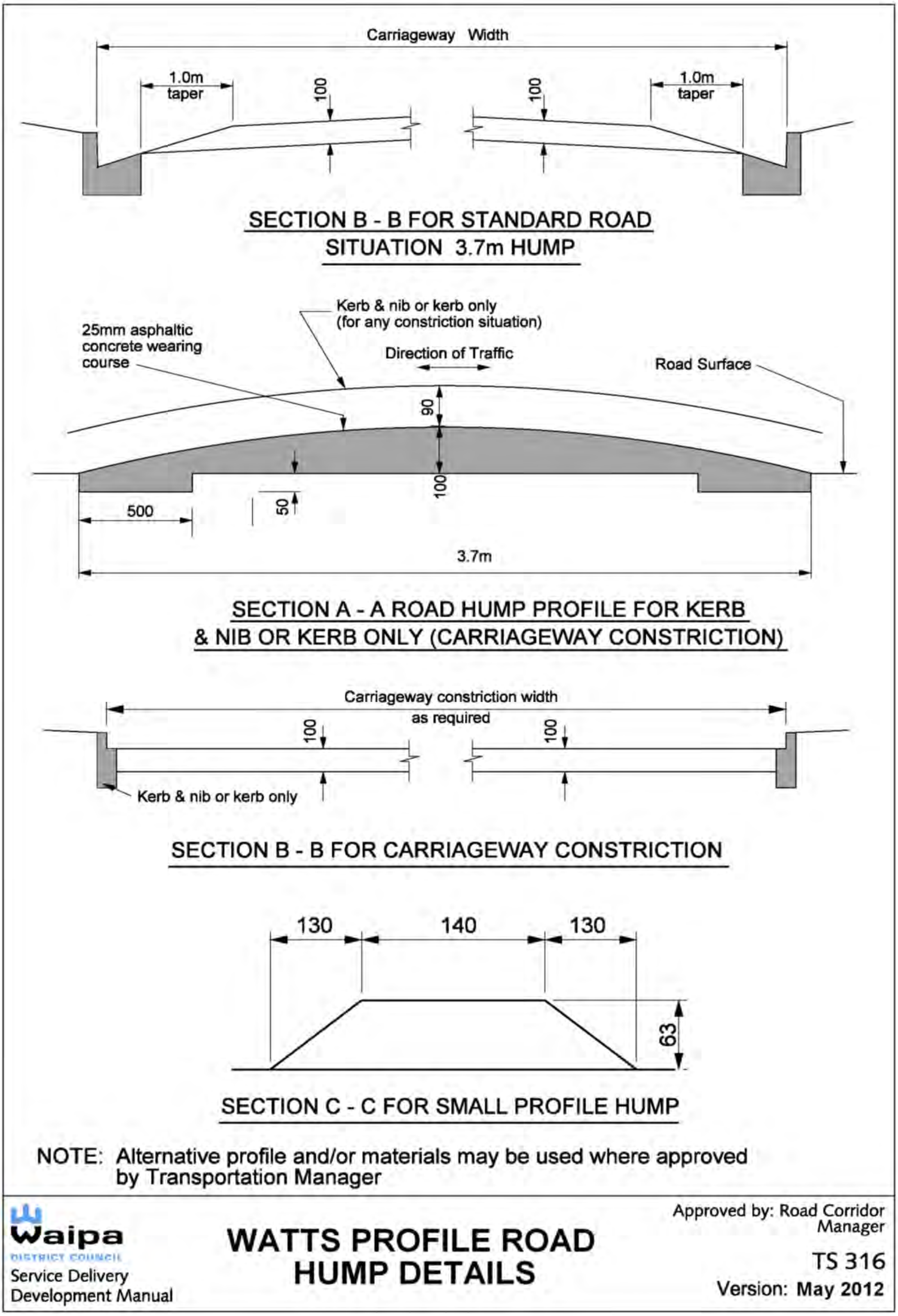


Figure 47: TS 316 Watts profile road hump details

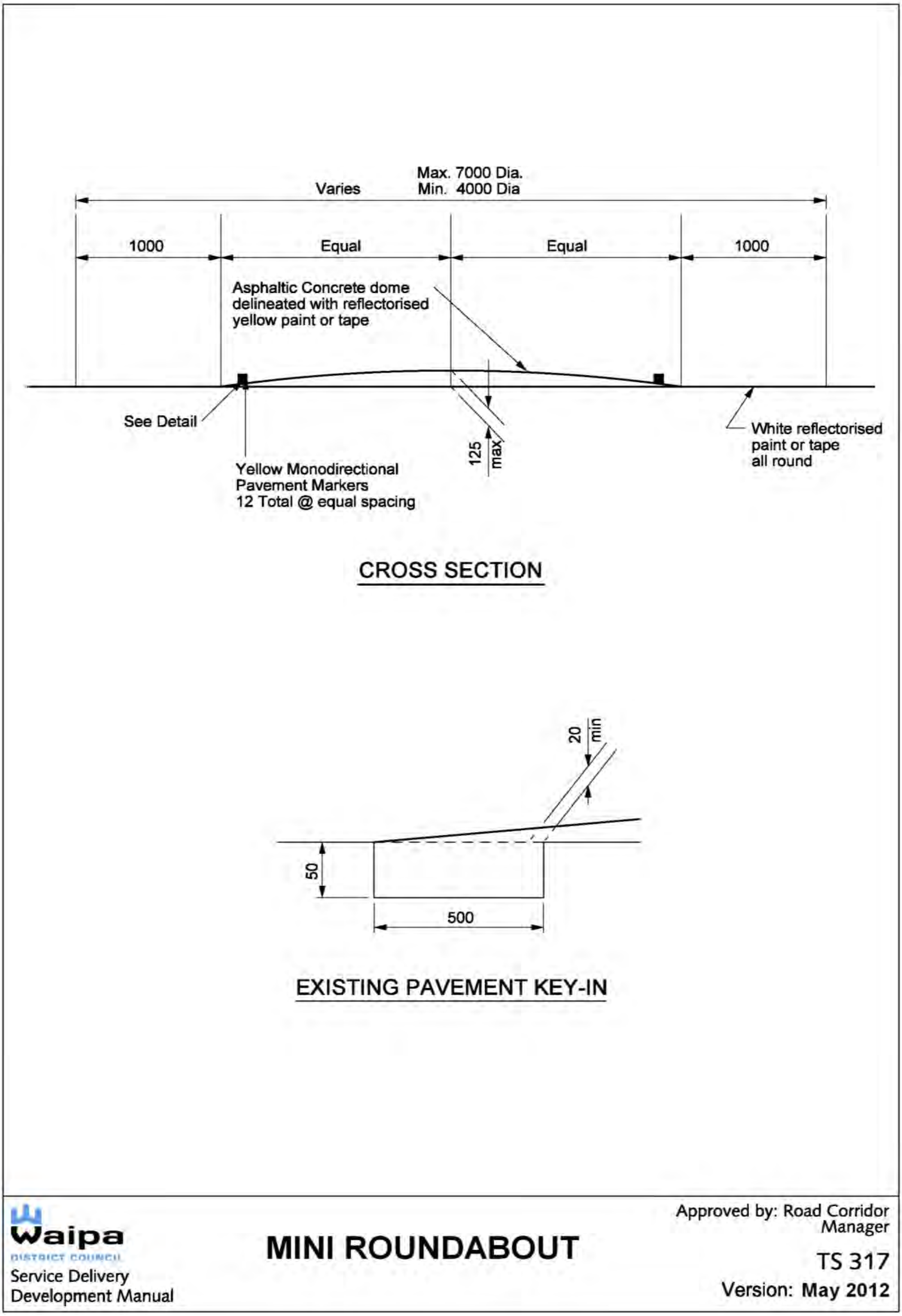


Figure 48: TS 317 Mini roundabout

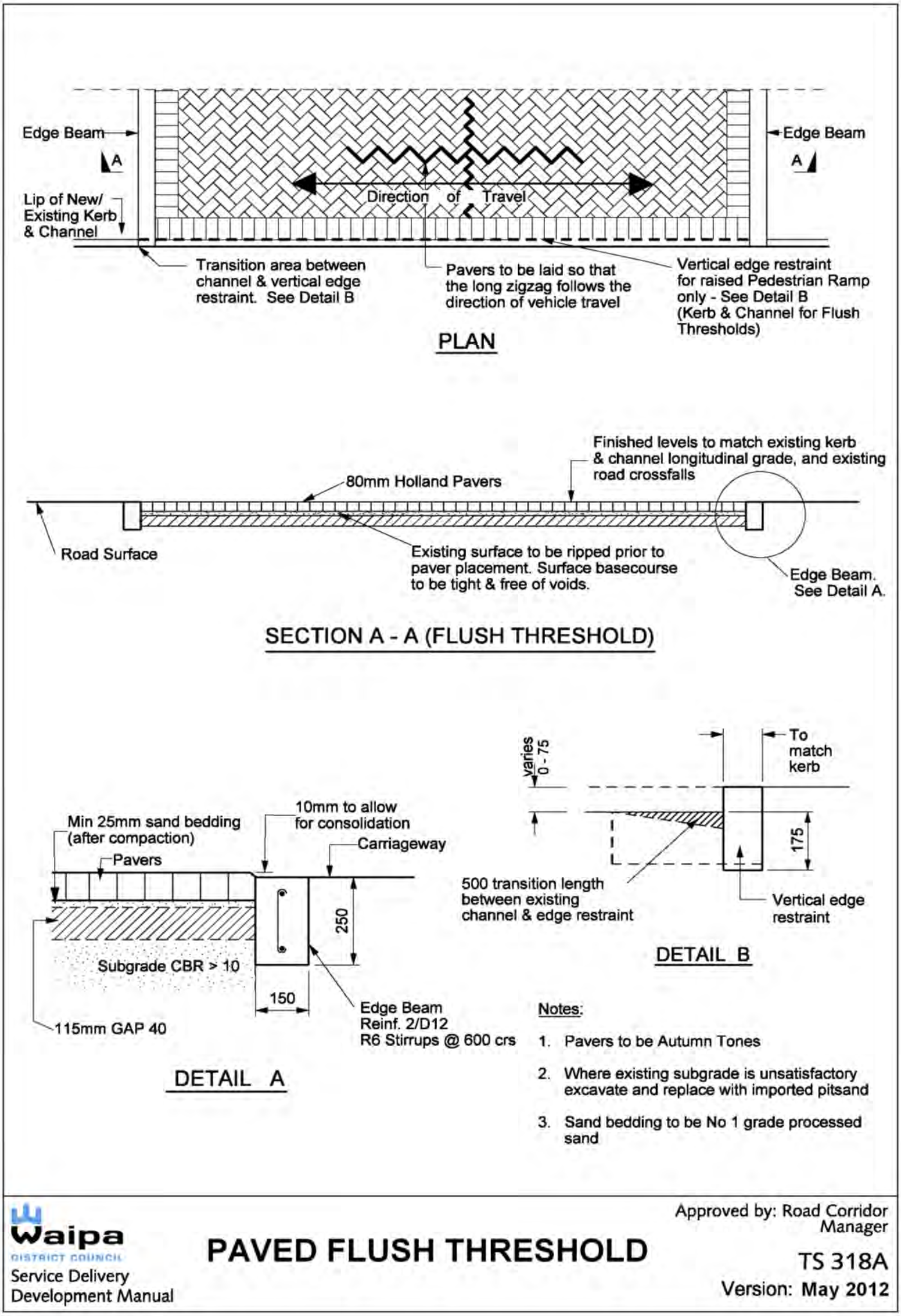
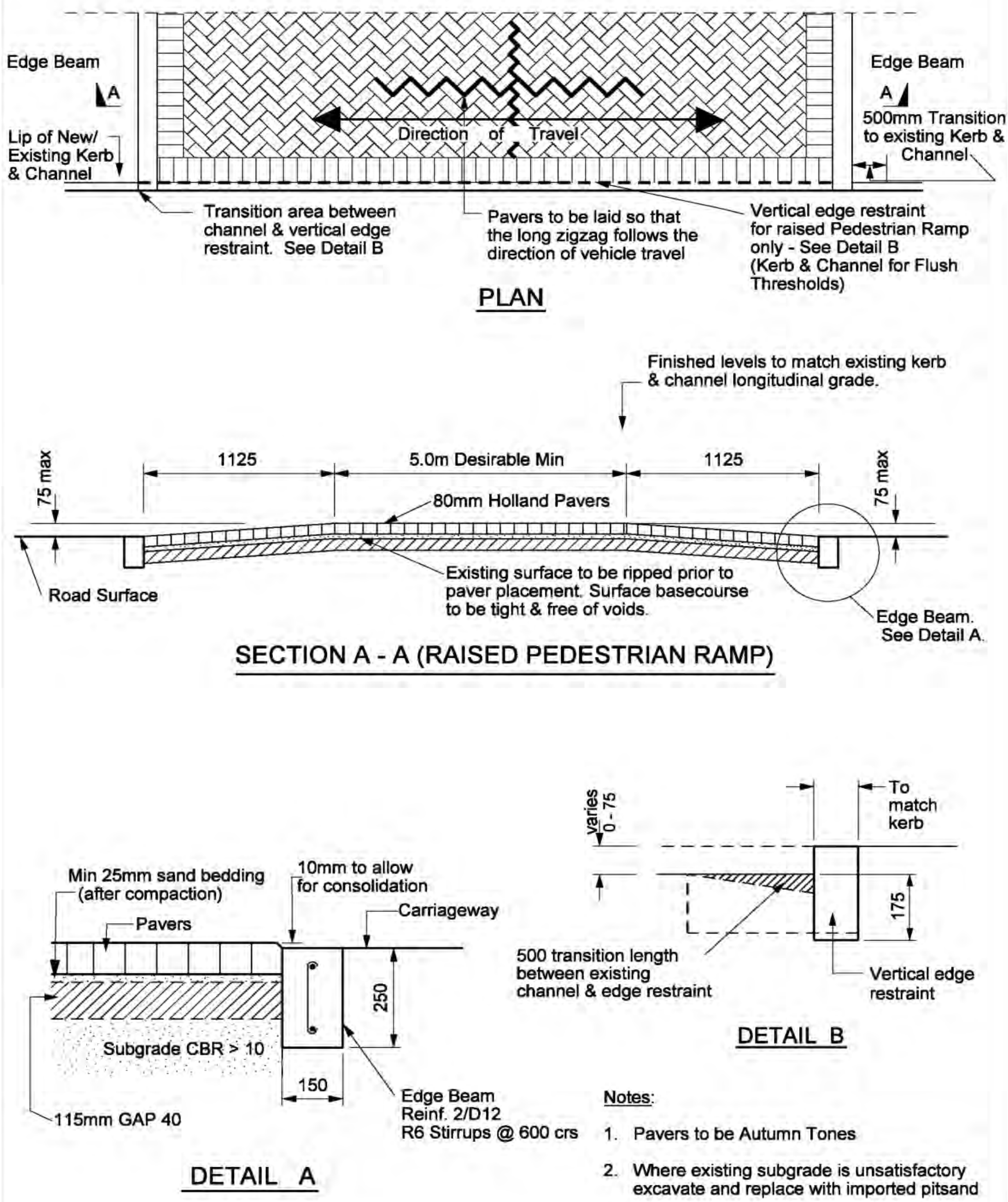


Figure 49: TS 318A Paved flush threshold



Notes:

1. Pavers to be Autumn Tones
2. Where existing subgrade is unsatisfactory excavate and replace with imported pitsand
3. Sand bedding to be No 1 grade processed sand

Waipa District Council
Service Delivery Development Manual

PAVED RAISED PEDESTRIAN RAMP

Approved by: Road Corridor Manager

TS 318 B

Version: May 2012

Figure 50: TS 318B Paved raised pedestrian ramp

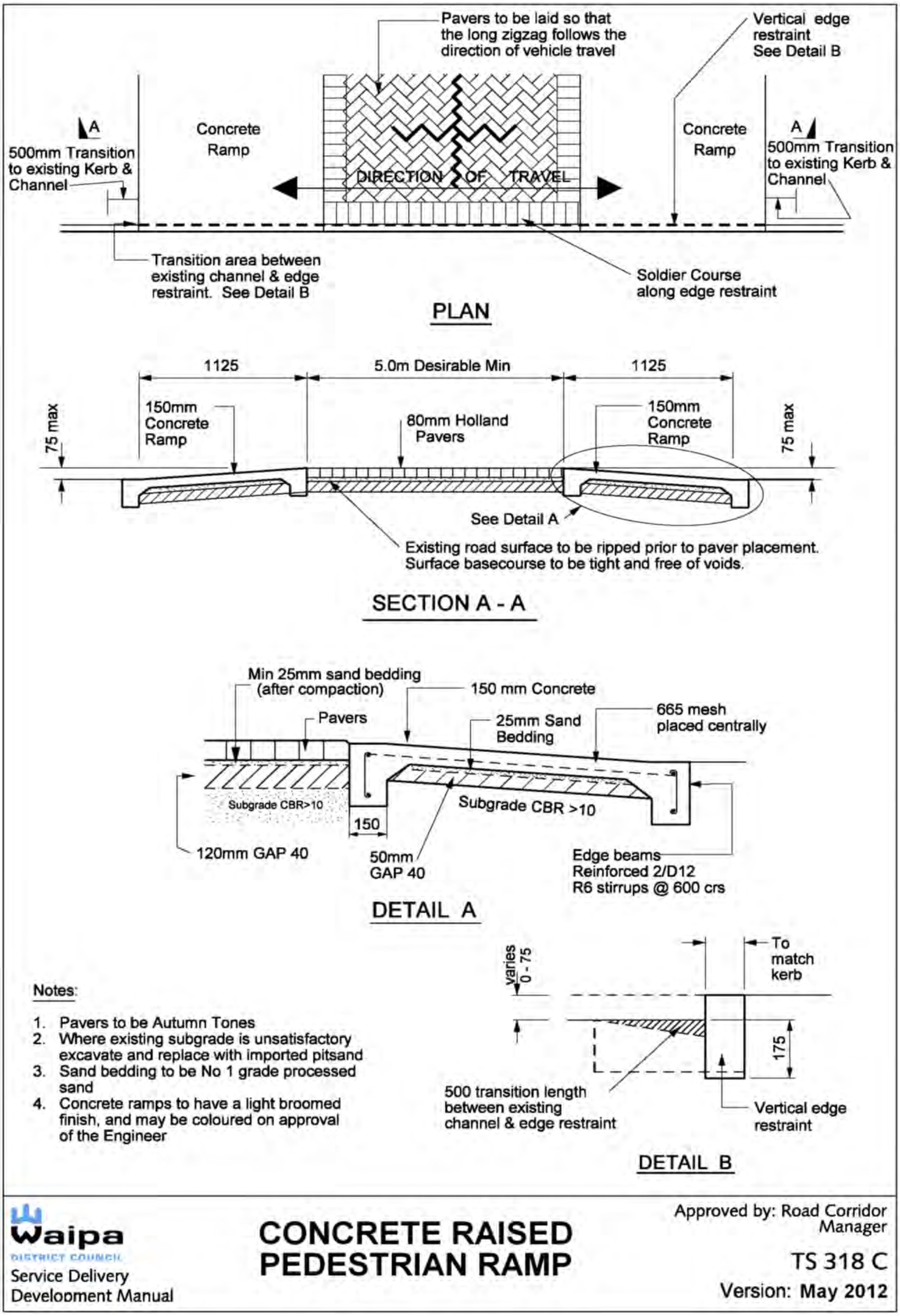


Figure 51: TS 318C Concrete raised pedestrian ramp

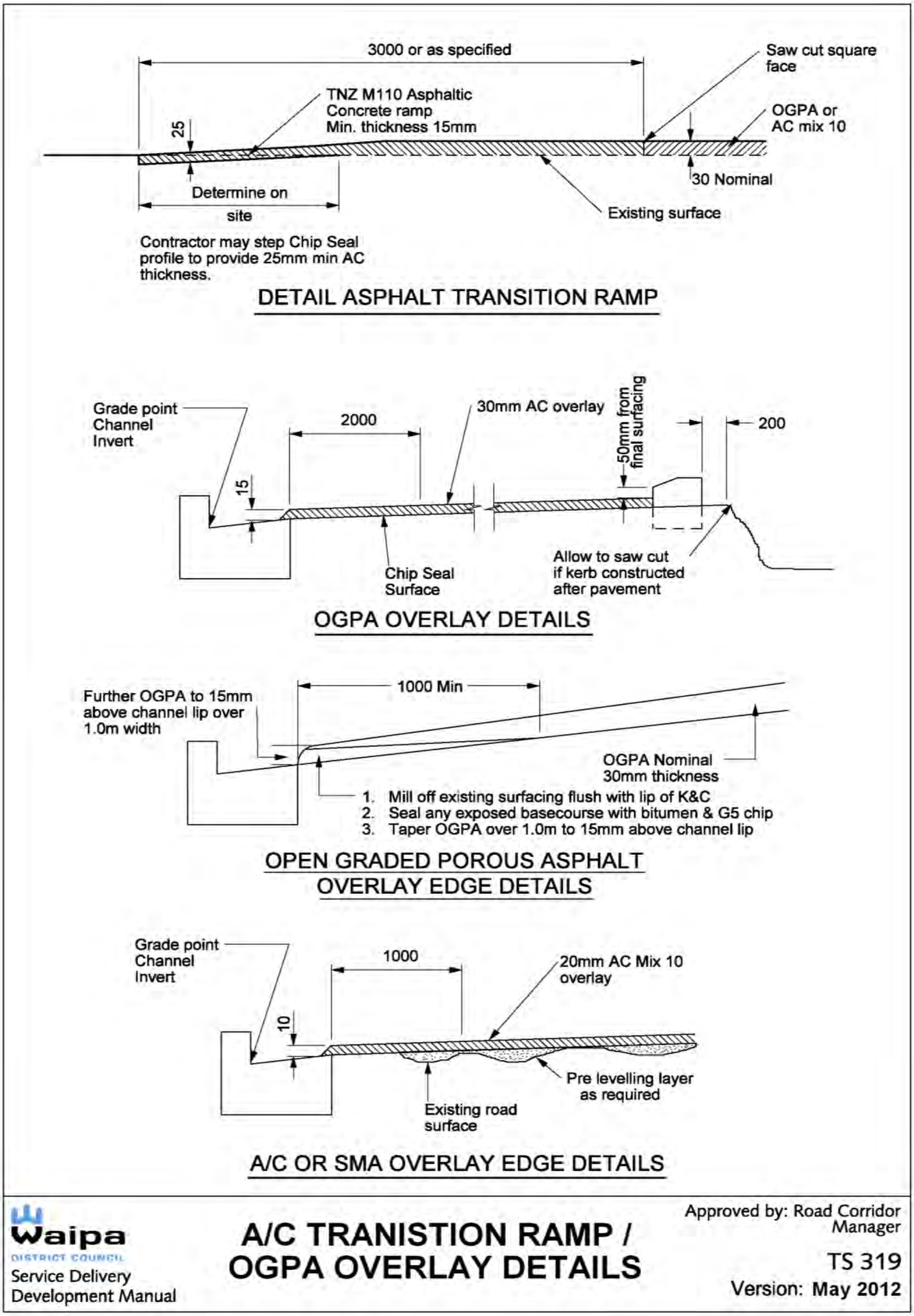


Figure 52: TS 319 A/C transition ramp / OGPA overlay details

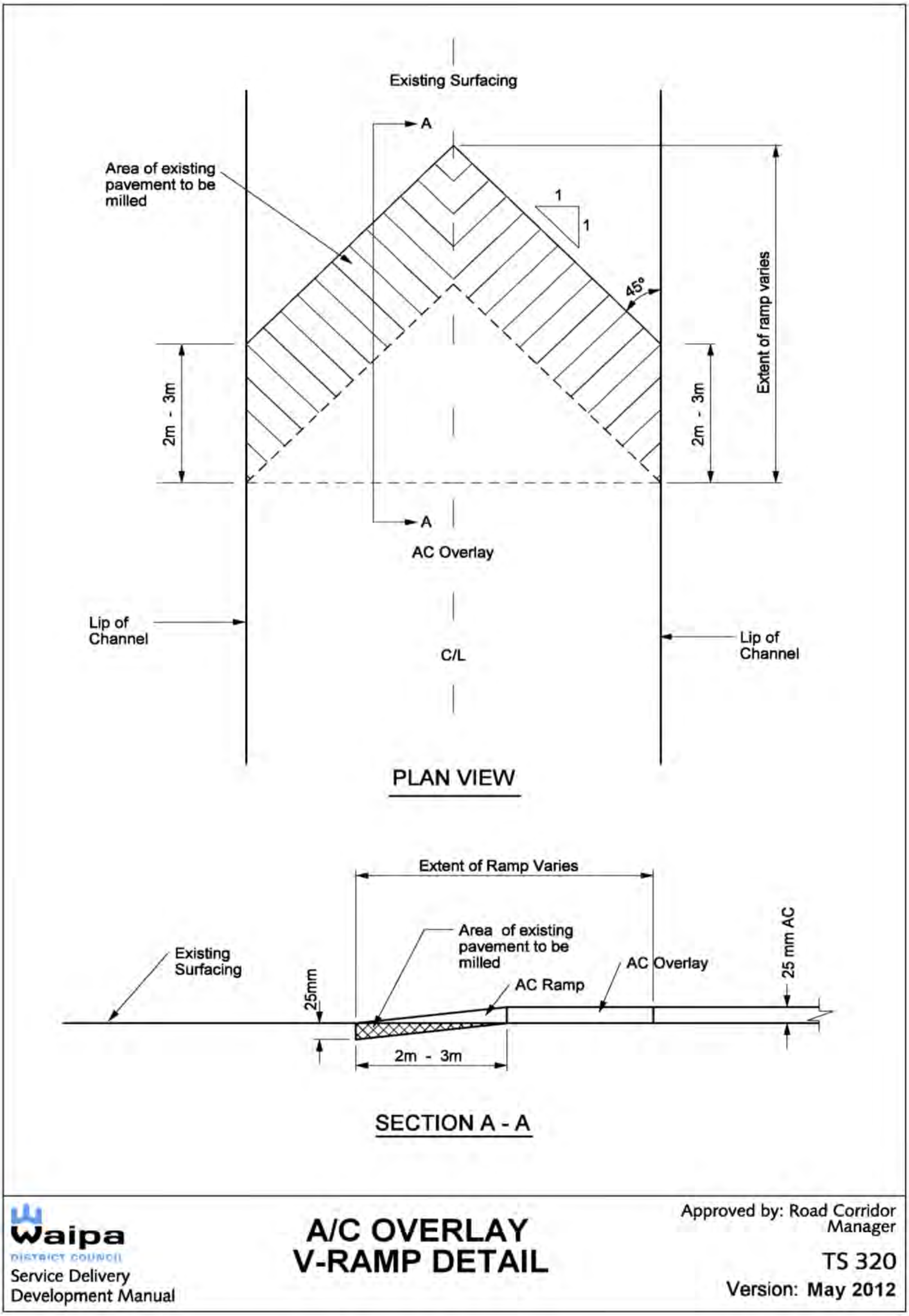


Figure 53: TS 320 A/C overlay v-ramp detail

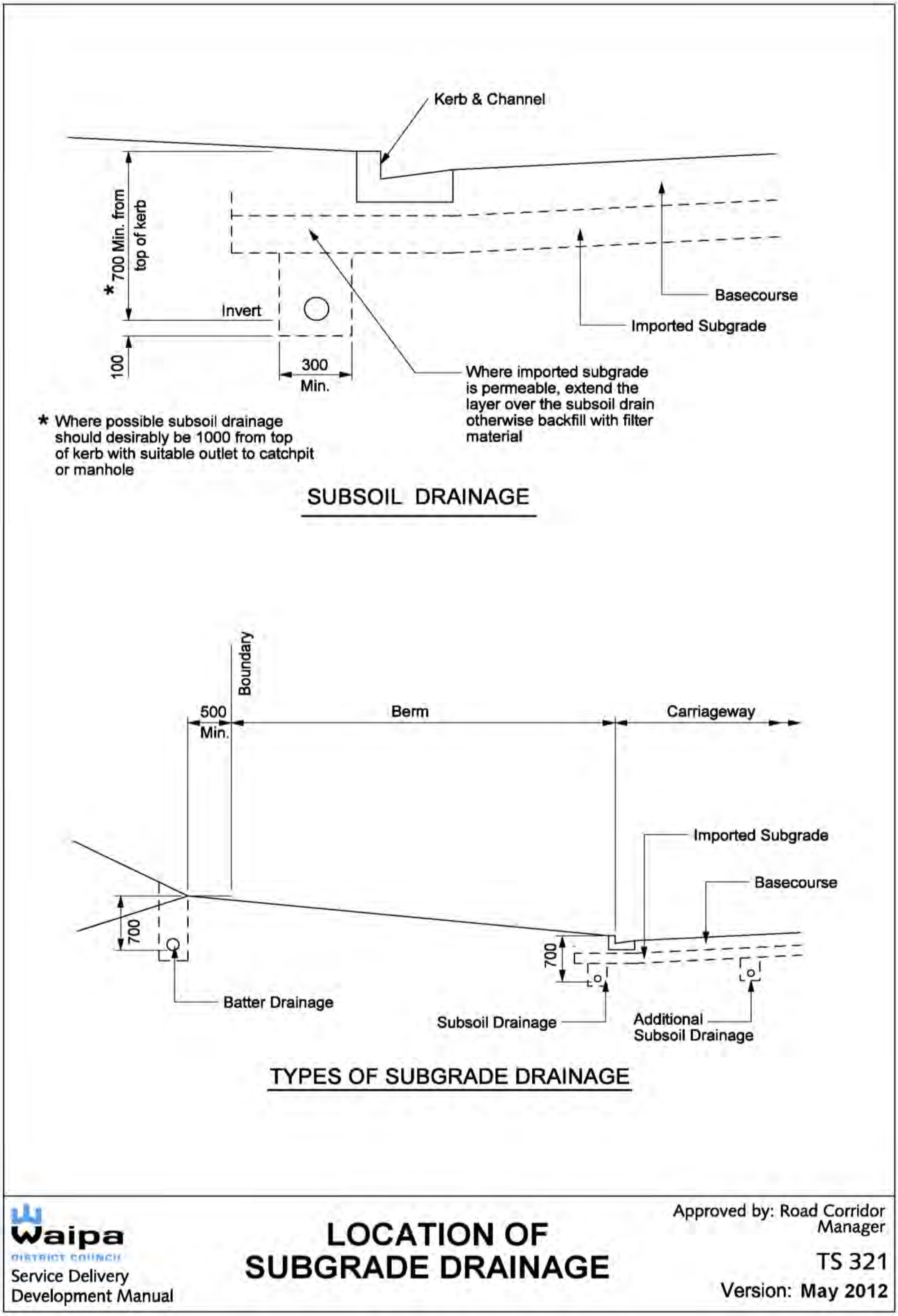


Figure 54: TS 321 Location of subgrade drainage

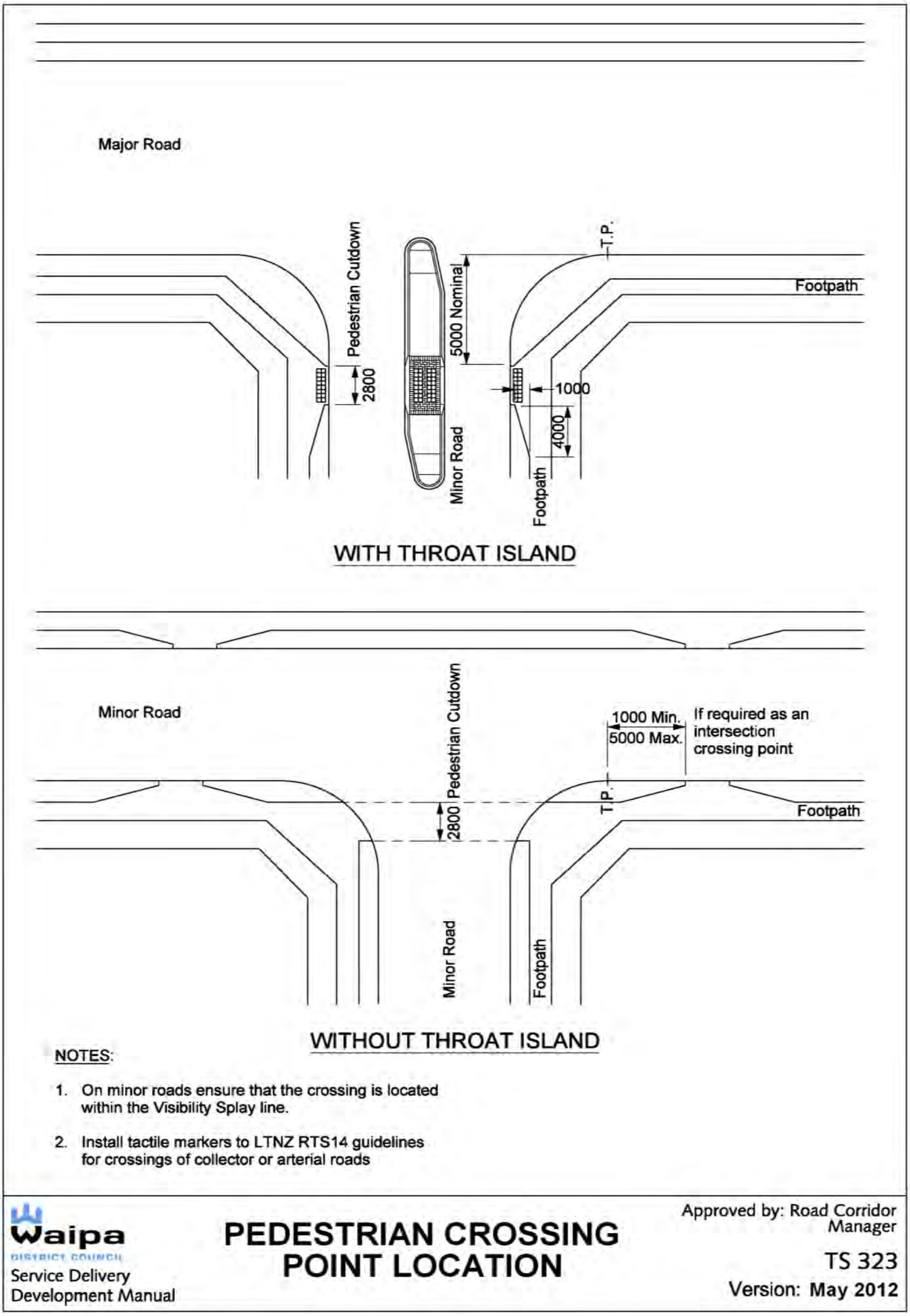


Figure 55: TS 323 Pedestrian crossing point location

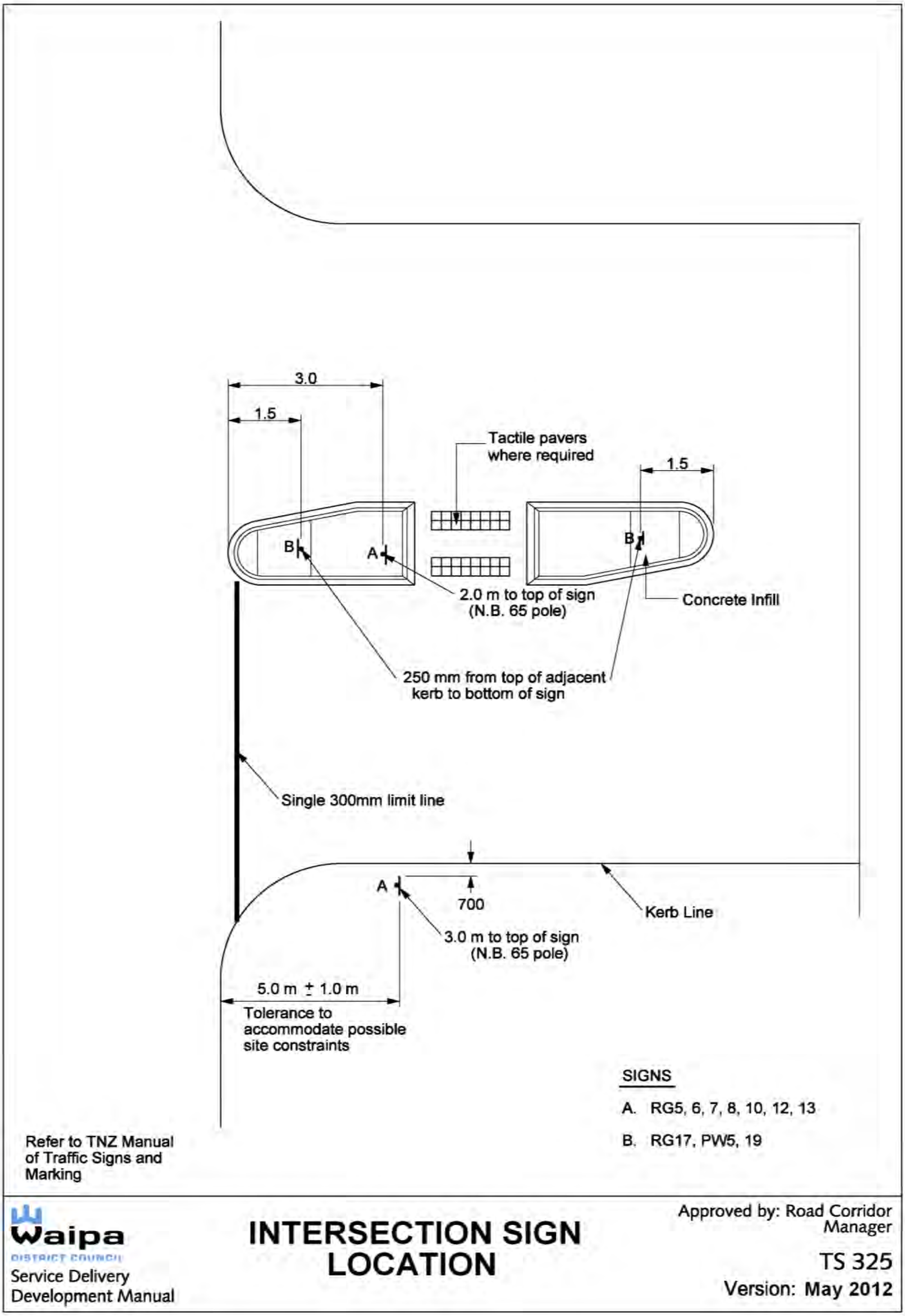
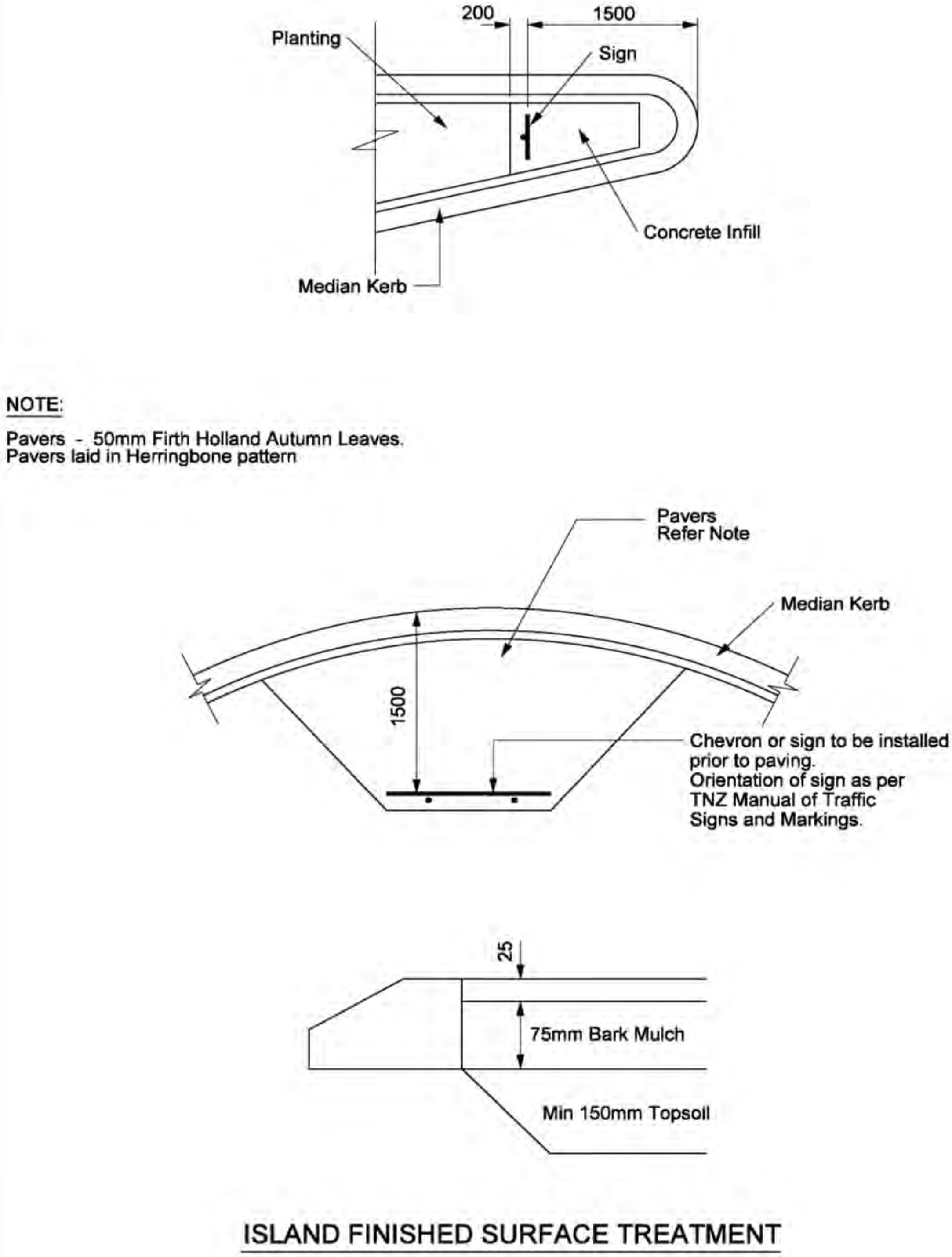


Figure 56: TS 325 Intersection sign location



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TRAFFIC ISLAND SIGN VISIBILITY & PLANTING DETAILS

Approved by: Road Corridor Manager

TS 326

Version: **May 2012**

Figure 57: TS 326 Traffic island sign visibility and planting details

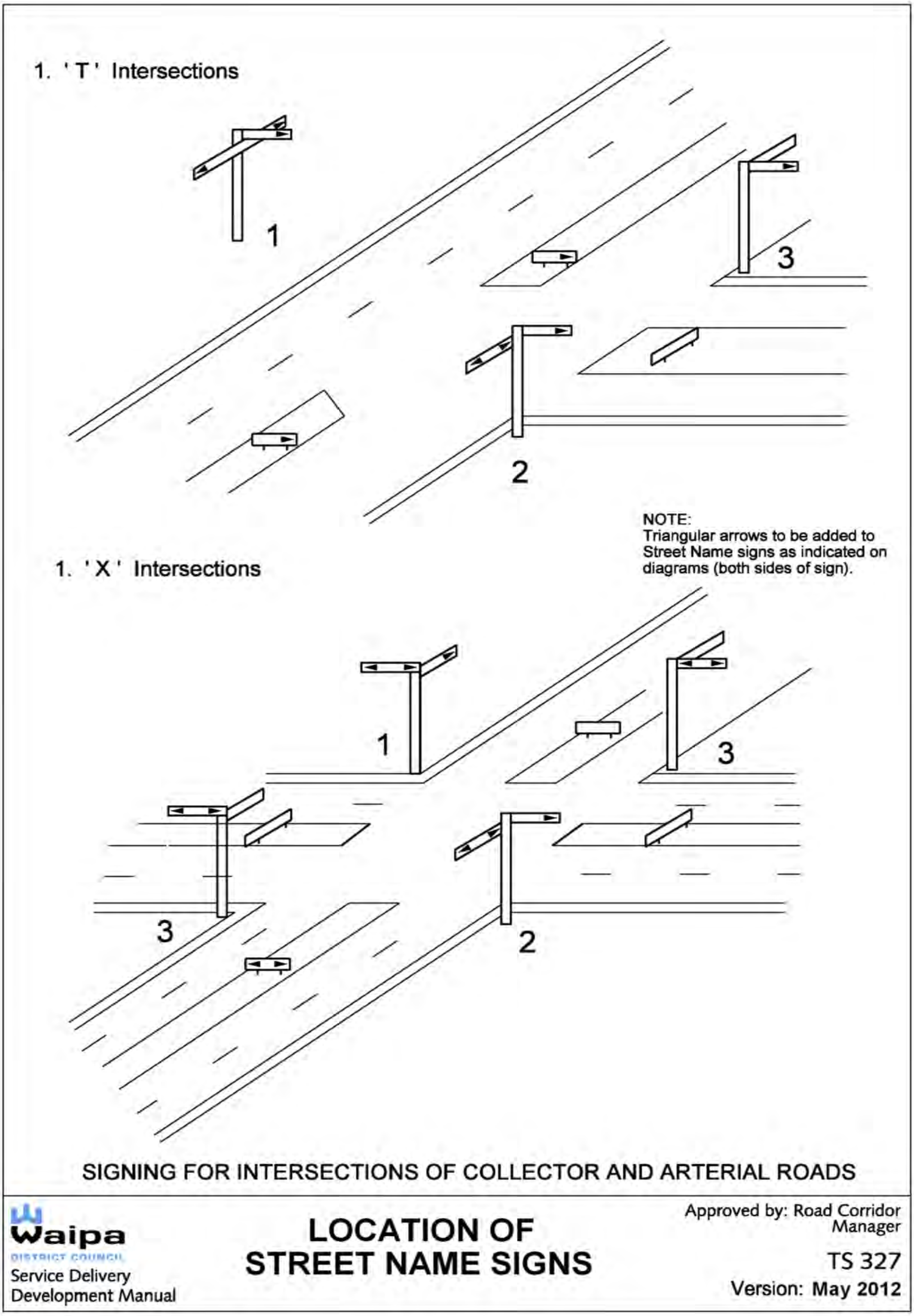


Figure 58: TS 327 Location of street name signs (collector/arterial)

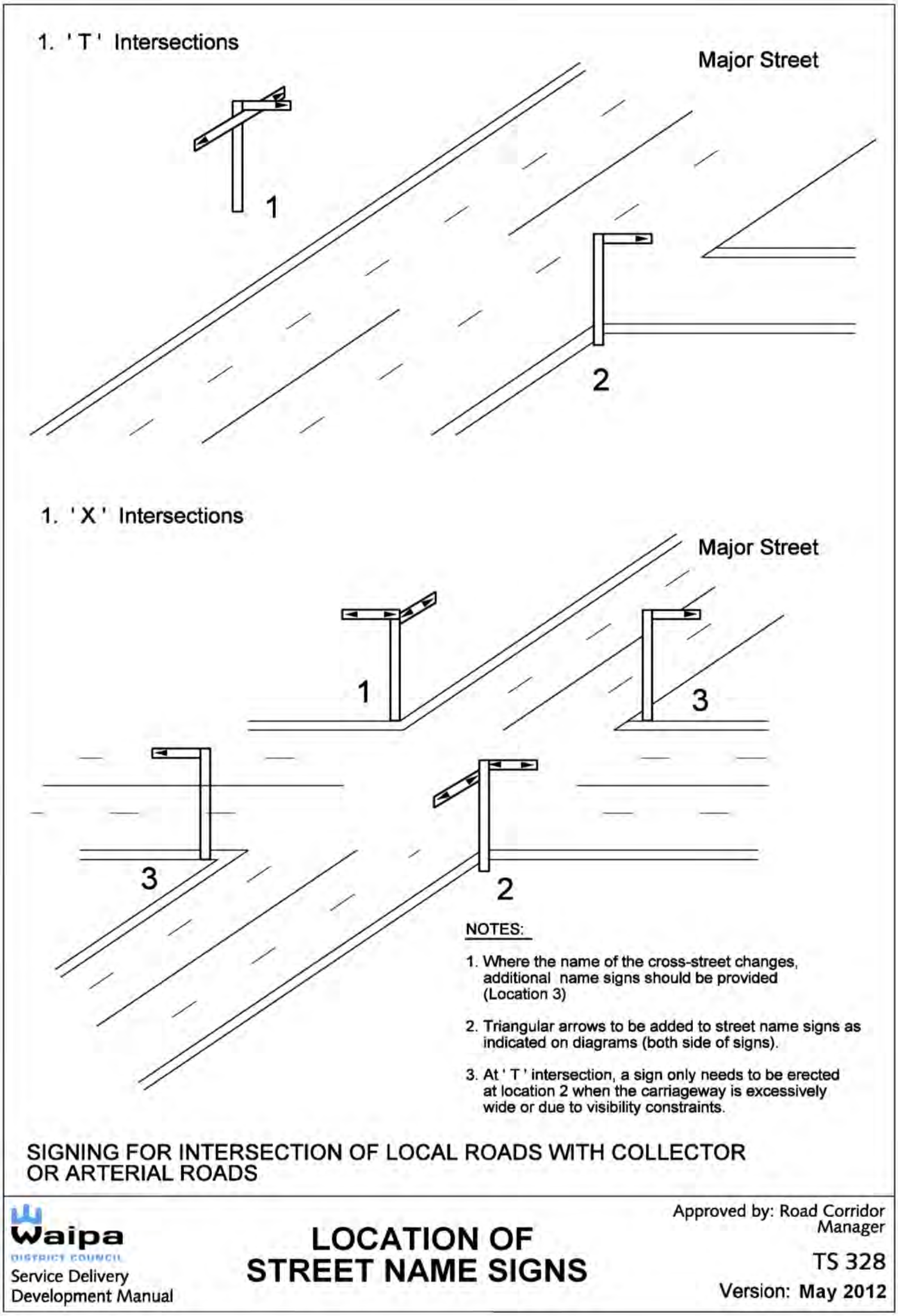


Figure 59: TS 328 Location of street name signs (local/collector or arterial)

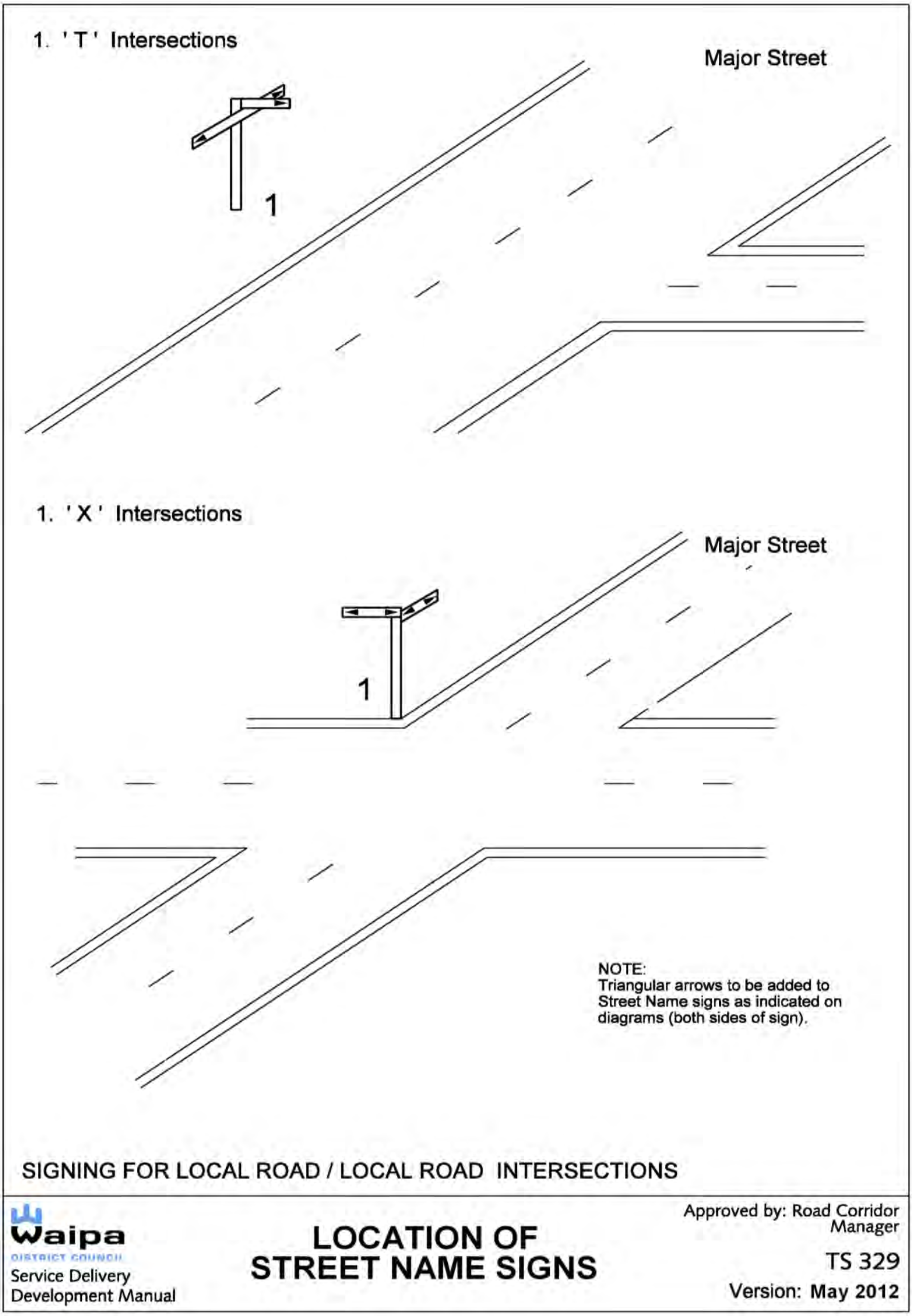
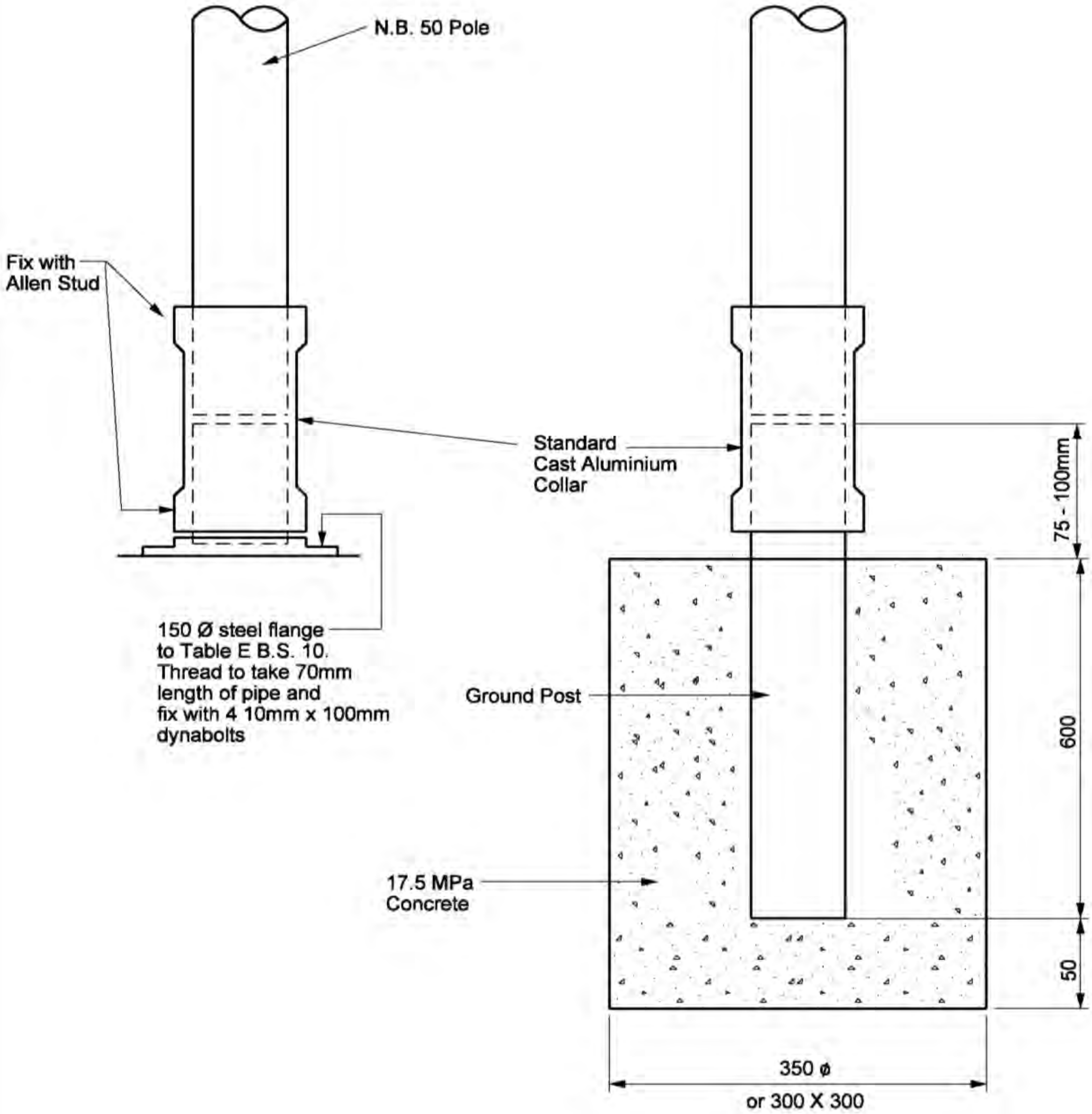


Figure 60: TS 329 Location of street name signs (local/local)



Waipa District Council
Service Delivery
Development Manual

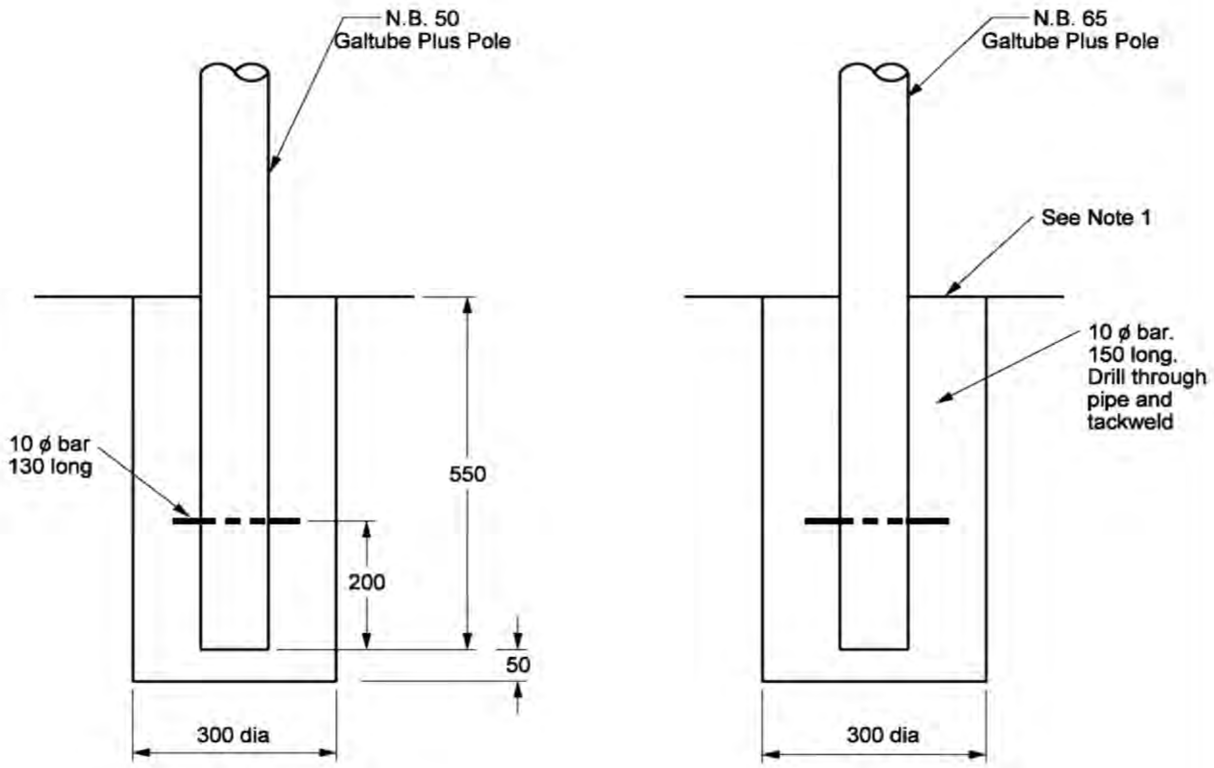
KNOCK DOWN SIGN INSTALLATION - COLLAR TYPE

Approved by: Road Corridor Manager

TS 330

Version: May 2012

Figure 61: TS 330 Knock down sign installation - collar type



NB 50 Galtube Plus Pole

NB 65 Galtube Plus Pole

NOTES:

1. This detail is for grass berm and planting areas only. In all other situations the concrete is to be recessed to allow reinstatement of the surrounding surface up to the pole.
2. Concrete to have 20 MPa in place strength at 28 days.
3. Steel tube shall be:- Cast in-situ in 300 dia concrete surround
4. NB50 poles to be used for:- Road Name signs, Parking, Bus Stop, Truck By-Law, and No Stopping.
5. NB65 poles to be used for all other signs excluding RG17, 17.1, PW5, I9

Waipa District Council
Service Delivery
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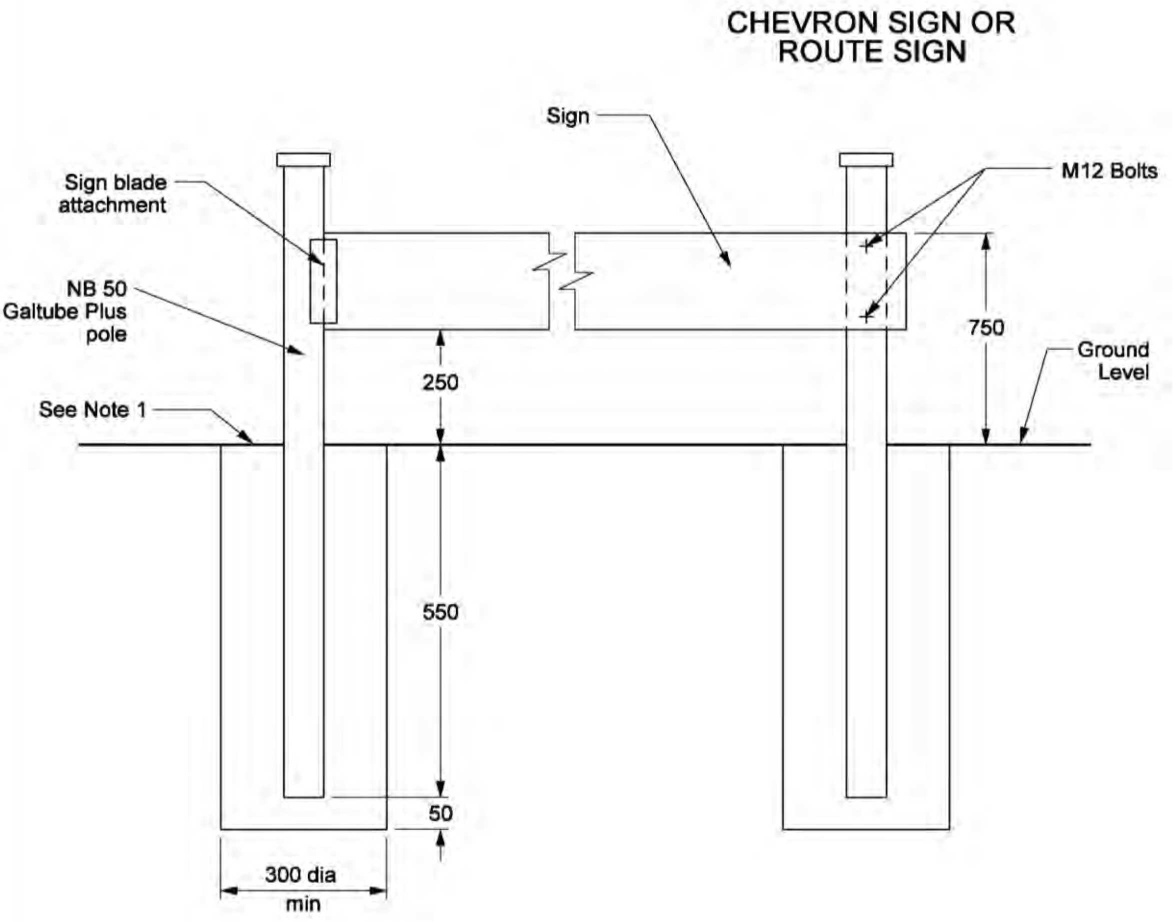
INSTALLATION OF ROAD SIGN POLES

Approved by: Road Corridor Manager

TS 331

Version: **May 2012**

Figure 62: TS 331 Installation of road sign poles



NOTES:

1. This detail is for grass berm and planting areas only. In all other situations the concrete is to be recessed to allow reinstatement of the surrounding surface up to the pole.
2. Steel tube shall be:-
   Cast in-situ in 300 dia concrete surround

Waipa District Council
Service Delivery Development Manual

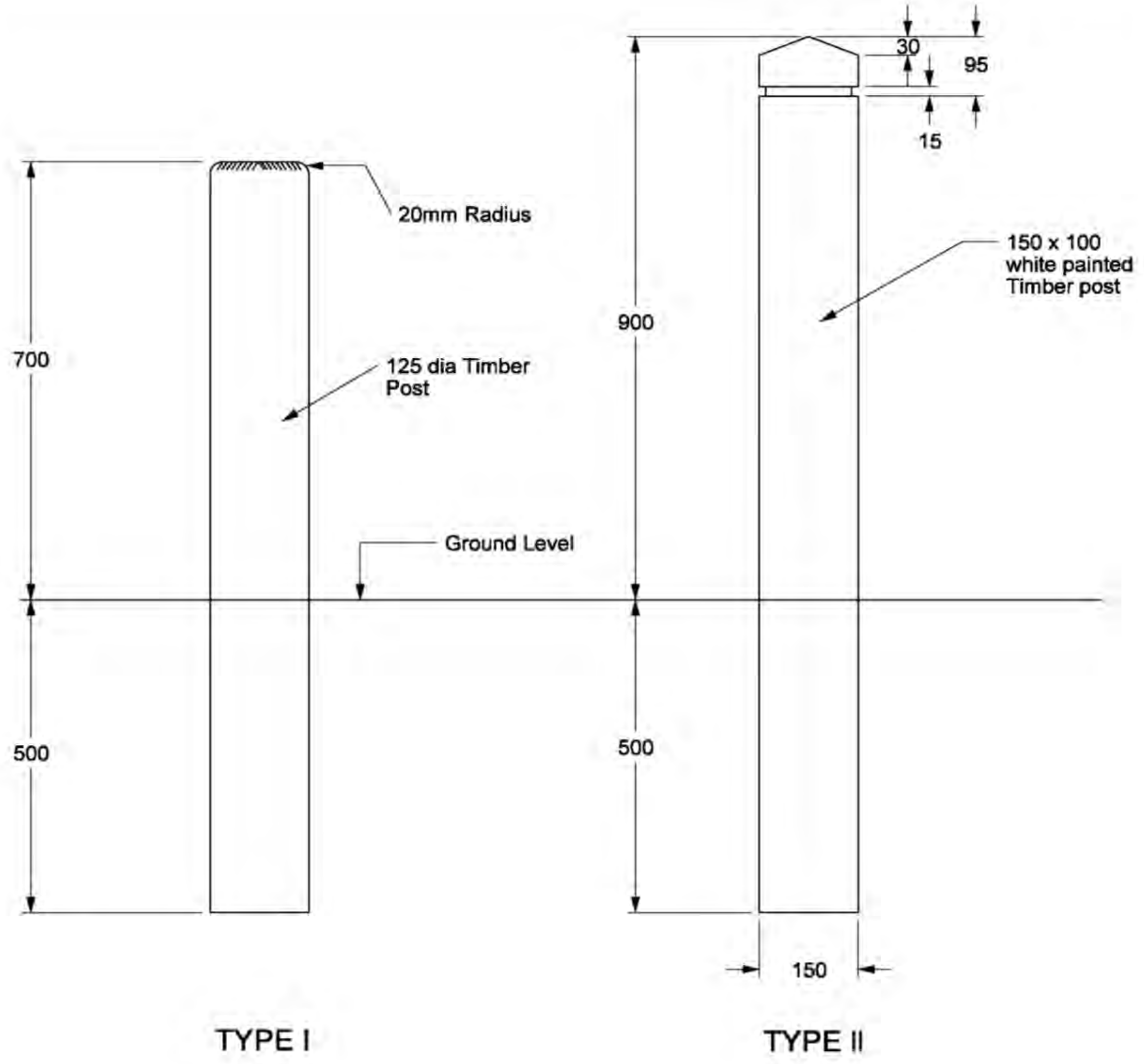
INSTALLATION OF CHEVRON OR ROUTE & LOW LEVEL ROAD NAME SIGN

Approved by: Road Corridor Manager

TS 332

Version: May 2012

Figure 63: TS 332 Installation of chevron or route and low level road name sign



NOTES:

1. Type I Bollards are generally to be installed in grass verge areas.
2. Type II Bollards are generally to be installed in footpath areas.
3. All Bollards are to have a 600mm clearance to the kerb face.
4. For the installation of Type II Bollards, the surrounding surface is to be reinstated.
5. The soil is to be well compacted around the timber bollard.
6. Timber to be H.4 treated.
7. Bollards to be installed at pedestrian crossings are to be Type II but without the groove at the top.

Waipa District Council
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TIMBER BOLLARDS

Approved by: Road Corridor Manager

TS 334

Version: **May 2012**

Figure 64: TS 334 Timber bollards

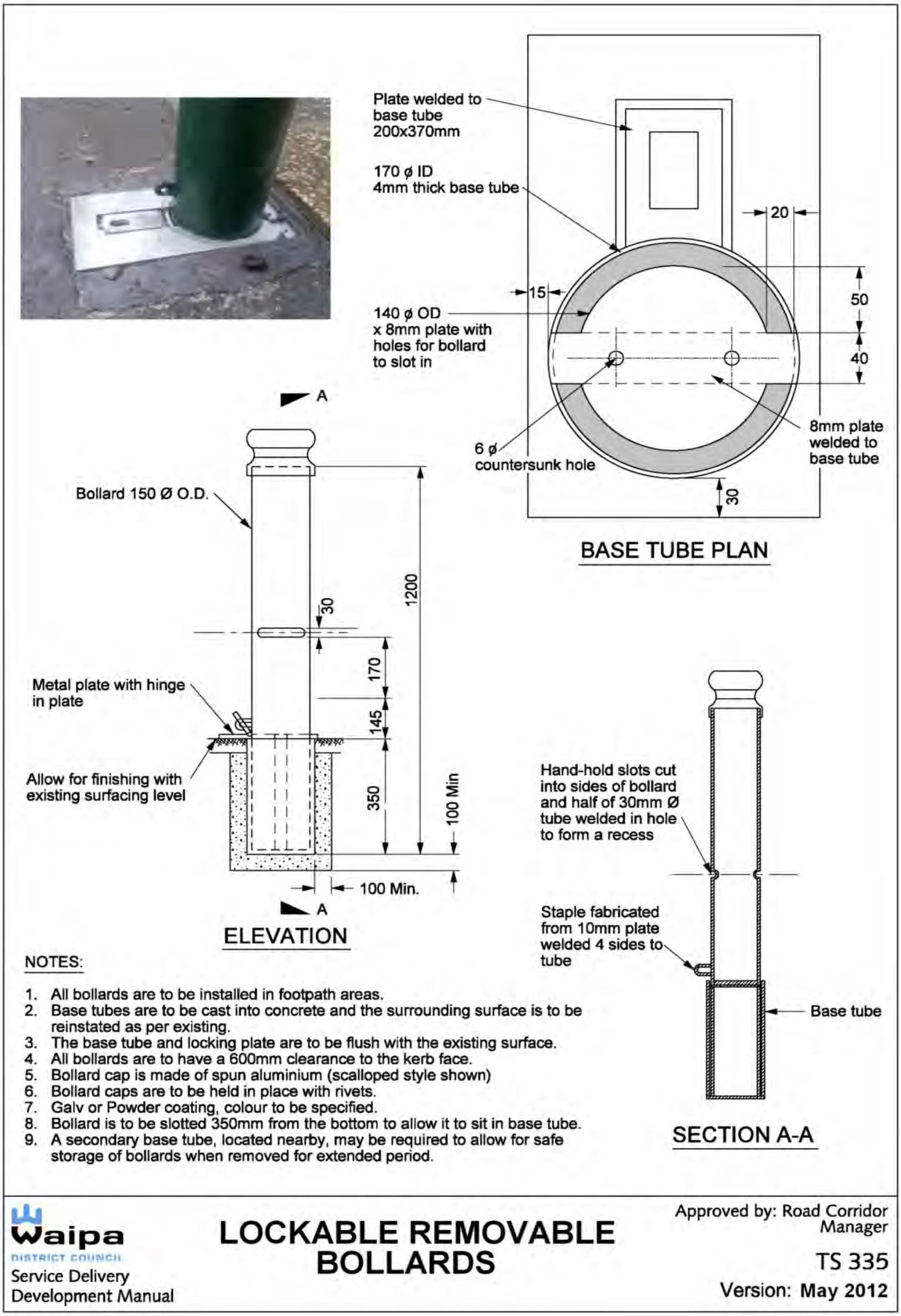


Figure 65: TS 335 Lockable removable bollards

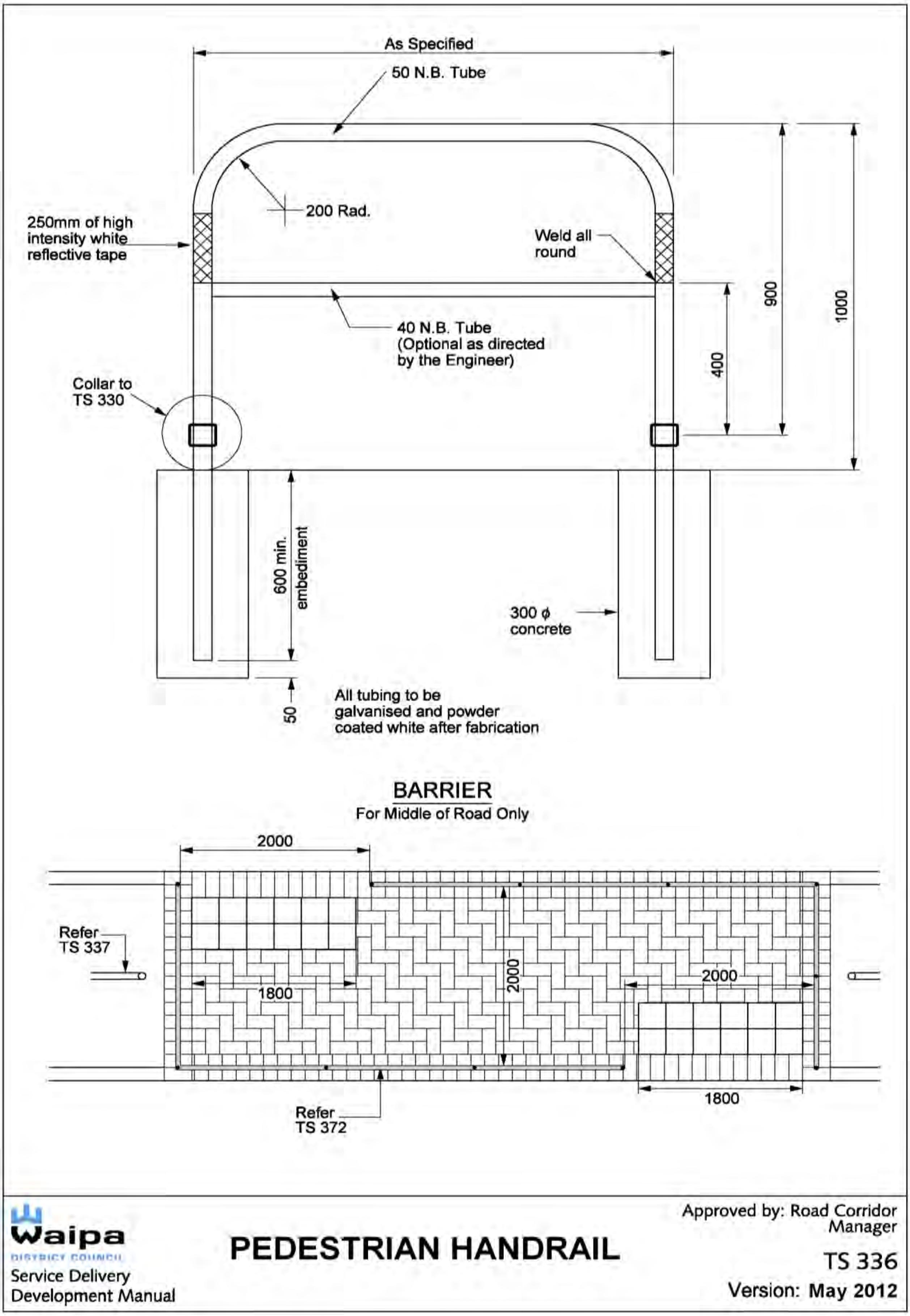


Figure 66: TS 336 Pedestrian handrail

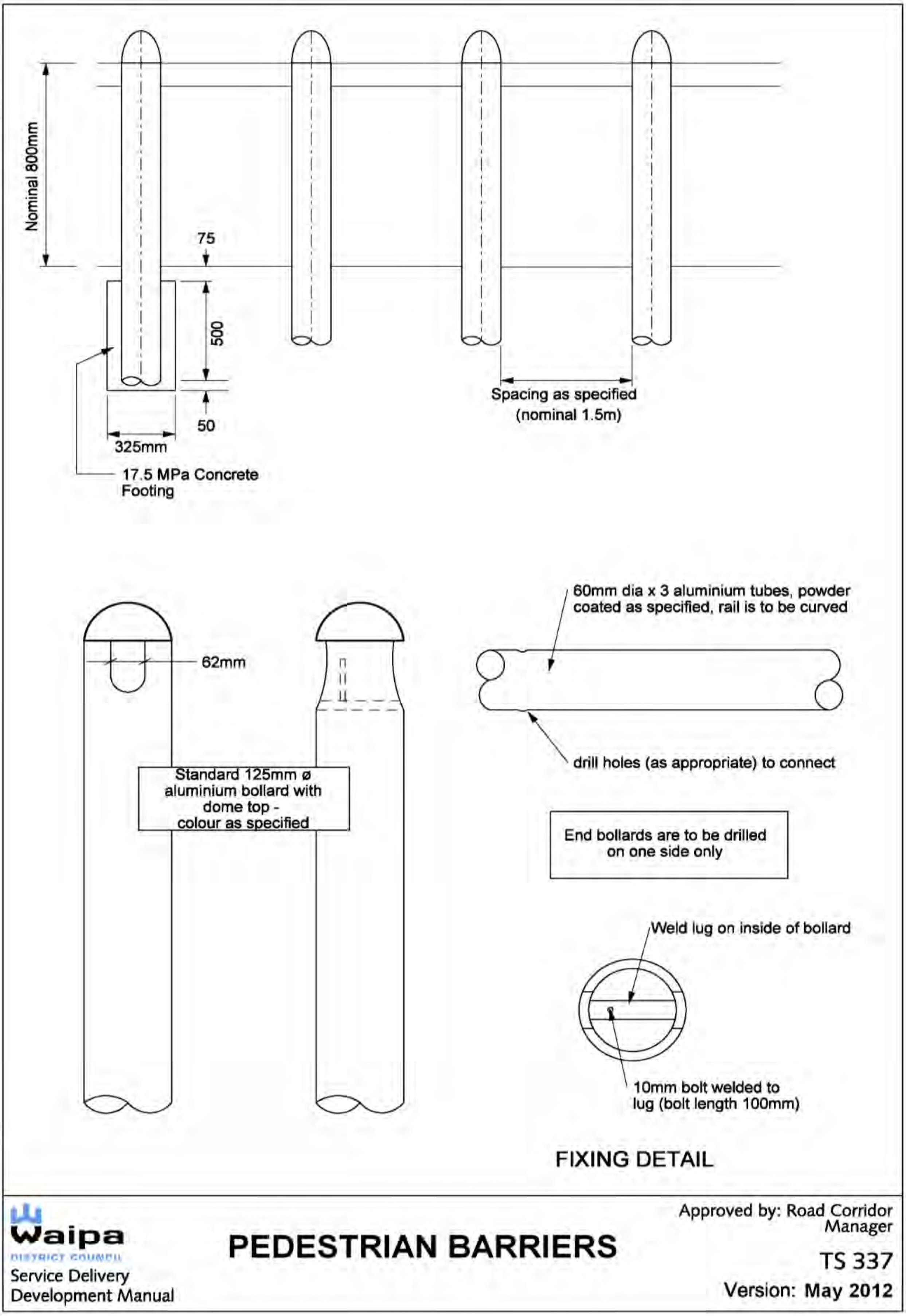


Figure 67: TS 337 Pedestrian barriers

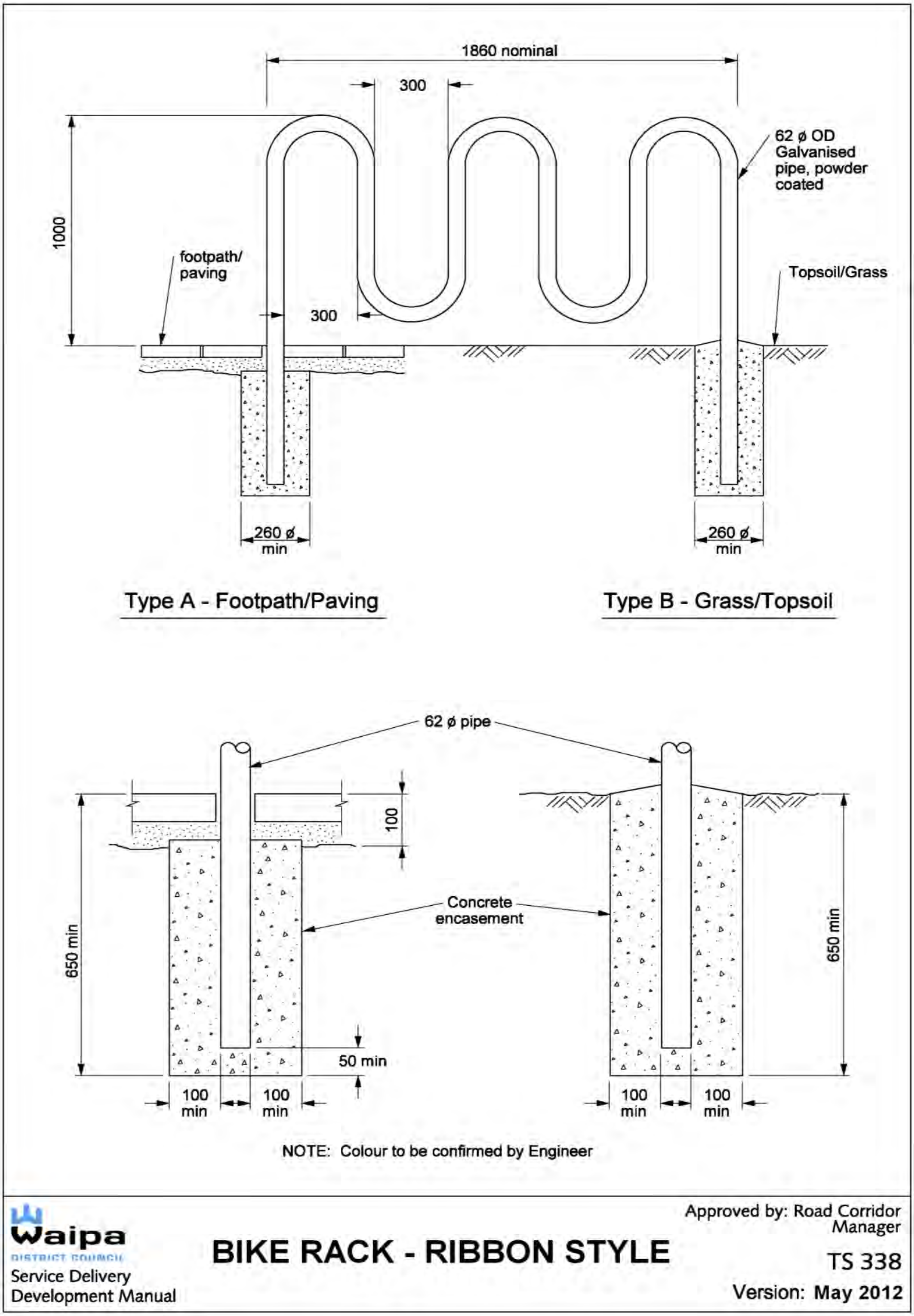


Figure 68: TS 338 Bike rack - ribbon style

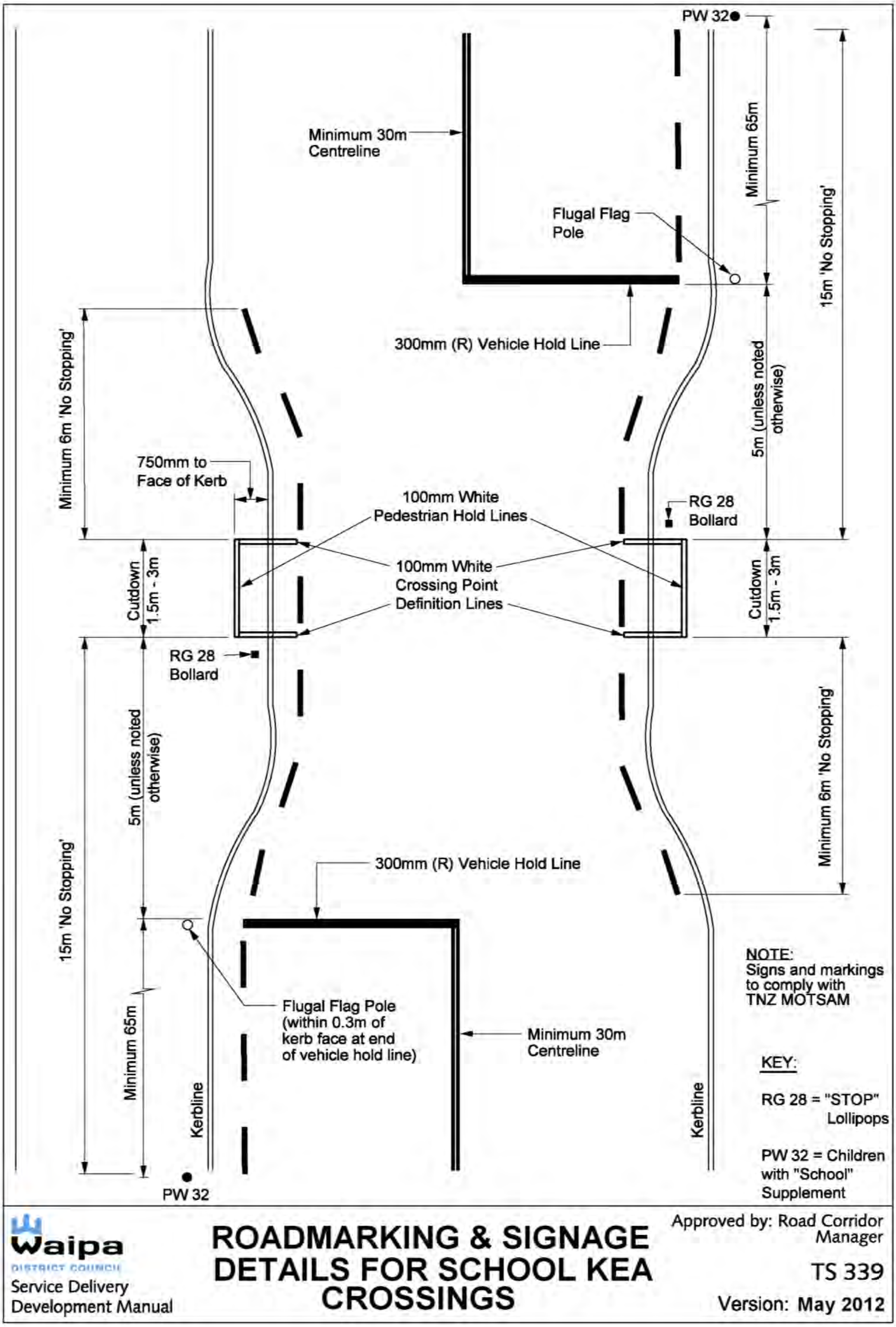


Figure 69: TS 339 Roadmarking and signage details for school kea crossings

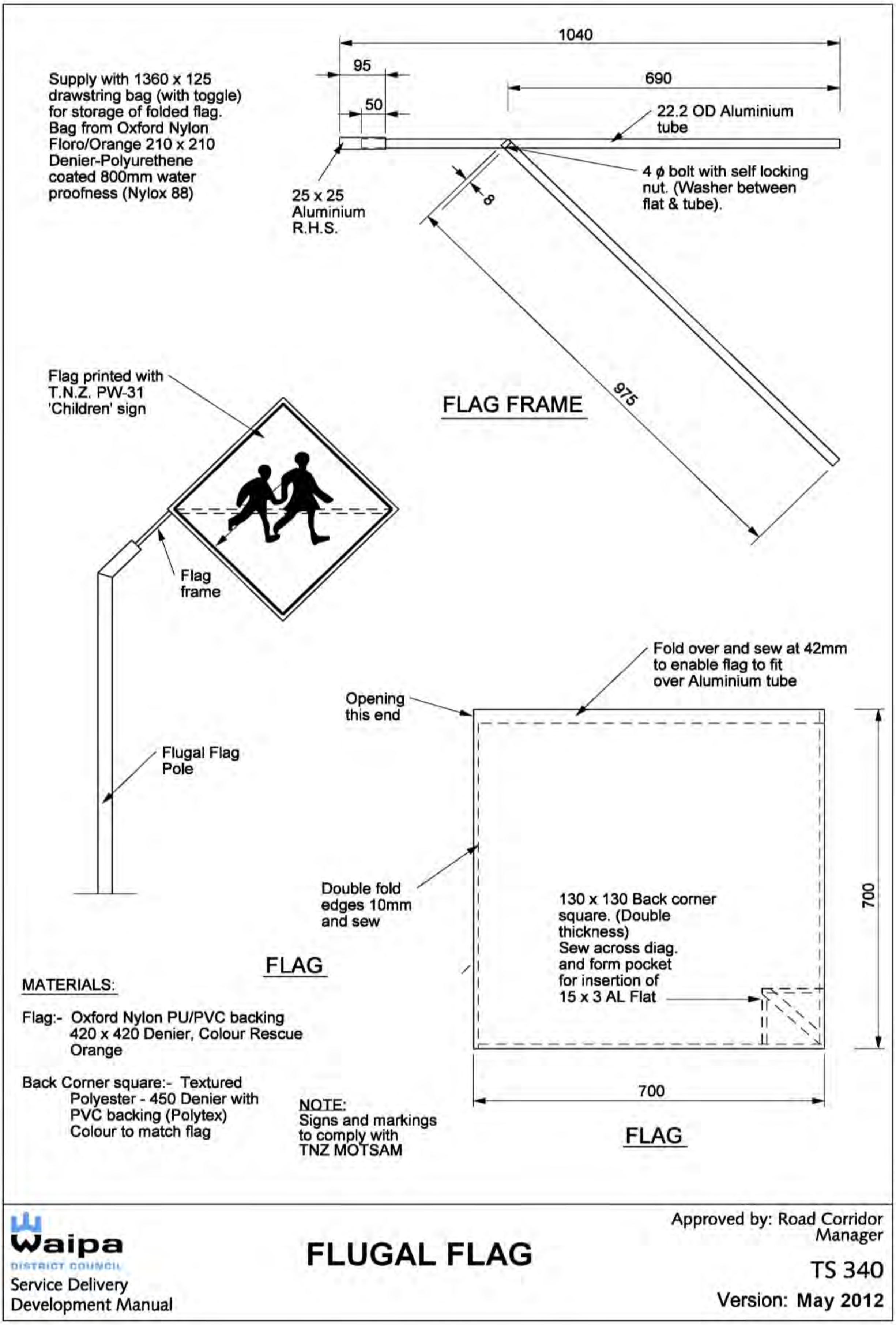


Figure 70: TS 340 Flugal flag

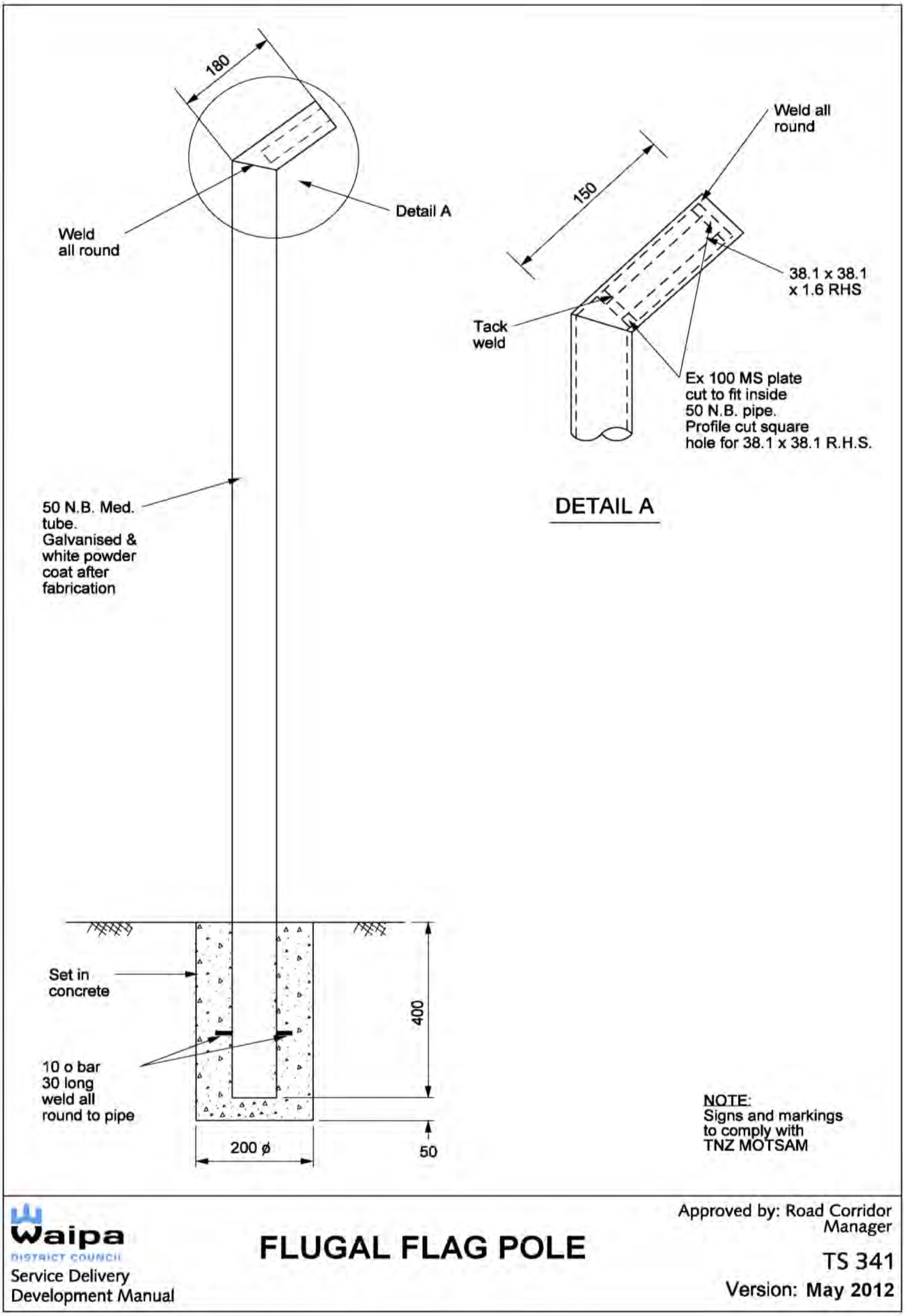


Figure 71: TS 341 Flugal flag pole

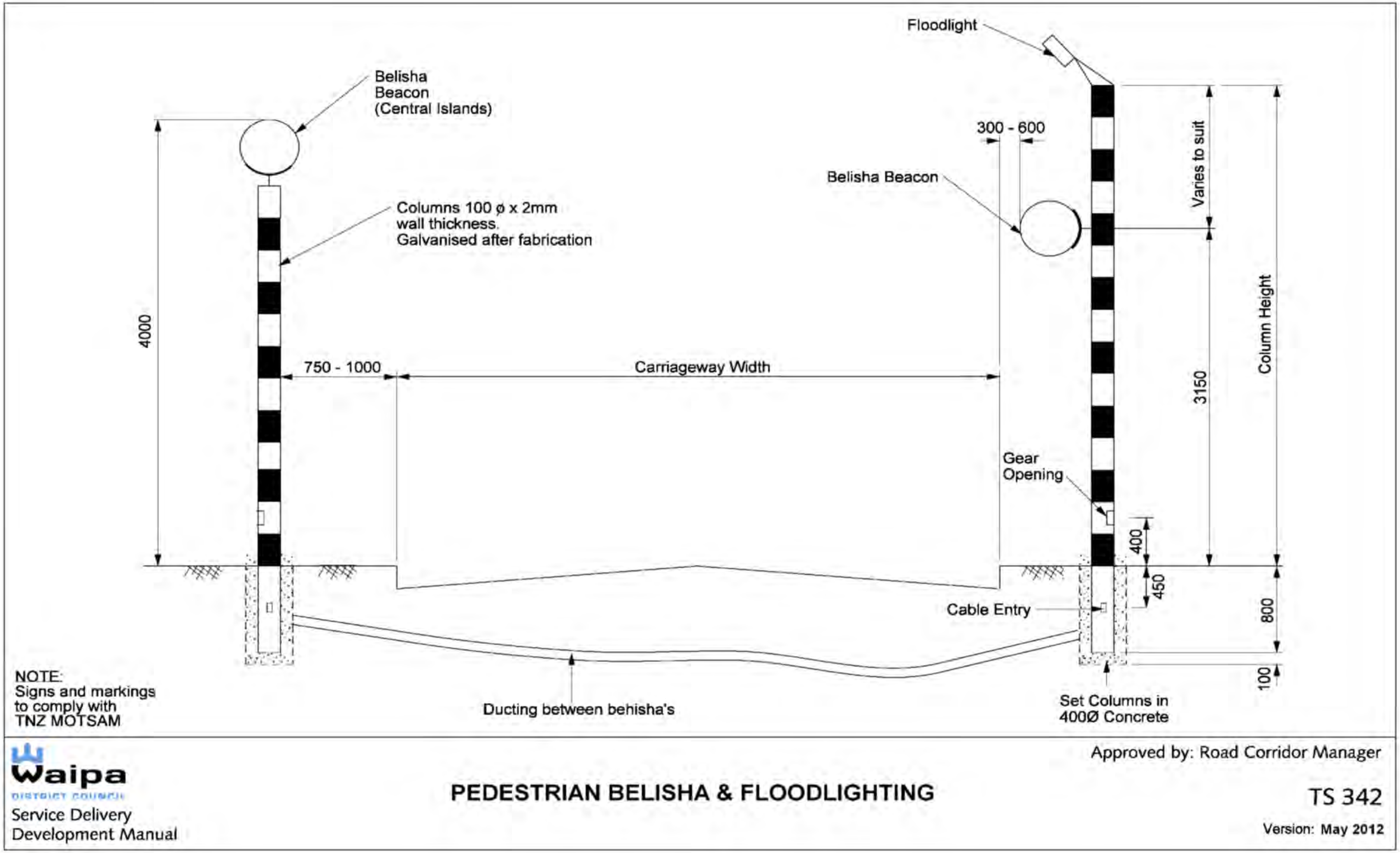


Figure 72: TS 342 Pedestrian belisha and floodlighting

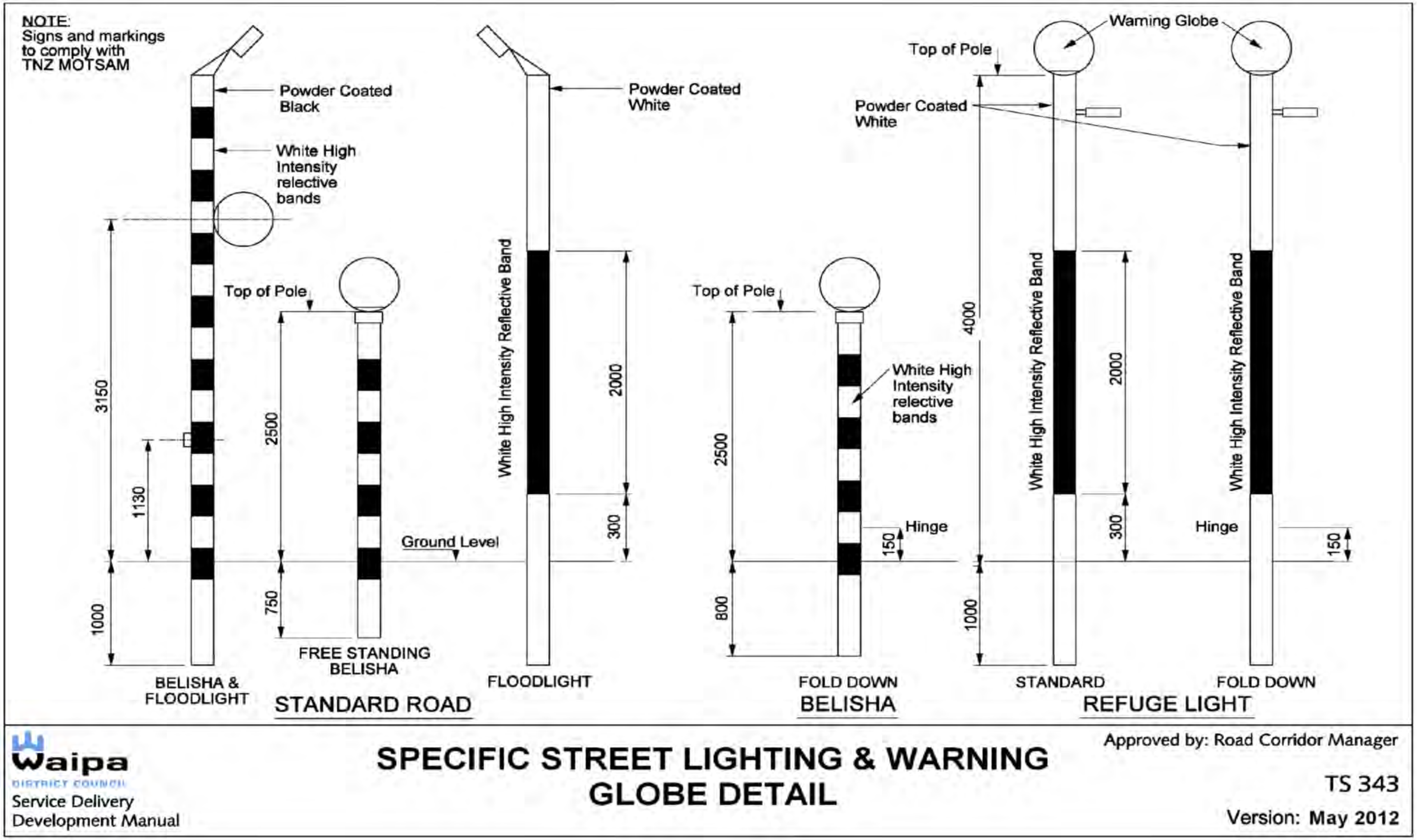
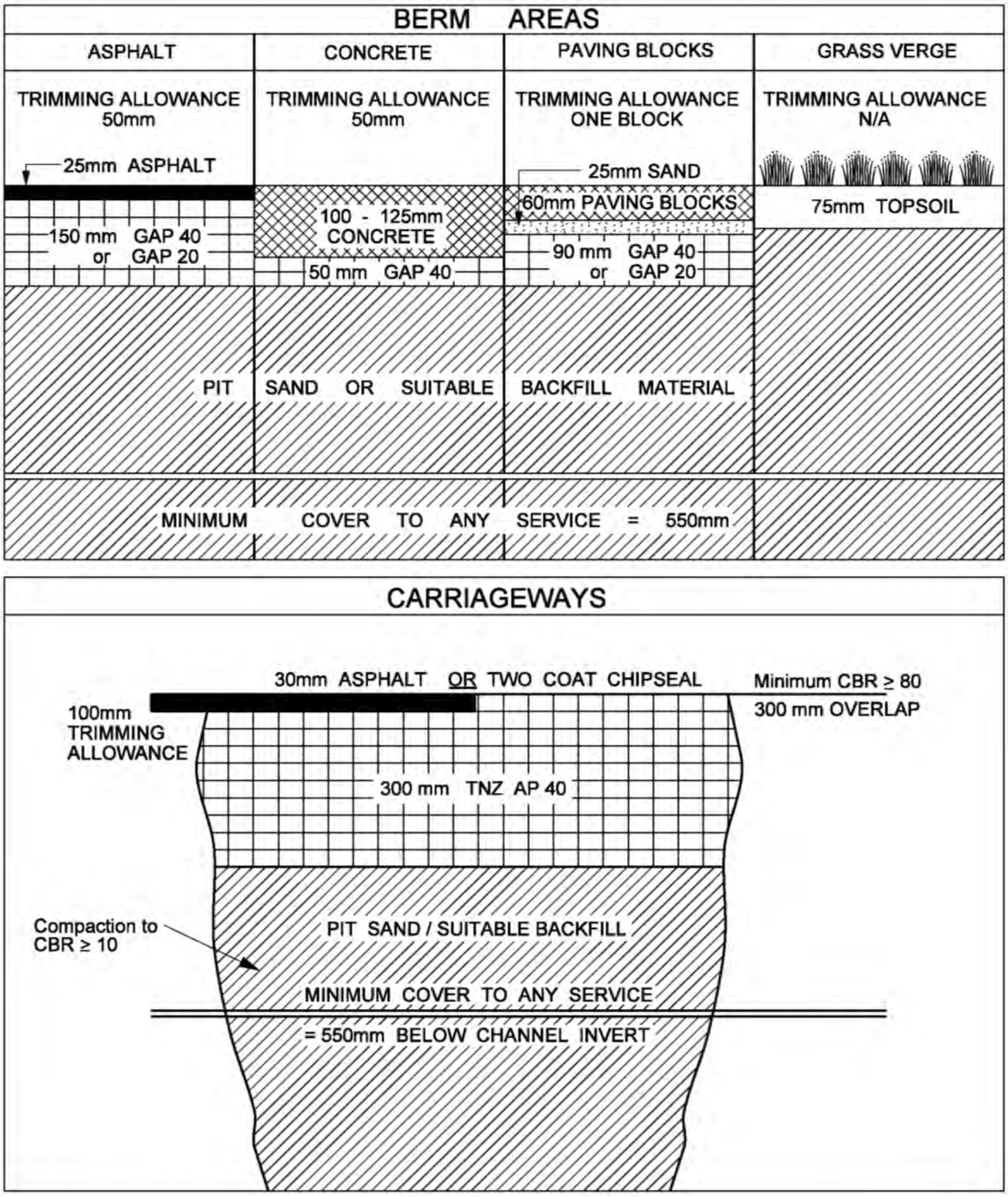


Figure 73: TS 343 Specific street lighting and warning globe detail



1. Sawcut, where appropriate, observing trimming allowances prior to commencing excavation.
2. Remove excavated material from site unless suitable for backfilling.
3. Place and compact backfill material in layers.
4. Place and compact metal pavement in appropriate lifts.
5. Reinstate surfacing to required shape tolerances.
6. Carry out waterproof sealing of all asphalt trenches in carriageways.
7. In Hamilton soils.CBR ≥ 10 approximates to 12 blows per 300mm

Waipa DISTRICT COUNCIL
Service Delivery Development Manual

TRENCH REINSTATEMENT

Approved by: Road Corridor Manager

TS 344

Version: May 2012

Figure 74: TS 344 Trench reinstatement

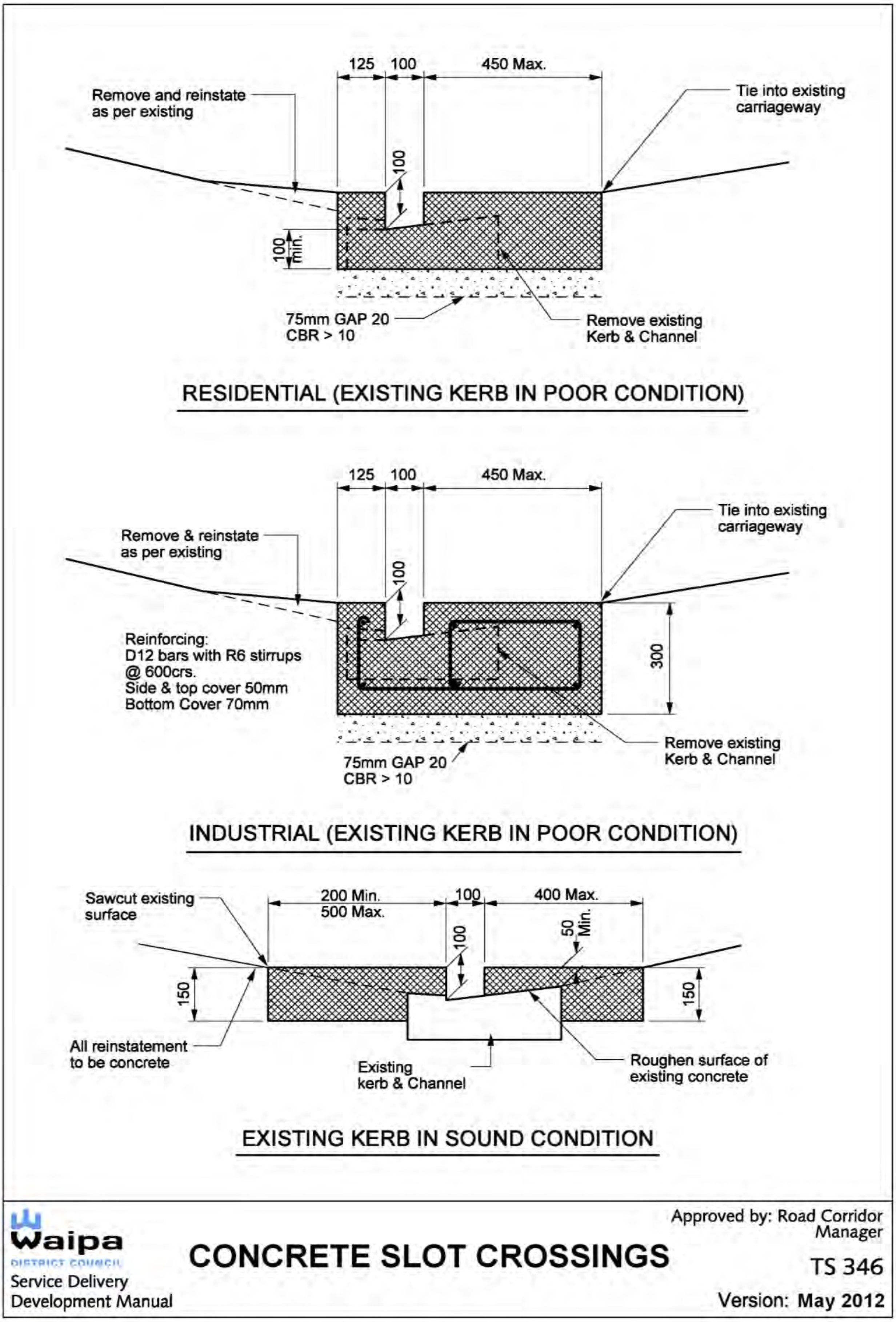


Figure 75: TS 346 Concrete slot crossings

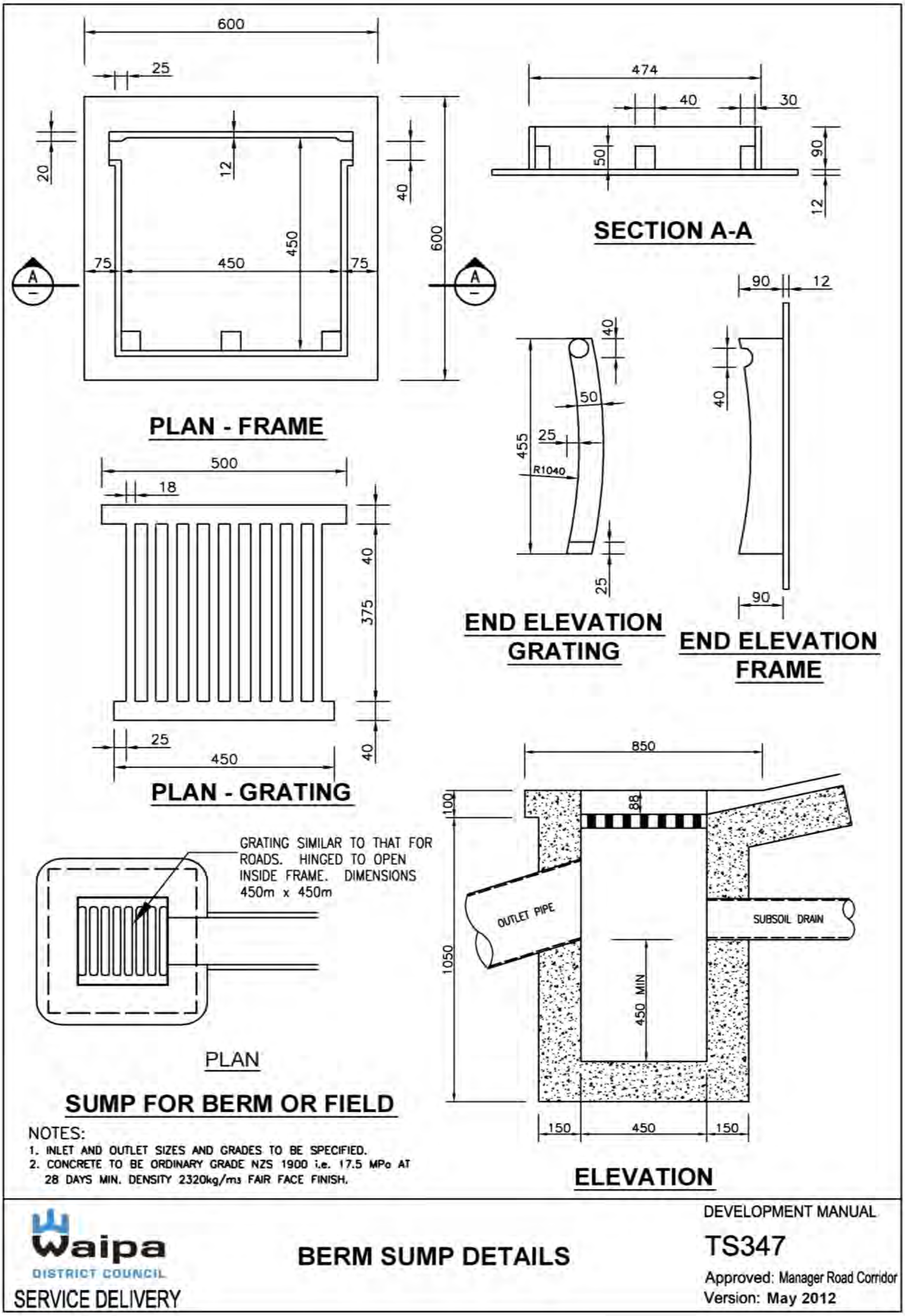


Figure 76: TS 347 Berm sump details

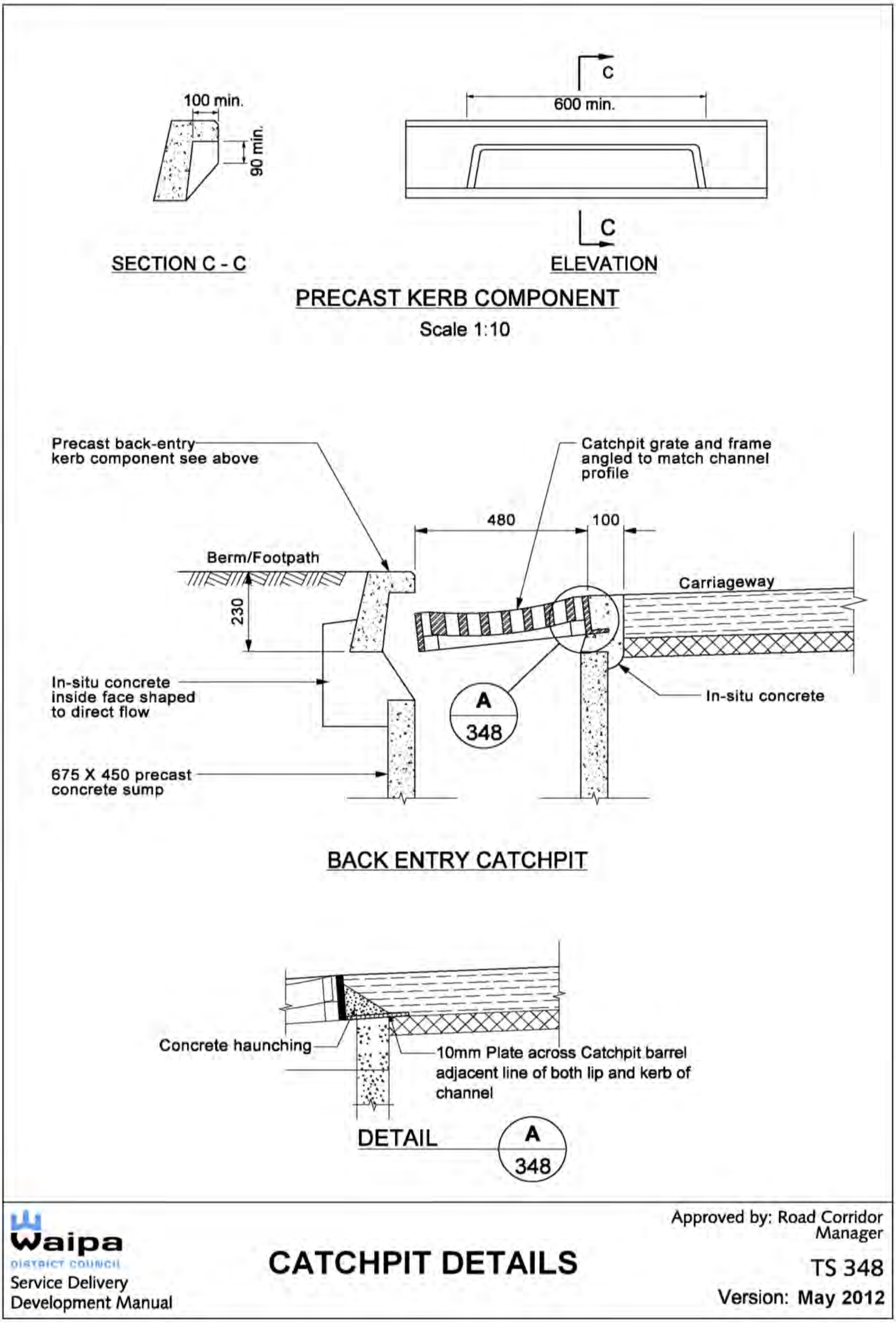
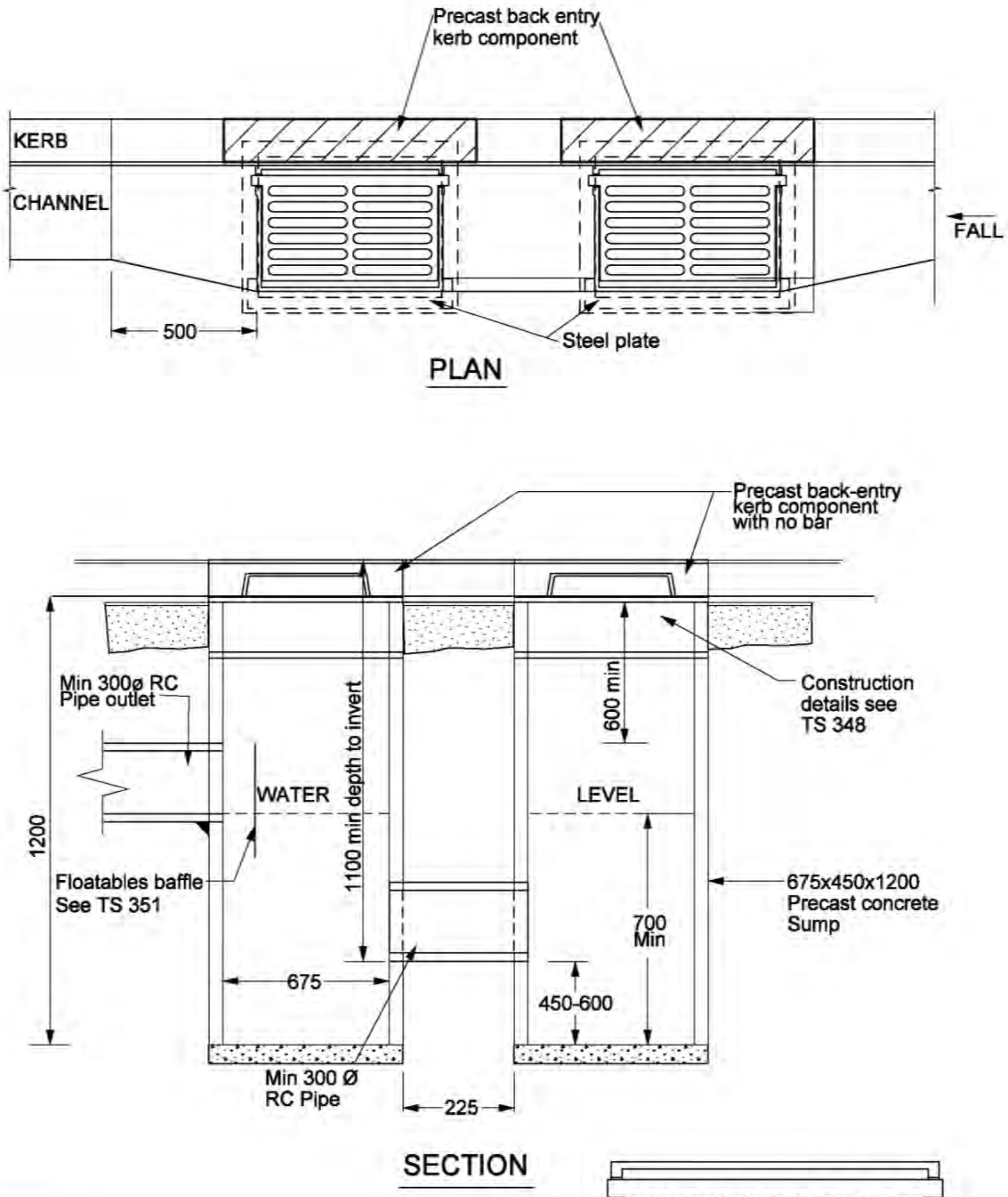
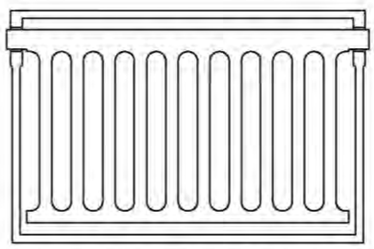


Figure 77: TS 348 Catchpit details



NOTES:

1. Cast iron grate with parallel slots shown in drawing refer to development manual vol 2 pt 3.8.5 for correct catchpit grate selection.
2. Epoxy product to be "ramset epcon C6" 2 pot epoxy or approved equivalent.
3. All in-situ concrete shall have a minimum 28 day strength of 20MPa
4. For details see TS 348



Alternative cast iron grate configuration (Perpendicular slots), for cycle routes

Waipa DISTRICT COUNCIL
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DOUBLE SUMP CATCHPIT DESIGN

Approved by: Road Corridor Manager

TS 349

Version: May 2012

Figure 78: TS 349 Double sump catchpit design

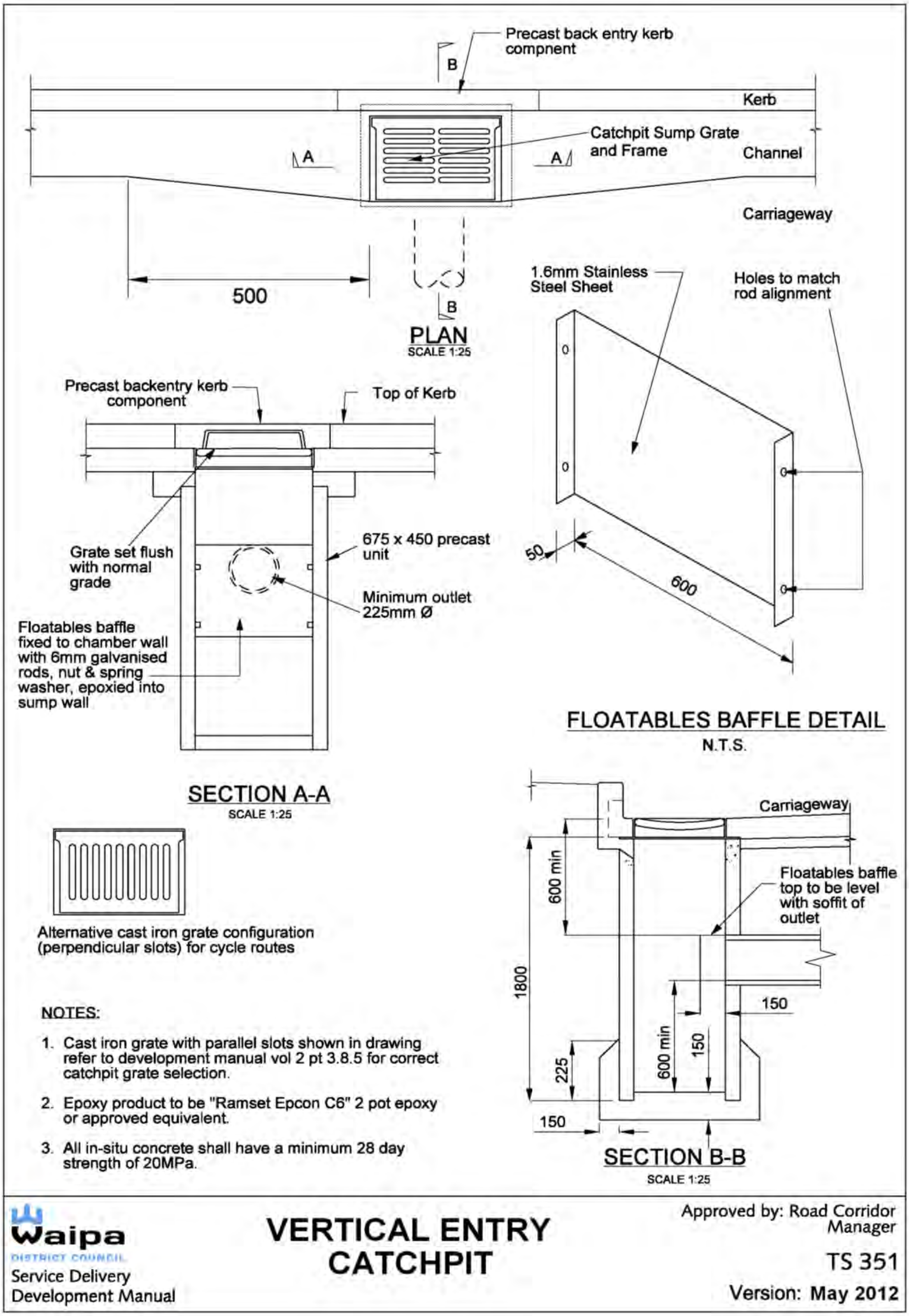
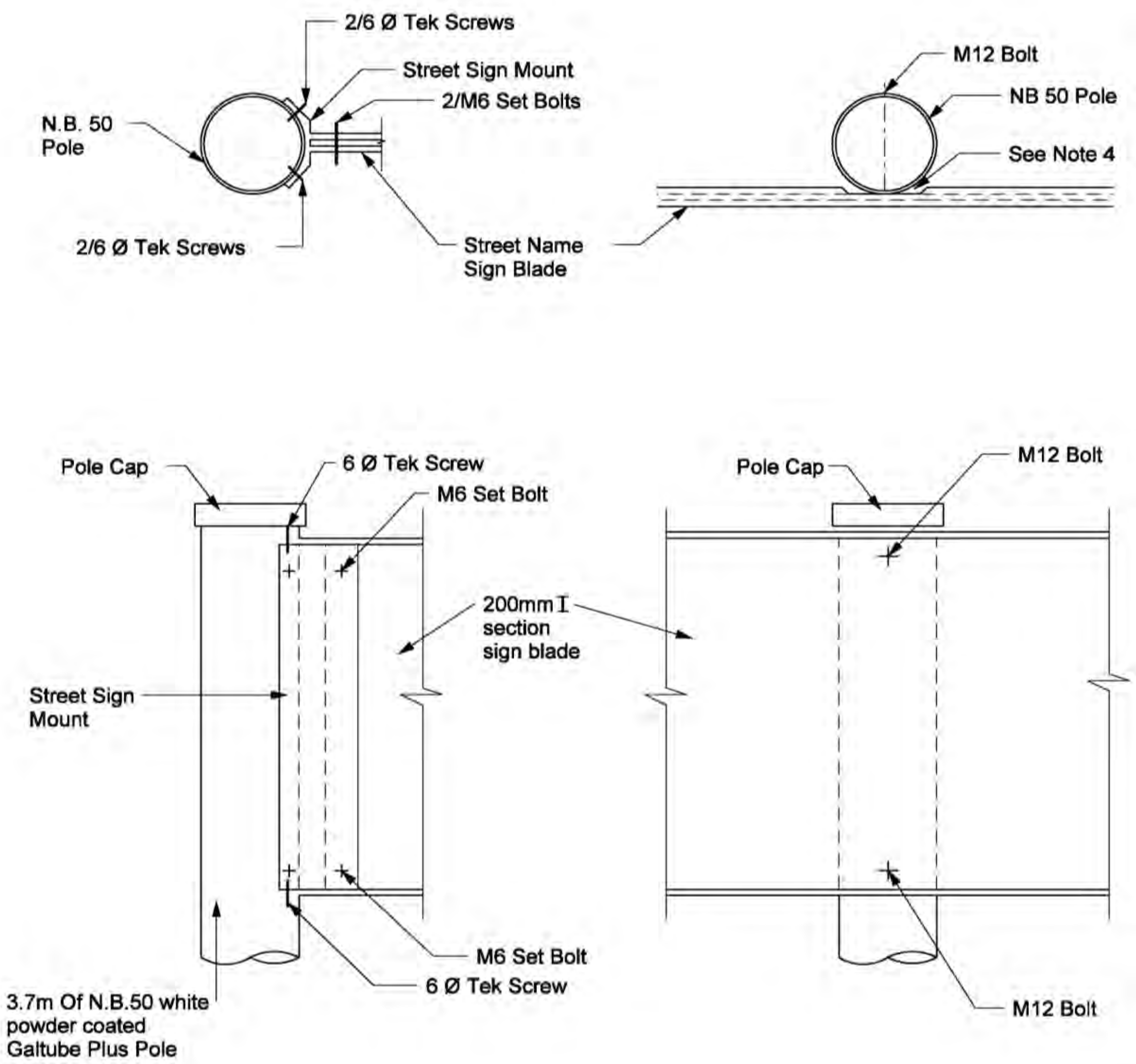


Figure 79: TS 351 Vertical entry catchpit

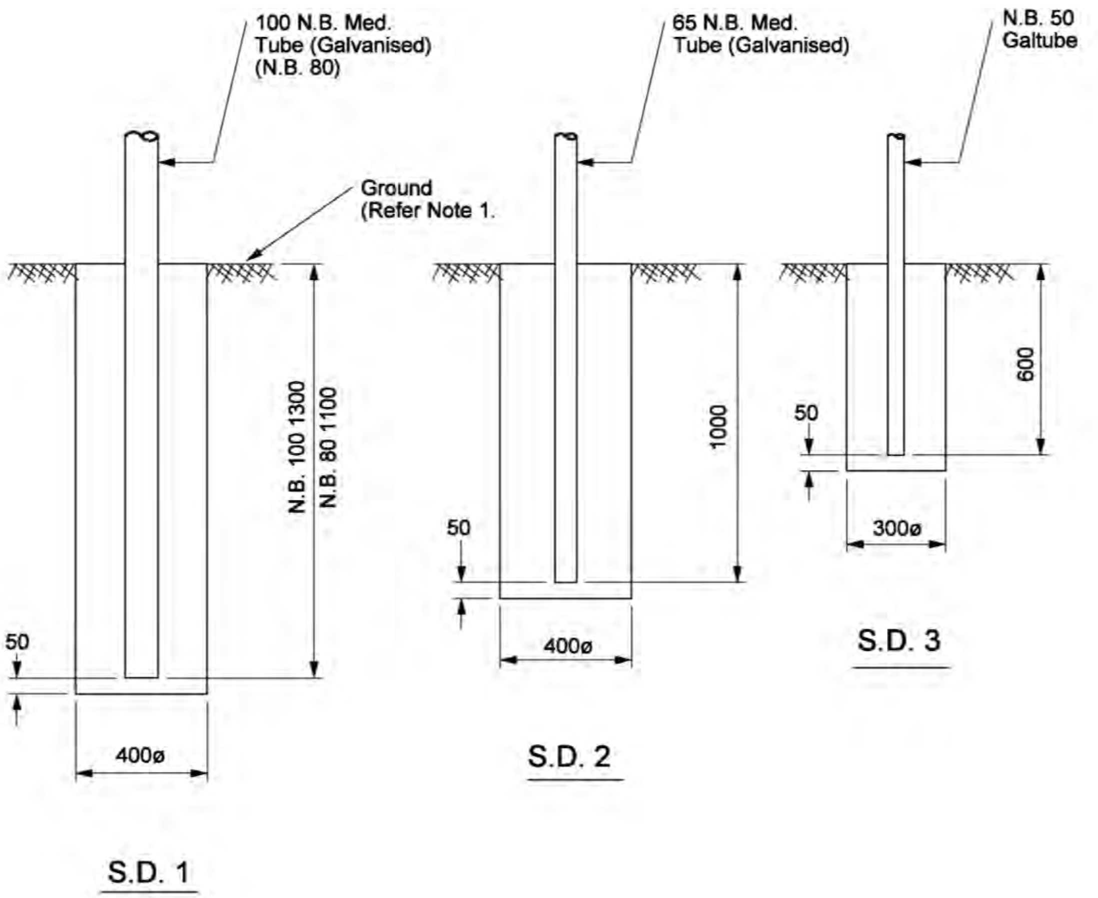


NOTES:

1. Plastic washers are to be used against the sign face. Bolts are to be tightened in a manner which will not tear the reflective sheeting
2. The distance between the ground and the top of the top sign blade shall be 3.0m.
3. Lettering on the sign blade to finish not less than 30mm from blade end to allow complete visibility of the sign.
4. Where street name signs are to be attached to other than N.B.50 Poles, the street sign mount is to be slotted top and bottom and strapped to pole with stainless steel bands.
5. Cut notch into I section sign blade (top and bottom) to enable sign to sit flat against pole.
6. No Exit supplements are to be taped to bottom flange of sign.
7. "Sign fix" brackets shall be used for end mounted signs longer than 1.2m

Waipa DISTRICT COUNCIL Service Delivery Development Manual	**ATTACHMENT OF STREET NAME SIGN BLADES TO POLES**	Approved by: Road Corridor Manager TS 358 Version: May 2012

Figure 80: TS 358 Attachment of street name sign blades to poles



NOTES:

1. This detail is for grass berm and planting areas only. In all other situations the concrete is to be recessed to allow reinstatement of the surrounding surface up to the pole.
2. Concrete to have 20 MPa in place strength at 28 days.
3. Poles are to be powder coated white.
4. All poles to be capped

Waipa DISTRICT COUNCIL
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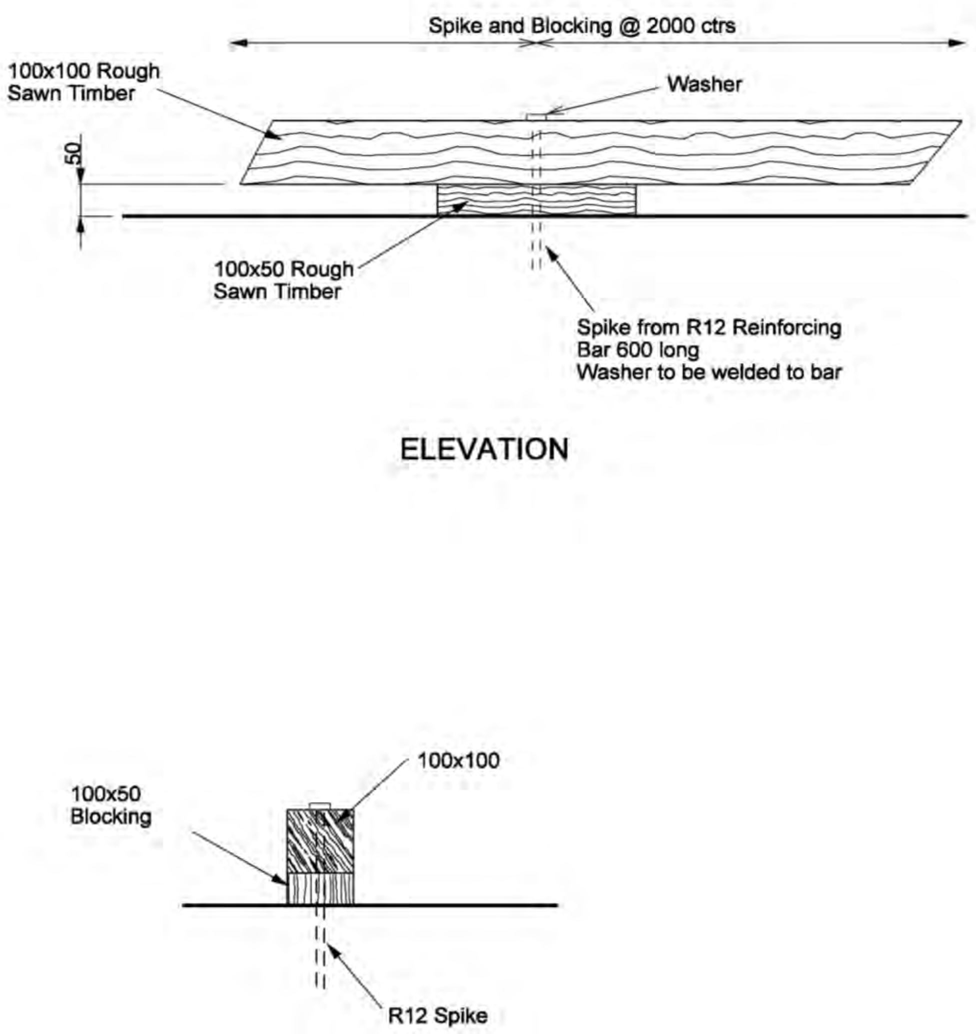
N.B. 100, 80, 65, 50
POLE FOUNDATIONS

Approved by: Road Corridor Manager

TS 360

Version: **May 2012**

Figure 81: TS 360 N.B. 100, 80, 65, 50 pole foundations



NOTES:

1. Timber should be treated to H4 Group A standard
2. To be installed within the road reserve at the property boundary where appropriate.

Waipa District Council
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LOW LEVEL TIMBER BARRIER

Approved by: Road Corridor Manager

TS 361

Version: **May 2012**

Figure 82: TS 361 Low level timber barrier

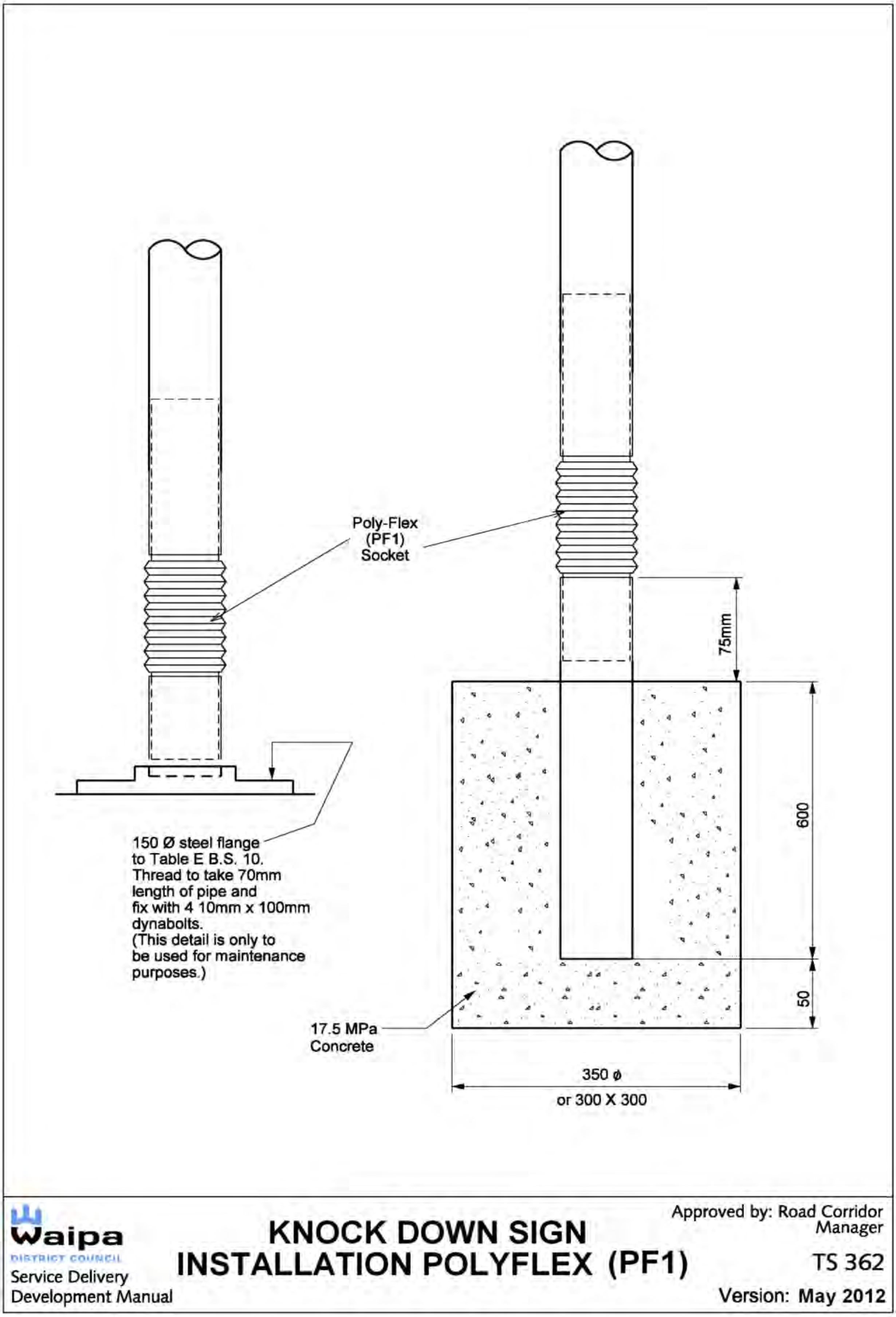


Figure 83: TS 362 Knock down sign installation polyflex (PF1)

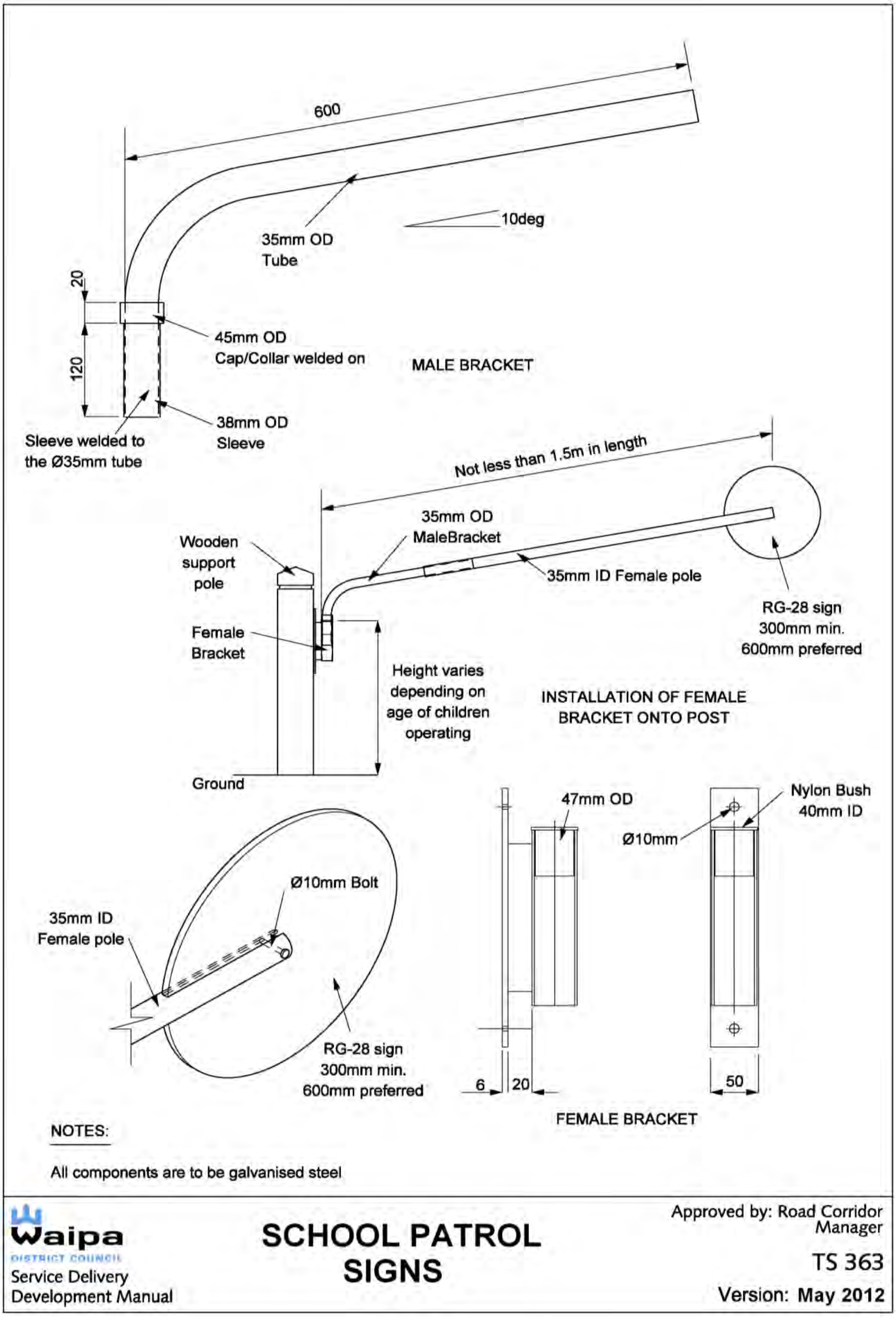
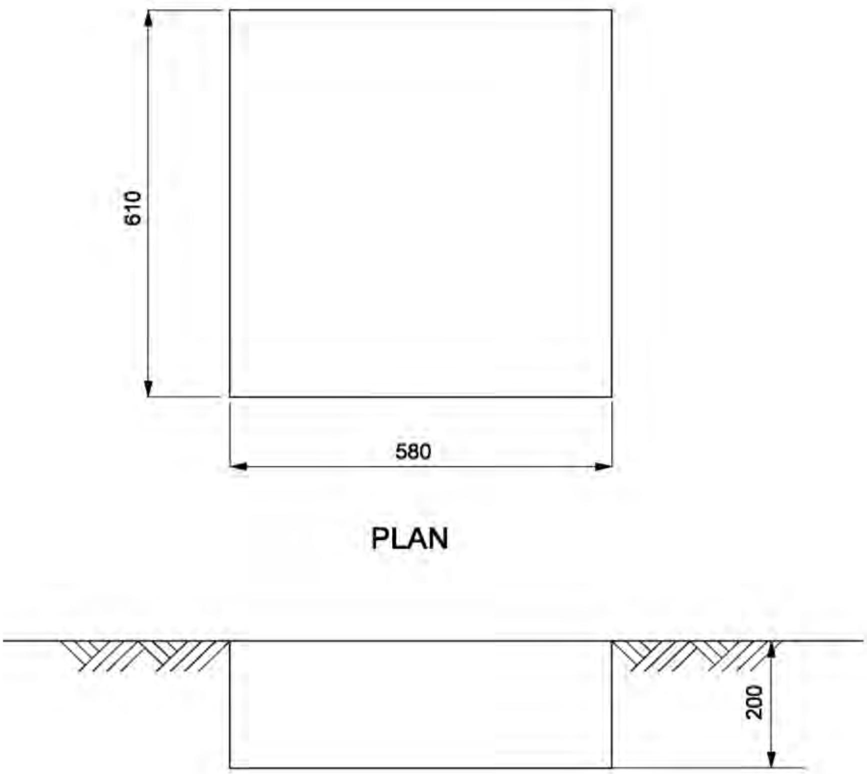


Figure 84: TS 363 School patrol signs



NOTES:

1. Existing surfacing to be sawcut prior to excavation.
2. Concrete strength to be 20 Mpa.
3. Base surfaces to be a well trowelled smooth finish.
4. Base surface to be level.
5. Reinstate footpath area (if required)
6. Contractor to leave site clean and tidy, removing any soil and concrete residue from work area.
7. Where bin is located beside a bus shelter, place bins on RH side facing road unless otherwise specified using 4 x 10mm dia. bolts in base to fit bin.

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CONCRETE BASE DETAILS FOR STEEL LITTER BINS

Approved by: Road Corridor Manager

TS 364

Version: **May 2012**

Figure 85: TS 364 Concrete base details for steel litter bins

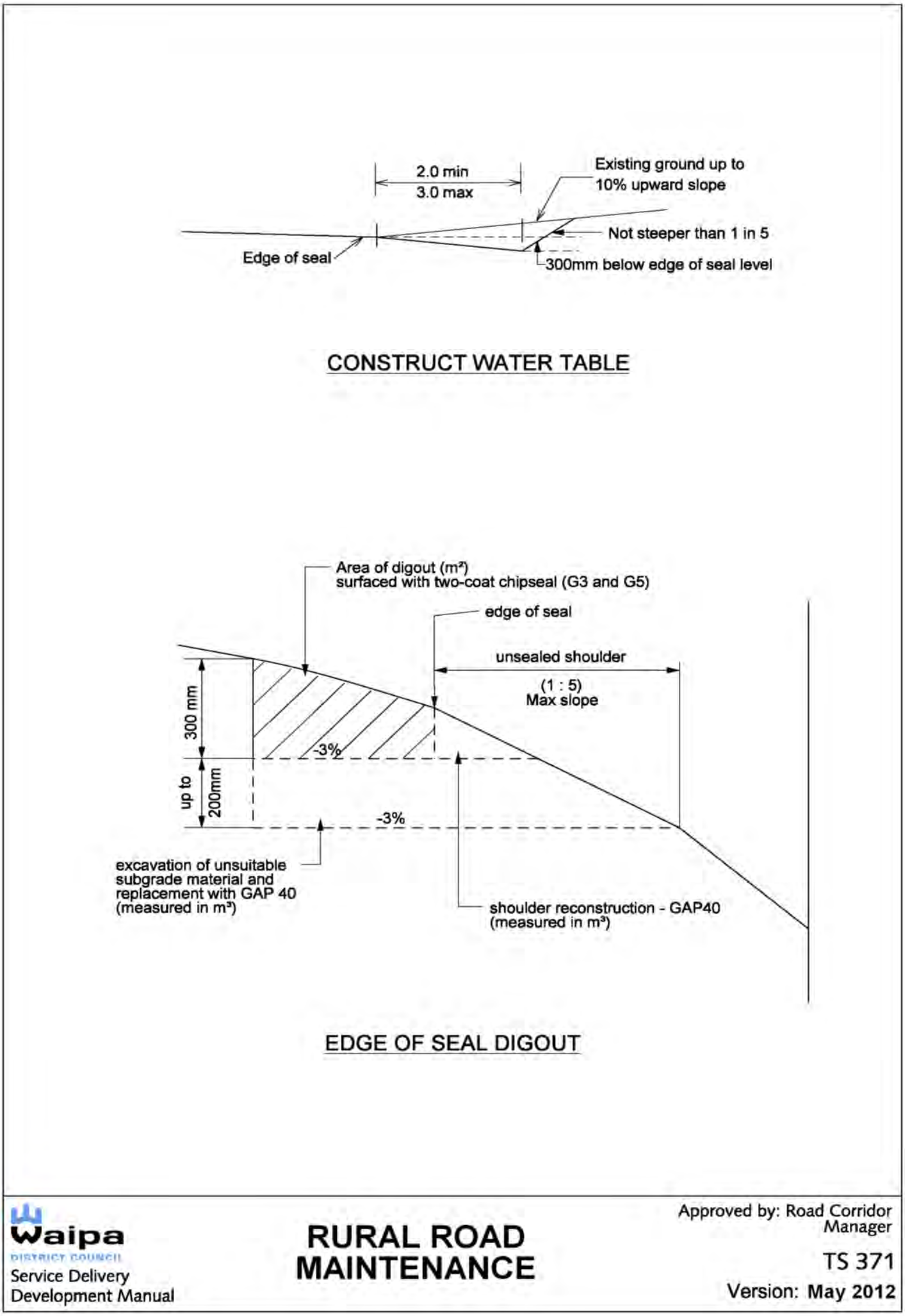


Figure 86: TS 371 Rural road maintenance

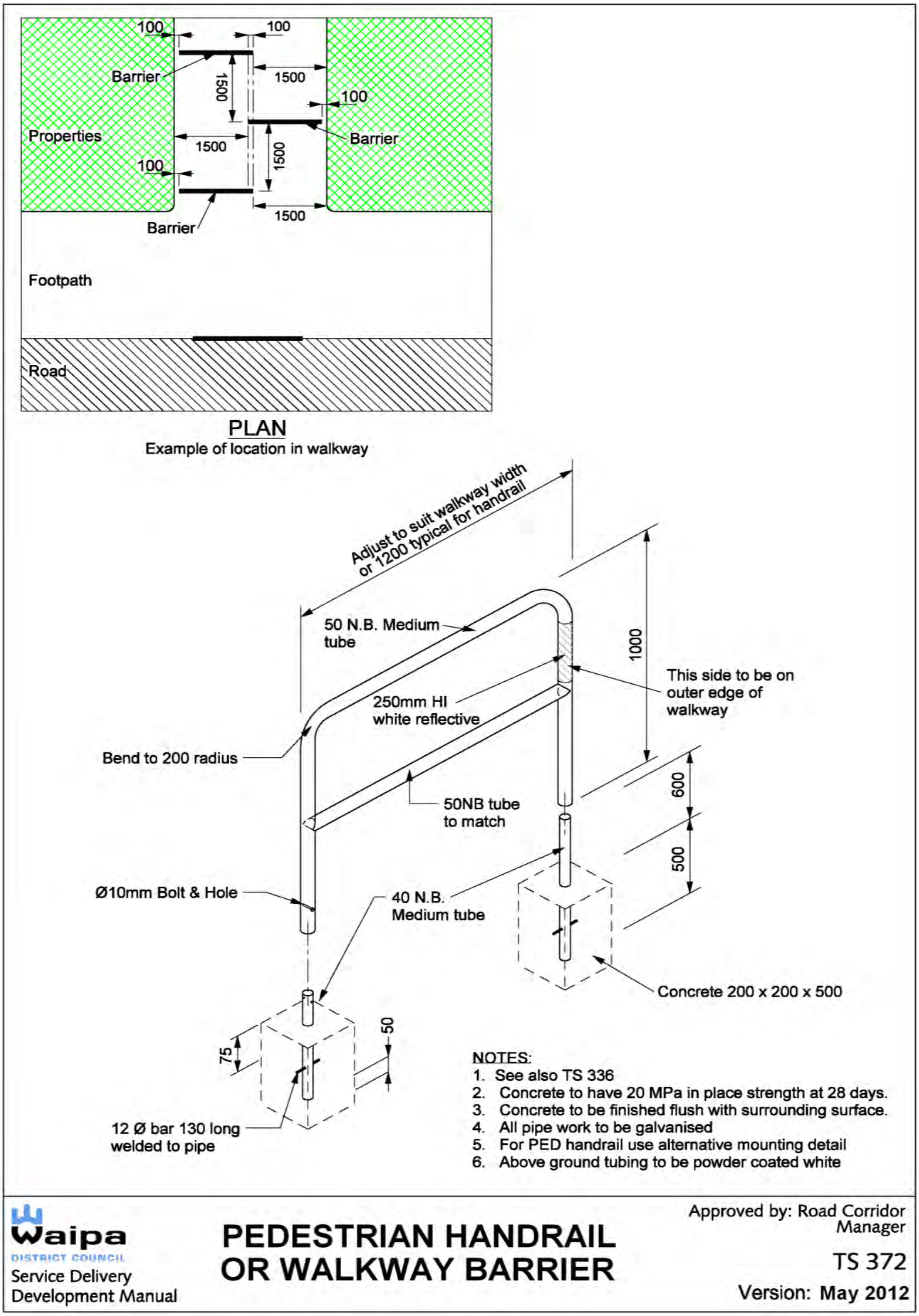


Figure 87: TS 372 Pedestrian handrail or walkway barrier

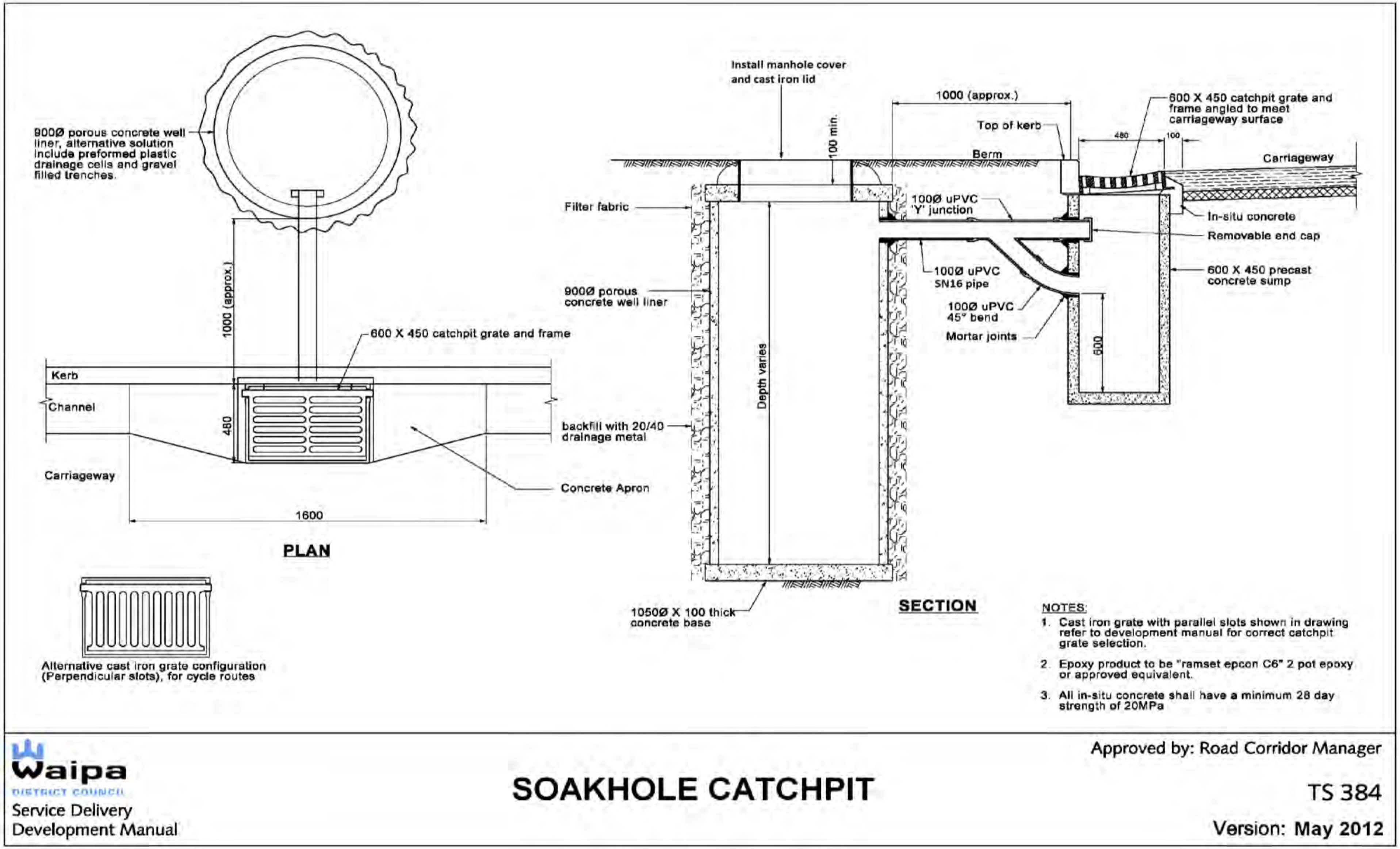
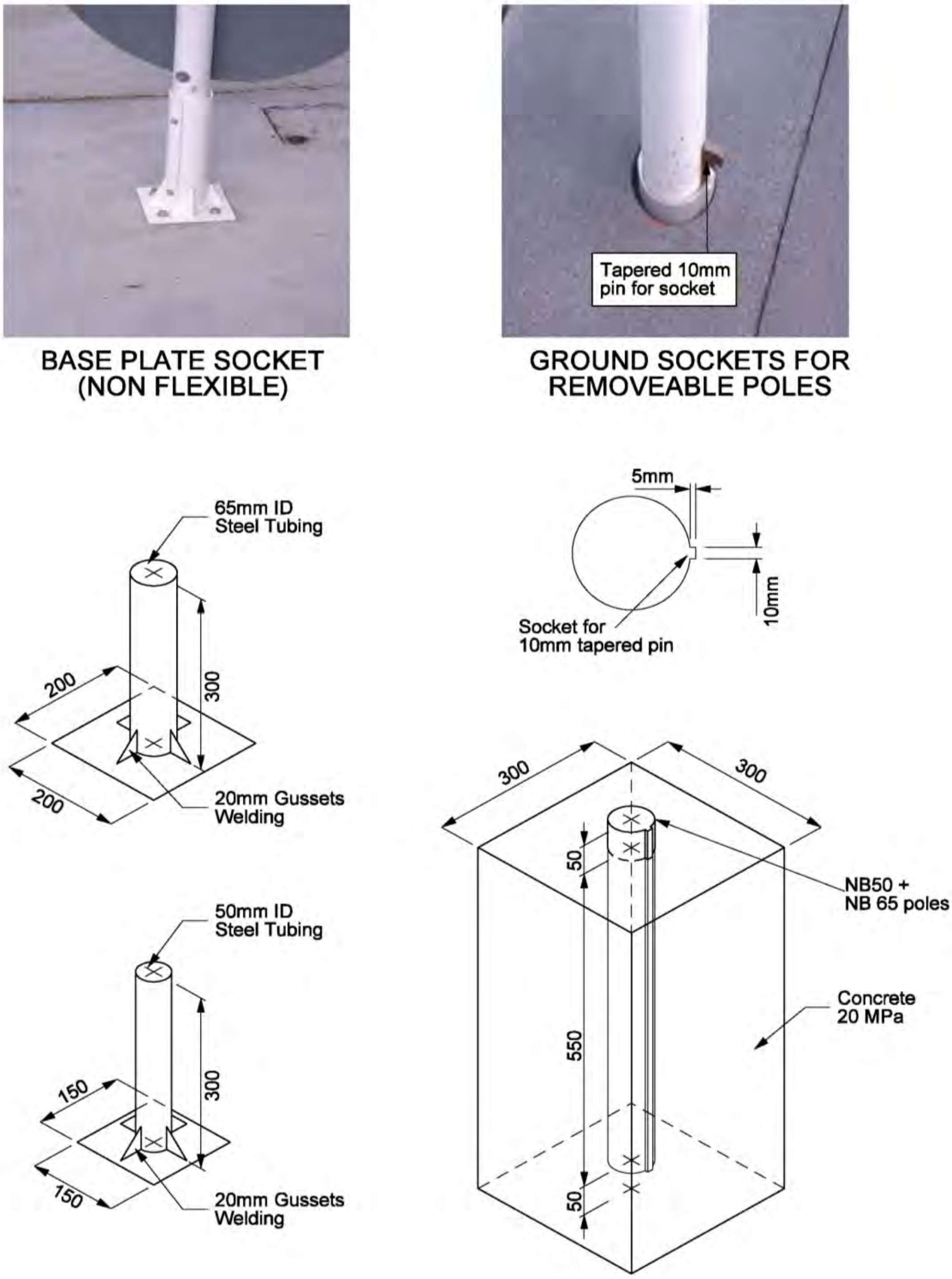


Figure 88: TS 384 Soakhole catchpit



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Development Manual

SOCKETS FOR REMOVABLE POLES

Approved by: Road Corridor Manager

TS 390

Version: **May 2012**

Figure 89: TS 390 Sockets for removable poles

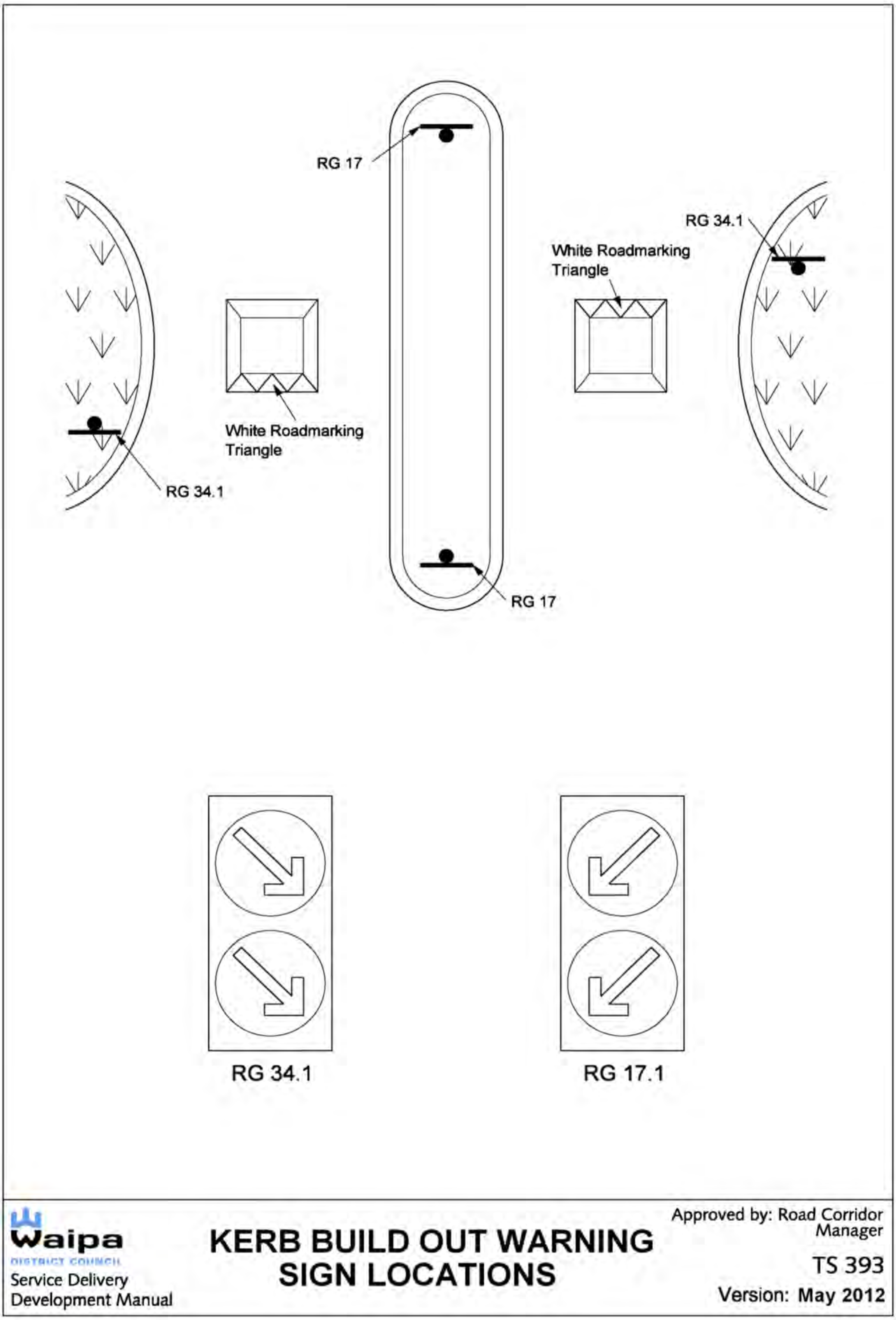
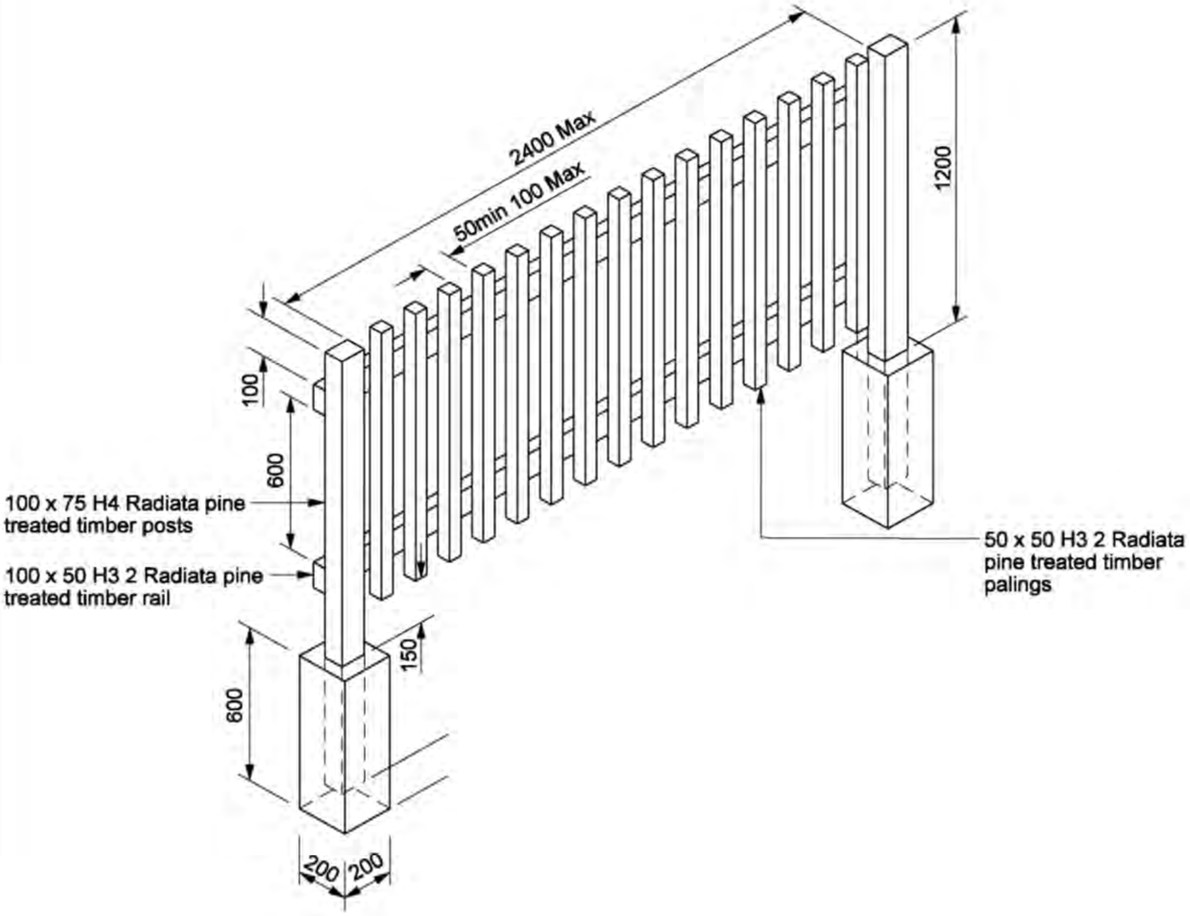


Figure 90: TS 393 Kerb build out warning sign locations



NOTES

1. Posts 100 x 75mm H4 Radiata pine treated timber posts.
2. Rails 100 x 50mm H3.2 Radiata pine treated timber rails x3
3. Paling 50 x 50mm H3.2 radiata Pine treated timber palings
4. 1.2m high for approx 10m from each end of accessway then 1.5 or 1.8 max.
5. Alternative treatments such as pool fence may be acceptable

Waipa DISTRICT COUNCIL Service Delivery Development Manual	**PEDESTRIAN ACCESSWAY FENCE DETAIL**	Approved by: Road Corridor Manager TS 394 Version: **May 2012**

Figure 91: TS 394 Pedestrian accessway fence detail

Part 4: Stormwater Drainage

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Standard Figures

Part 4 – Section 1: Acceptable fittings and Materials

4.1.1 Scope

4.1.1.1 This specification covers the list of materials acceptable for use within the Waipa District Council stormwater network, and covers materials (up to the boundary) which Council has, or will, assume responsibility for. Fittings not in accordance with this list will be rejected unless written approval from Council is obtained prior to installation. Rejected products and materials will be subject to removal at the Contractor or Subdivider's cost.

4.1.1.2 This list of Acceptable Fittings and Materials will be updated in July and December each year or at other times when four or more acceptable products need to be incorporated into the list.

4.1.1.3 All applications to the Acceptable Fittings and Materials list must be accompanied by the pro-forma Volume 4: Quality Checklists & Appendices, Part 9, Appendix 6: Application for Acceptance of Water or Drainage Product for Use in the Waipa District Council Water Supply Area or Drainage District.

4.1.1.4 Requirements for acceptance of materials are as follows:

(a) Conforms to appropriate New Zealand, Australian or British standards with evidence of the licence number issued.

(b) Manufacturer operates to an acceptable quality assurance standard.

(c) Details of composition, dimensions, specific use and design life are supplied by the manufacturer.

(d) Details of acceptance by other New Zealand local authorities.

(e) Details are supplied by the manufacturer on how the product should be installed.

(f) The product is acceptable to Waipa District Council (taking into account such factors as compatibility with other approved products, ease of use, availability of supply, etc.).

4.1.1.5 Where there is no standard, the manufacturer will be required to supply copies of their quality assurance procedures and producer statements to support their performance and composition claims for the products concerned.

4.1.1.6 Completed applications and supporting information should be addressed to:

The Manager
Water Services
Waipa District Council
Private Bag 2402
Te Awamutu 3840

4.1.1.7 Council reserves the right to refuse any material or fitting from the Acceptable Fittings and Materials list for any reason and at any time. In such circumstances, Council will provide written notification, stating reasons why the material or fitting has been refused or removed from the Acceptable Fittings and Materials list.

4.1.2 Pipe materials

Table 33: Pipe materials including manufacturer

Pipe Materials	Manufacturer/Product ID
Centrifugally Spun Manufactured Concrete Pipes(manufactured to AS/NZS 4058:2007)	
Rubber Ring jointed Class 2,3 & 4	Hynds (Licence #2586)
225mm – 2500mm diameter	Humes (Licence #2618)
Flush Jointed Class S 1,2 & 3	Hynds (Licence #2586)
600mm – 2500mm diameter	Humes (Licence #2618)
Skid Ring Joint Class 2,3 & 4	Hynds (Licence #2586)
600mm, 675mm – 1200mm & 2100mm diameter	Humes (Licence #2586)
ROLLER COMPACTED MANUFACTURED CONCRETE PIPES ACCEPTED FOR STORMWATER ONLY	
Rubber Ring jointed Class 2, 3 & 4 manufactured to AS/NZS4058:2007	
225mm diameter	Humes (Licence #2618)
600mm diameter	Humes (Licence #2618)
PVC PIPE	
AS/NZS1254:2002 Class SN16 RRJ	Marley (Licence #2365)
100mm – 300mm diameter and associated fittings	Iplex (Licence #SMK P2012)
	Keyplas (Licence #2622)
	Plastics STORM-LOCK (Licence #003)
POLYPROPYLENE PIPE (STORM BOSS)	
AS/NZS5065:2005 Class SN 16 RRJ	
225mm – 450mm diameter and associated fittings	Waters and Farr
MANHOLE RISERS	
1050mm – 2500mm diameter	Humes
300mm – 2400mm diameter	Hynds
DUCTILE IRON MANHOLE LID AND FRAME	
Korum Heavy Duty	Saint Gobain CDK 060 EK
Tec Light Duty	Saint Gobain CBTE 60 EG
MANHOLE STEPS	
Stainless Steel (manufactured to NZS/BS 970.1 : 1991)	Costavic
MWT253 Plastic encapsulated Stainless Steel	Nextep Miyama Safety Step (Licence #JP-JQA-QM6570)

Part 4 – Section 2: Construction Specification

4.2.1 General

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

4.2.2 Materials

4.2.2.1 ***Standards***

(a) All materials used shall conform with Section 1 above.

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

4.2.2.2 ***Pipes***

(a) Pipes shall be of the type and class shown on the Figures.

4.2.2.3 ***Concrete***

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

(b) All concrete shall have a minimum crushing strength of 20.0 Mpa at 28 days unless otherwise specified or detailed.

4.2.2.4 ***Roading materials***

(a) Roading materials, chips, sealers, etc., shall comply with Volume 3, Part 3, Section 1.

4.2.2.5 ***Storage of pipes, material and plant***

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

4.2.3 Street openings

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

4.2.3.2 All excavations in road reserves shall comply with the National Code of Practice for Utilities' Access to the Transport Corridors.

4.2.4 Existing utility services

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

4.2.5 Excavation

4.2.5.1 *General*

(a) Pipe laying shall be carried out in open cut except where permission has been obtained from Council for alternative methods.

4.2.5.2 *Trench outlines*

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

4.2.5.3 *Trench protection*

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

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

(c) All timber used in trenching shall be removed before backfilling.

4.2.5.4 *Subsoil water*

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

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

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

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

4.2.5.5 *Trench excavation*

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

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

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

4.2.5.6 ***Extra excavation***

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

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

4.2.5.7 ***Excavated material unsuitable for backfill***

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

4.2.5.8 ***Excavated wet material***

(a) Where, in the opinion of the Engineer, excavated material is too wet for immediate re-use as backfill, but will be suitable if allowed to dry, such material shall be stockpiled at any site that may be agreed and, when ready, replaced in the trench as backfill in accordance with Clause 4.2.7.

4.2.5.9 ***Disposal of excavated material***

(a) All excavated material which is not required for backfilling, or which has been deemed unsuitable for backfilling shall be removed from site.

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

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

4.2.6 Licensed drain layers

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

4.2.7 Bedding, pipe laying and jointing

4.2.7.1 ***Bedding***

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

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

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

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

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

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

4.2.7.2 ***Pipe laying and tolerances***

(a) *General*

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

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

(b) *Grade Control*

(i) Pipes shall be accurately laid to the lines, levels, and gradients shown on the Figures using pipe-laying laser equipment. The variation between specified invert level and invert level as laid shall not exceed 5mm.

(ii) The variation from grade of one pipe to the next shall not exceed 3mm. Where the variation exceeds the tolerance, the Engineer may order the removal and relaying of the pipes affected.

(c) *Service Connections (specific approval required)*

(i) Stormwater connections to a Council system require the specific approval from the Water Services Manager.

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

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

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

(v) Up until a service connection is utilised (i.e. connected to private drains), it shall be indicated on site as shown in Figure 96: TS 404 Connection details.

4.2.7.3 *Jointing*

(a) *Rubber Ring Joints*

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

4.2.8 Backfilling

4.2.8.1 *General*

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

4.2.8.2 *Pipe surround material*

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

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

4.2.8.3 *Bulk backfill material outside of carriageway areas*

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

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

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

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

(e) Compaction test results (or substituted scala penetrometer tests) shall be submitted to Council for approval by appending test results to the QA form on page 603. CBR value is to be determined by the Engineer, if required.

4.2.8.4 *Bulk backfill material in carriageway areas*

(a) For backfilling and trench reinstatement in carriageways, see Volume 3, Part 3, Section 13.

(b) Compaction test results (or substituted scala penetrometer tests) shall be submitted to Council for approval by appending test results to the QA form on page 603.

4.2.9 Manholes

4.2.9.1 *Types*

(a) Manholes shall be constructed in the position and to the details as shown on the Figures.

(b) Precast concrete manhole components may be used for the works subject to them complying in all respects to details specified hereafter and the details for finished manholes shown in Figure 92: TS 400.1 Manhole top and chamber slabs, Figure 94: TS 400.3 New manhole on existing line (sheet 2) and Figure 95: TS 400.5 New install manhole.

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

4.2.9.2 *Channels and benching*

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

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

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

(d) The benching shall have step recesses as shown in Figure 92: TS 400.1 Manhole top and chamber slabs, Figure 94: TS 400.3 New manhole on existing line (sheet 2) and Figure 95: TS 400.5 New install manhole.

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

(f) The construction tolerance for drop through the manhole shall be:

(i) No less than the Manhole Drop as shown on figures; or

(ii) No more than 5mm more than the Manhole Drop as shown on figures.

4.2.9.3 ***Flexible joints***

(a) All pipelines shall have a flexible joint adjacent to the manhole on all incoming and outgoing pipes as shown in Figure 92: TS 400.1 Manhole top and chamber slabs, Figure 94: TS 400.3 New manhole on existing line (sheet 2) and Figure 95: TS 400.5 New install manhole. The base of the manhole shall extend up to these flexible joints. The upper part of the pipe inside the manhole shall be cut back to the wall, the reinforcement cut out and the ends plastered with an epoxy mortar to a neat finish. Manholes not located at changes of line or gradient or at junctions with existing or proposed pipeline may be moved sufficiently to utilise existing pipe joints.

4.2.9.4 ***Drop connections***

(a) Drop connections into stormwater manholes may be avoided by allowing pipes up to and including 300mm diameter to have an open “cascade” inside the manhole, providing the steps are clear of any cascade.

4.2.9.5 ***Manhole steps***

(a) *Manhole Step Location*

(i) Manhole steps shall be provided at 300mm centres vertically (refer Figure 94: TS 400.3 New manhole on existing line (sheet 2). The top step shall not be more than 300mm below the top of the top slab, and the lowest step shall be not more than 375mm above the bench, or such lower level if detailed on other than standard manholes.

(b) *Bolt-Through Type Manhole Steps*

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

(ii) Prior to tightening, BM100 shall be placed around the step shank both inside and outside the manhole riser. After the steps have been tightened in place, the outside recess that houses the nut shall be sealed with Expocrete "UA" or acceptable equivalent in accordance with the manufacturer’s directions. Plastering of the recess will not be accepted.

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

4.2.9.6 ***Manhole tops***

(a) Manhole tops shall be constructed as detailed in Figure 92: TS 400.1 Manhole top and chamber slabs, Figure 94: TS 400.3 New manhole on existing line (sheet 2) and Figure 95: TS 400.5 New install manhole. The manhole frames and covers shall be to Figure 99: TS 407 Manhole cover and frame. The frame shall be set over the openings and adjusted to the correct height and slope using adjustment rings and mortar so as to conform with the surrounding surface – refer Figure 98: TS 406 Typical manhole top construction. They shall be held in place with a bold fillet of concrete, the top of which shall be 40mm below the top edge of the frame.

4.2.10 Site mortar jointing of pipes into manholes or pipelines or catch pits

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

(a) All screeded concrete surfaces to accept mortar shall be thoroughly scrubbed clean.

(b) All contact surfaces to accept mortar showing signs of contamination with oil, grease or any other non-water soluble agent shall be cleaned with "Expandite Mastic Acid" or an acceptable equivalent, applied and neutralised in accordance with the manufacturer’s directions.

(c) All mortar used for the 'on-site' jointing of drainage components shall be Expocrete "UA" or an approved equivalent. The surface priming, mixing of components, application and cure period to be in accordance with the manufacturer's directions.

4.2.11 Field concrete bandage

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

4.2.12 Culvert inlet and outlet structures

4.2.12.1 Culvert inlet and outlets shall be constructed as shown in Figure 100: TS 409 Inlet and outlet structure. Alternative proprietary structures are permissible subject to site specific approval by Council.

4.2.12.2 Lot connections into open stormwater drains shall be constructed as shown in Figure 101: TS 409B 100mm stormwater outlet structure.

4.2.13 Pavement surface conditions

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

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

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

4.2.14 Soak holes

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

4.2.15 Stormwater pipes to kerb and channel

4.2.15.1 Connection directly to Kerb and Channel will only be permitted in exceptional circumstances.

4.2.16 Testing

4.2.16.1 ***RCRRJ pipes 600mm diameter and above***

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

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

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

4.2.16.2 ***RRJ pipes below 600mm diameter***

(a) All stormwater pipes (<600mm diameter) and branch pipelines, including extended connections (>6m in length), are to be flushed, CCTV inspected then, at the discretion of Council officers, tested using a Low Pressure Air Test set down in the BIA Verification Method E1/VM1 Section 8.0 (as quoted below):

(i) *Low Pressure Air Test*

- Introduce air to the pipeline till a pressure of 300mm of water is reached. (This shall be measured by a manometer such as a 'U' tube, connected to the system).
- Wait until the air temperature is uniform (indicated by the pressure remaining steady).

- Disconnect the air supply.
- Measure pressure drop after 5 minutes.
- The pipeline is acceptable if the pressure drop does not exceed 50mm.

(b) The low pressure air test is highly susceptible to temperature fluctuations during the test period. A 1^{o}C change during the 5 minute test period will cause a pressure change of 30mm water gauge or 60% of the permitted change.

(c) Failure to soak ceramic and concrete pipes can cause highly variable results.

4.2.16.3 ***Infiltration test***

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

(b) Where infiltration is observed into stormwater pipelines, the following test shall apply.

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

4.2.17 Cleaning pipelines

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

4.2.18 Reinstatement

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

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

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

4.2.19 As-built records

4.2.19.1 An accurate "as-built" record shall be maintained as work progresses in accordance with Volume 1, Part 2 of this Manual and Section 3 of this Specification.

4.2.20 Work on in-service storm and wastewater sewers and manholes

4.2.20.1 Where connections are required to an operating stormwater pipe, the following requirements shall apply:

(a) Before any person enters any operating manhole or pipeline, the safety plan incorporating Confined Space Entry aspects shall be accepted by Council.

(b) Before making any connection, the new line to be brought into use shall be properly cleaned out and approved by Council as complying with all specifications.

(c) As soon as possible after the connection has been made and flow has been diverted, the benching shall be finished off to its new form.

(d) No concrete or any other debris shall be permitted to enter the pipe at any stage during connection or diversion.

Part 4 – Section 3: Works Completion and Clearance

4.3 Works Completion and Clearance

4.3.1 As-built plans

4.3.1.1 Upon completion of construction work, copies of "As-Built" plans and data recording information about the completed works, as listed in Table 34: Asset Specific Data shall be provided to Council. Separate plans are required for wastewater, stormwater and water supply for contracts and larger developments only (Refer Threshold Matrix in this Part. Responsibility for providing the plans and associated data shall lie with:

(a) The Developer, in the case of land development (urban and industrial sub-division).

(b) The Contractor, in the case of works constructed for Council under contract to Council.

4.3.1.2 Plans presented in fulfilment of this requirement shall be shown as "As-Built" in the amendments part of the figure title block and signed-off as 'approved for issue' by a person having responsibility for the quality assurance aspect of the as-built information.

4.3.1.3 As-built plans and associated data shall be sent to:

(a) In the case of subdivisions:

Development Engineering Manager **Waipa District Council** **Private Bag 2402** **Te Awamutu**

(b) E-mail electronic files to: as-builts@waipadc.govt.nz and include in the subject heading: Council Subdivision Consent Number, subdivision name and stage number

(c) In the case of Council contracts, send to the Engineer for forwarding to the appropriate Council asset manager.

4.3.2 Data presentation formats

4.3.2.1 For larger developments, the as-built data is required in three formats (Refer Threshold Matrix in this Part):

(a) Conventional hard copy plans using line formats as indicated in Volume 1, Part 2, figure sheet size A3 and plan scale 1:500 preferred.

(b) Electronic Microsoft Excel spread sheets listing various attributes of the assets constructed - refer blank template files accessed from the Table of Contents page of this Part.

(c) Where as-built plans are prepared using computer aided design software, DXF format export files of the hard copy plans are required. The specification for the format is laid out in Volume 4: Appendix 7.

4.3.2.2 Hard copy plans are used in updating Council's records. The DXF format files facilitate data upload to the GIS. The spread sheet lists of asset data facilitate data upload to the asset information database. As well as recording dimension and materials information, this database is used to manage asset condition information.

4.3.3 Asset values

4.3.3.1 This requirement has been suspended pending review. Refer to Volume 4, Part 9, Appendix 8.

4.3.4 Datum's and units of measurement

4.3.4.1 Only metric units are to be used in as-built data. Principally these are millimetres *(mm)*, meters *(m)*, litres/sec *(L/s)*, cubic meters /day.

4.3.4.2 All levels are to be in terms of Moturiki Datum and to two decimal places.

4.3.4.3 Geographic coordinates shall be:

(a) New Zealand Geodetic Datum 2000 (NZGD2000).

(b) Projection: Mount Eden Circuit 2000.

4.3.4.4 Coordinates should be presented in standard 6-digit format (east coordinate followed by north coordinate) to two decimal places. e.g. 305718.97, 643728.35.

4.3.5 Asset components types and as-built data requirements

4.3.5.1 As-built data shall be accompanied by the following list of project specific data:

(a) Works construction contractor.

(b) Project name or subdivision name (including subdivision stage number).

(c) Council contract number (Council projects).

(d) Council project ledger code (Council projects).

(e) Name of person responsible for preparing the as-built data.

(f) Date of preparing the as-built data.

(g) Date of construction.

4.3.5.2 The following list of asset specific data shall be supplied as tabulated data and shown on the figures.

> Advice Note: Occasionally privately owned assets need to be shown on as-built plans; such assets shall be clearly labelled 'Private …'*name and details of asset*'.

Table 34: Asset Specific Data

Asset Component Type	Asset Attribute Required	Shown on plans	Comment
Stormwater Inlets	Plan ID	Yes	Plan number used to identify as-built plan
	Downstream MH ID	Yes	
	Property ID	Yes	Either property number or legal description adjacent to manhole
	Street Name	Yes	If street name is not applicable use a property deposited plan (DP) number
	Street Type	Yes	Qualifier to street name e.g. Crescent, Road, Lane, etc.
	Location		Private property, roadway, berm, reserve
	Structure Type	Yes	Plain end pipe, headwall, in-ground chamber, etc. Show structure location on plan
	Structure Material		PVC, concrete, timber, etc.
	Eastern coordinate		
	Northern coordinate		
	Asset Value		Refer Clause 4.3.3 of this section
	Comments		Any pertinent comments (particularly water table depth and soil conditions)
Stormwater Pipelines	Plan ID	Yes	Plan number used to identify as-built plan
(including culverts)	Upstream MH ID	Yes	Use pipe-end ID if pipeline is simply blanked-off
	Downstream MH ID	Yes	ID of stormwater outlet structure
	Street Name	Yes	If street name is not applicable, use a property deposited plan (DP) number
	Street Type	Yes	Qualifier to street name e.g. Crescent, Road, Lane, etc.
	Location		Private property, roadway, berm, reserve
	Pipe Diameter	Yes	Nominal bore in millimetres
	Pipe Length	Yes	Length upstream MH to downstream MH
	Pipe Gradient	Yes	Record as 1: ??? or ??.?? %
	Pipe Material	Yes	Material and strength classification
	Joint Type		RRJ
	Invert Level Upstream	Yes	Pipe invert level
	Invert Level Downstream	Yes	Pipe invert level
	Secondary Flow Path	Yes	Show on as-built plans (easement required on private land). Not required on data sheet
	Service Status	Yes	Abandoned and decommissioned pipelines are required to be identified on as-built records Show “A” for abandoned pipes

Asset Component Type	Asset Attribute Required	Shown on plans	Comment
			"D" for abandoned/decommissioned pipes
	Asset Value		Refer Clause 4.3.3 of this section
	Comments		Any pertinent comments (particularly water table depth and soil conditions). Identify culverts
Stormwater Service Pipelines	Plan ID	Yes	Plan number used to identify as-built plan
	Upstream MH ID	Yes	Use 'Pipe-End ID' if pipeline is simply blanked-off
	Downstream MH ID	Yes	Or ID of downstream asset
	Property ID	Yes	Either property number or legal description
	Street Name	Yes	If street name is not applicable use a property deposited plan (DP) number
	Street Type	Yes	Qualifier to street name e.g. Crescent, Road, Lane, etc.
	Service Type		Pipe drain, K & C connection
	Service Pipe Diameter	Yes	Nominal bore in millimetres
	Service Pipe Length	Yes	
	Service Pipe Material	Yes	Material and strength classification
	Invert level at private end	Yes	Pipe invert level
	Depth at Private End		Depth from ground level to invert level
	Eastern coordinate connection		Coordinate of customer end of service pipeline
	Northern coordinate connection		Coordinate of customer end of service pipeline
	Distance from left (LB) or right (RB) boundary	Yes	Distance to customer connection point relative to left-hand or right-hand boundary facing the property from the street
	Distance from front (FB) or back (BB) boundary	Yes	
	Asset Value		Refer Clause 4.3.3 of this section
	Comments		Any pertinent comments (particularly water table depth and soil conditions)
Stormwater Manholes	Plan ID	Yes	Plan number used to identify as-built plan
	MH ID	Yes	
	Property ID	Yes	Either property number or legal description adjacent to manhole
	Street Name	Yes	If street name is not applicable use a property deposited plan (DP) number

Asset Component Type	Asset Attribute Required	Shown on plans	Comment
	Street Type	Yes	Qualifier to street name e.g. Crescent, Road, Lane, etc.
	Lid Level	Yes	Top edge and northern part of rim casting
	Invert Level	Yes	Invert of all pipes entering manhole
	MH Diameter		Nominal Bore of MH risers
	Eastern coordinate		Location as per lid level
	Northern coordinate		Location as per lid level
	Asset Value		Refer Clause 4.3.3 of this section
	Comments		Any pertinent comments (particularly water table depth and soil conditions)
Stormwater Soakage Trench	Plan ID	Yes	Plan number used to identify as-built plan
	Street Name	Yes	If street name is not applicable use a property deposited plan (DP) number
	Street Type	Yes	Qualifier to street name e.g. Crescent, Road, Lane, etc.
	Location		Roadway, private, recreation reserve, etc.
	Trench soakage media	Yes	Cross-sectional diagram required of all soakage devices
	Length	Yes	
	Width	Yes	
	Depth	Yes	
	Ground Level		
	Invert Level		
	Eastern coordinate – end 1		
	Northern coordinate – end 1		
	Eastern coordinate – end 2		Only one set of coordinates is required if the ‘trench’ is circular, i.e. a ‘soakage hole’
	Northern coordinate – end 2		Only one set of coordinates is required if the ‘trench’ is circular, i.e. a ‘soakage hole’
	Structure Type	Yes	Proprietary name, lined hole, perforated pipe, etc.
	Asset Value		Refer Clause 4.3.3 of this section
	Comments		Any pertinent comments (particularly water table depth and soil conditions)
Stormwater Outlets	Plan ID	Yes	Plan number used to identify as-built plan
	Upstream MH ID	Yes	
	Property ID	Yes	Either property number or legal description

Asset Component Type	Asset Attribute Required	Shown on plans	Comment
			adjacent to manhole
	Street Name	Yes	If street name is not applicable use a property deposited plan (DP) number
	Street Type	Yes	Qualifier to street name e.g. Crescent, Road, Lane, etc.
	Location	Yes	Private property, roadway, berm, reserve
	Structure Type	Yes	Plain end pipe, headwall, etc. Show structure location on plan
	Structure material		PVC, concrete, timber, etc.
	Discharges to		Name of receiving water body, e.g. Waikato River
	Ground Level		
	Eastern coordinate		Location at point of stormwater discharge
	Northern coordinate		Location at point of stormwater discharge
	Asset Value		Refer Clause 4.3.3 of this section
	Comments		Any pertinent comments (particularly water table depth and soil conditions)
Stormwater Catch pits	Plan ID	Yes	Plan number used to identify as-built plan
	Catch pit ID	Yes	Provide a catch pit ID to ensure correct association of tabulated information and plan
	Property ID	Yes	Either property number or legal description adjacent to manhole
	Street Name	Yes	If street name is not applicable use a property deposited plan (DP) number
	Street Type	Yes	Qualifier to street name e.g. Crescent, Road, Lane, etc.
	Catch pit Type	Yes	Footpath berm, single or double sump, vertical entry
	Catch pit Grate Level		
	Eastern coordinate		Centre of catch pit grate
	Northern coordinate		Centre of catch pit grate
	Asset Value		Refer Clause 4.3.3 of this section
	Comments		Any pertinent comments (particularly water table depth and soil conditions)
Stormwater catch pit connections/ leads	Plan ID	Yes	Plan number used to identify as-built plan
	Catch pit ID	Yes	Identifier to associate pipeline with correct catch pit
	Downstream MH ID	Yes	Or ID of downstream asset

Asset Component Type	Asset Attribute Required	Shown on plans	Comment
	Property ID	Yes	Either property number or legal description adjacent to manhole
	Street Name	Yes	If street name is not applicable, use a property deposited plan (DP) number
	Street Type	Yes	Qualifier to street name e.g. Crescent, Road, Lane, etc.
	Connection Pipe Diameter		Nominal Bore of connection pipeline
	Connection Pipe Length	Yes	
	Connection Pipe Material		Material of connection pipeline
	Invert level downstream end of connection		RL of pipeline invert when catch pit connected to a manhole
	Asset Value		Refer Clause 4.3.3 of this section
	Comments		Any pertinent comments (particularly water table depth and soil conditions)
Stormwater Open Channels	Plan ID	Yes	Plan number used to identify as-built plan
	Upstream Outlet ID	Yes	Define lengths of open channel as draining between structures or junctions with other watercourses/drains
	Downstream Inlet ID	Yes	Define lengths of open channel as draining between structures or junctions with other watercourses/drains
	Street Name	Yes	If street name is not applicable, use a property deposited plan (DP) number
	Street Type	Yes	Qualifier to street name e.g. Crescent, Road, Lane, etc.
	Location	Yes	Private property, roadway, berm, reserve
	Channel Lining Material	Yes	
	Channel Length	Yes	Length upstream outlet to downstream inlet
	Channel Width	Yes	
	Average Depth		Formation depth, ground level to invert level
	Invert Level Upstream	Yes	
	Invert Level Downstream	Yes	
	Eastern coordinate – upstream inlet		
	Northern coordinate – upstream inlet		
	Eastern coordinate – downstream outlet		
	Northern coordinate – downstream outlet		

Asset Component Type	Asset Attribute Required	Shown on plans	Comment
	Asset Value		Refer Clause 4.3.3 of this section excluding land value, formation cost only
	Comments		Any pertinent comments (particularly water table depth and soil conditions)
Stormwater Subsoil Drains	Plan ID	Yes	Plan number used to identify as-built plan
	Downstream MH ID	Yes	Or ID of discharge point for drain
	Street Name	Yes	If street name is not applicable, use a property deposited plan (DP) number
	Street Type	Yes	Qualifier to street name e.g. Crescent, Road, Lane, etc.
	Location	Yes	Private property, roadway, berm, reserve
	Ownership	Yes	Public or private responsibility for the subsoil drain
	Pipe Diameter	Yes	Nominal bore in millimetres
	Pipe Length	Yes	Length upstream MH to downstream MH
	Pipe Material	Yes	PE, Earthenware, etc.
	Invert Level Upstream	Yes	
	Invert Level Downstream	Yes	
	Eastern coordinate – upstream end		
	Northern coordinate – upstream end		
	Eastern coordinate – downstream outlet		
	Northern coordinate – downstream outlet		
	Asset Value		Refer Clause 4.3.3 of this section
	Comments		Any pertinent comments (particularly water table depth and soil conditions)
Stormwater Control Device	Plan ID	Yes	Plan number used to identify as-built plan
	Street Name	Yes	If street name is not applicable, use a property deposited plan (DP) number
	Street Type	Yes	Qualifier to street name e.g. Crescent, Road, Lane, etc.
	Location		Private property, roadway, berm, reserve
	Site Plan	Yes	Site plan showing detention area location and contours relative to adjoining properties and receiving watercourse. To show control

Asset Component Type	Asset Attribute Required	Shown on plans	Comment
			structure(s) in both plan and elevation and access provision
	Type		e.g. Detention area, wet detention pond, wetland, chamber, etc.
	Surface Area	Yes	Surface area at top water level. On the plan, show extent of pond at top water level
	Total Capacity		Total volume of detention area below top water level
	Live Storage Capacity		Volume of detention area between normal water level and top water level
	Top water level	Yes	Level at which spillway becomes operative
	Outlet invert	Yes	Invert level of discharge control pipeline (lower operating level)
	Asset Value		Refer Clause 4.3.3 of this section excluding land value, formation cost only
	Comments		Any pertinent comments
Secondary Flow Paths	Plan ID	Yes	Plan number used to identify as-built plan
	Street Name	Yes	If street name is not applicable, use a property deposited plan (DP) number
	Street Type	Yes	Qualifier to street name e.g. Crescent, Road, Lane etc.
	Location		Private property, roadway, berm, reserve
	Site Plan	Yes	Site plan showing secondary flow path location and contours relative to adjoining properties and receiving watercourse
	Type		e.g. grassed swale, concrete footpath
	Surface Width	Yes	Surface width at top water level. On the plan, show extent of secondary flow path at top eater level
	Overflow Level	Yes	RL of point at which overflow into the secondary flow path begins
	Asset Level		Refer Clause 4.3.3 of this section, exclude land value, formation cost only
	Comments		Any pertinent comments such as covered by easement over xxx property title

4.3.6 Threshold matrix for as-built data

4.3.6.1 For small developments, the provision of separate as-built plans for each service, separate data sheets and DXF data is not justified. Therefore, the following matrix has been developed to guide when each type of data presentation is required. If the data presented is not clear, Council may request additional information.

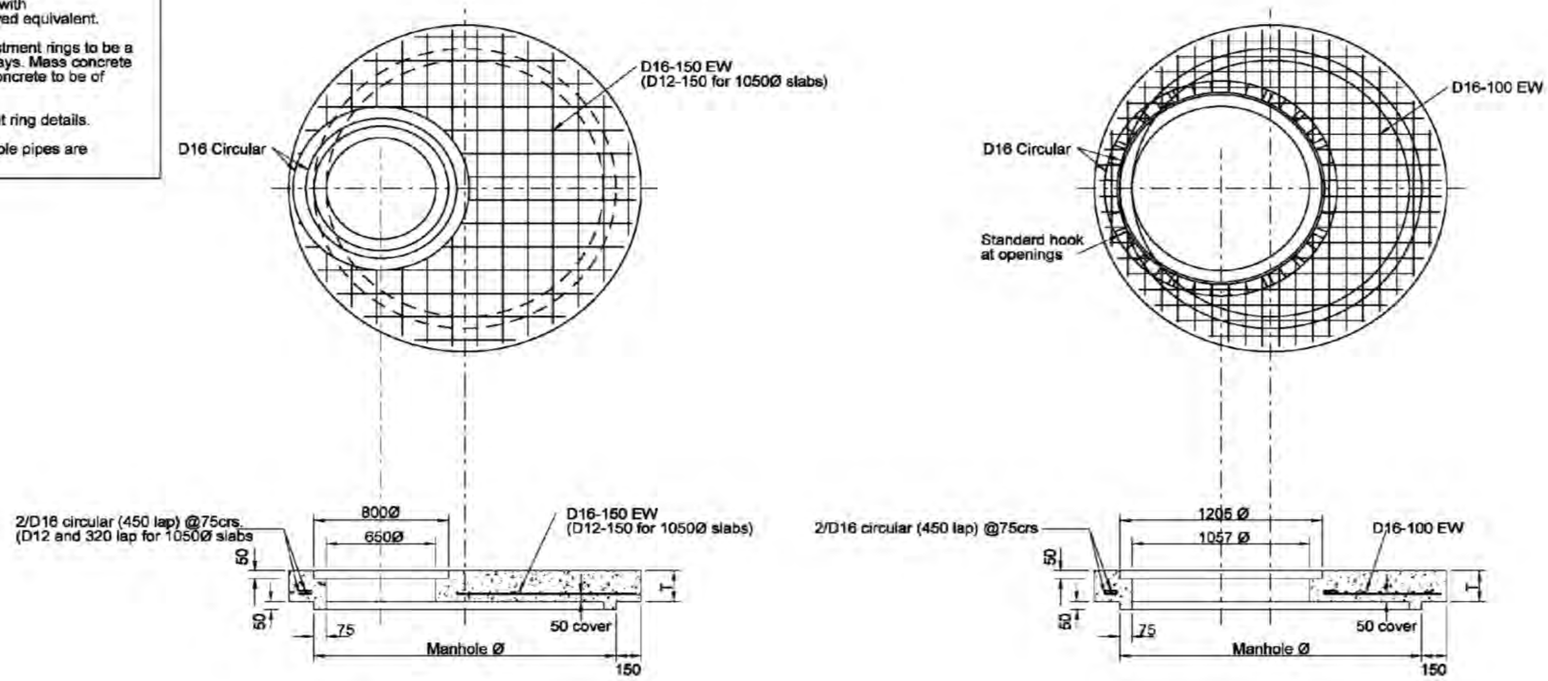
Table 35: Threshold Matrix for As-built Data

	Small development (2 – 5 lots)	Medium development (5 - 10 lots)	Large development (10+ lots)	Contract
Separate plans for each service	No	Not required if adequate clarity is possible on same plan	Yes	As per large development or contract documents
DXF data	Please supply if available	Yes	Yes	As above
Separate data spread sheets	No, include information on plans	WW or SW if >2 manholes or 10 lots water if more than 5 hydrants or valves	Yes	As above
GST invoice on vesting	Yes	Yes	Yes	As above
Plan size	A3	A3	A3	As above

4.3.6.2 As-built figures must be scalable. Refer to Volume 1, Part 2, Clause 2.4.3.

NOTES

1. Manhole chambers and chimneys flush joint Class 'S'
2. All flush joints to be sealed with expandite BM100 or approved equivalent.
3. Concrete in slabs and adjustment rings to be a minimum of 21MPa at 28 days. Mass concrete to be 21MPa at 28 days. Concrete to be of ordinary grade.
4. Refer TS 406 for adjustment ring details.
5. Diameters of precast manhole pipes are nominal only.



MANHOLE TOP SLAB

Manhole Ø	Slab Thickness (T)
1000 Ø - 1400 Ø 1450 Ø - 1800 Ø Over 1800 Ø	150mm 200mm 250mm

MANHOLE CHAMBER SLAB

Manhole Ø	Slab Thickness (T)
1350 Ø - 1800 Ø Over 1800 Ø	200mm 250mm

Waipa DISTRICT COUNCIL
Service Delivery
Development Manual

MANHOLE TOP & CHAMBER SLABS

Approved by: Water Services Manager

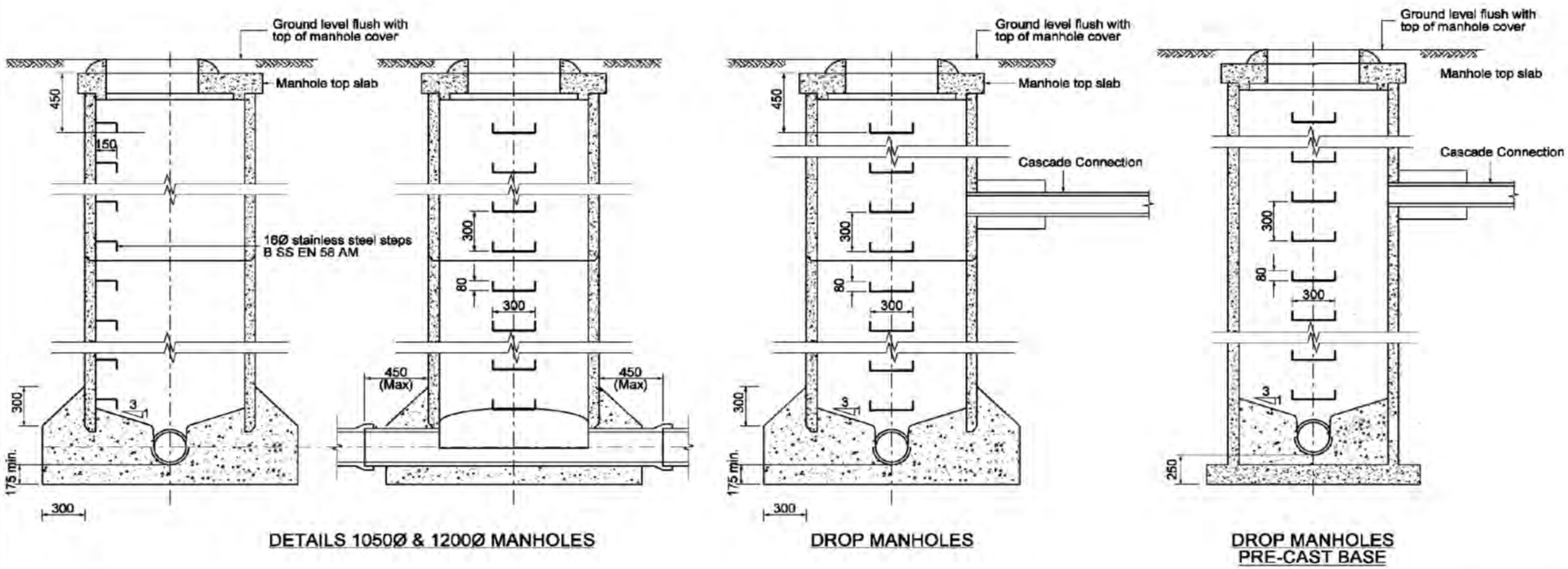
TS 400.1

Version: May 2012

Figure 92: TS 400.1 Manhole top and chamber slabs

NOTES

1. Manhole chambers and chimneys flush joint Class 'S'
2. All flush joints to be sealed with expandite BM100 or approved equivalent.
3. Concrete in slabs and adjustment rings to be a minimum of 21MPa at 28 days. Mass concrete to be 21MPa at 28 days. Concrete to be of ordinary grade.
4. If further internal drop connections are expected, design manhole diameter may be increased (ie. 1050Ø → 1200Ø)
5. Refer TS 406 for adjustment ring details.
6. Diameters of precast manhole pipes are nominal only.



Waipa District Council
Service Delivery Development Manual

NEW MANHOLE ON EXISTING LINE
SHEET 1

Approved by: Water Services Manager

TS 400.2

Version: May 2012

Figure 93: TS 400.2 New manhole on existing line (sheet 1)

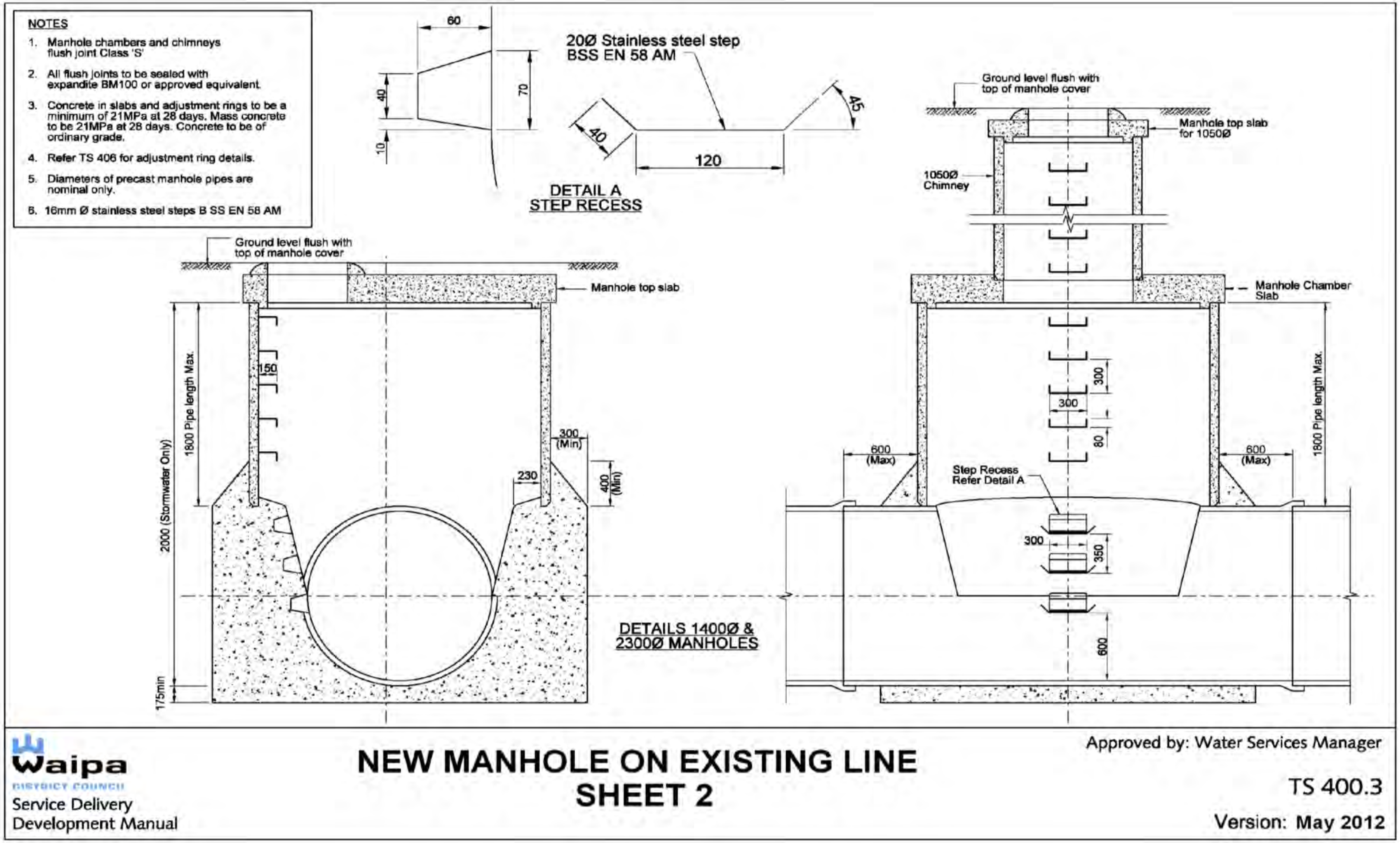


Figure 94: TS 400.3 New manhole on existing line (sheet 2)

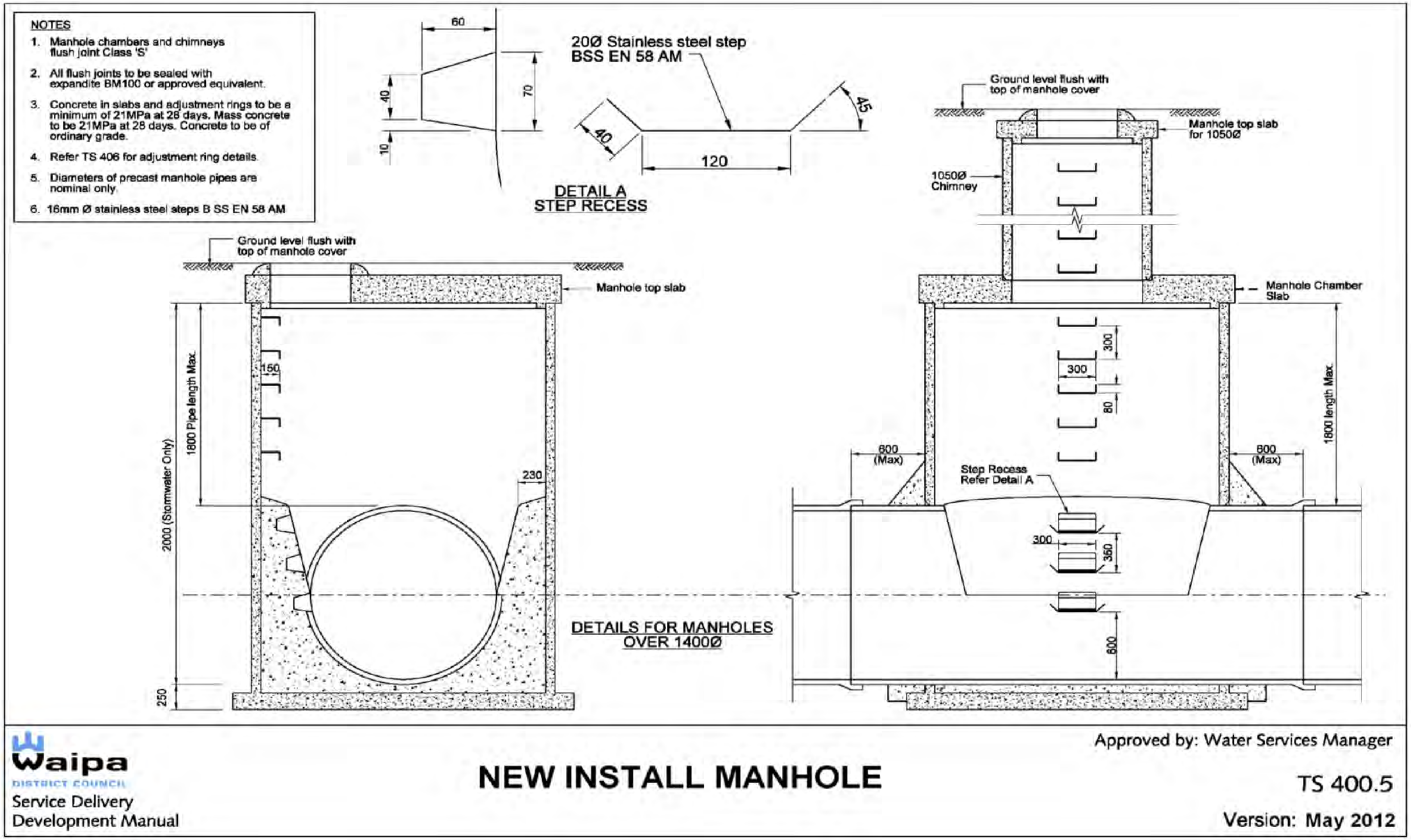


Figure 95: TS 400.5 New install manhole

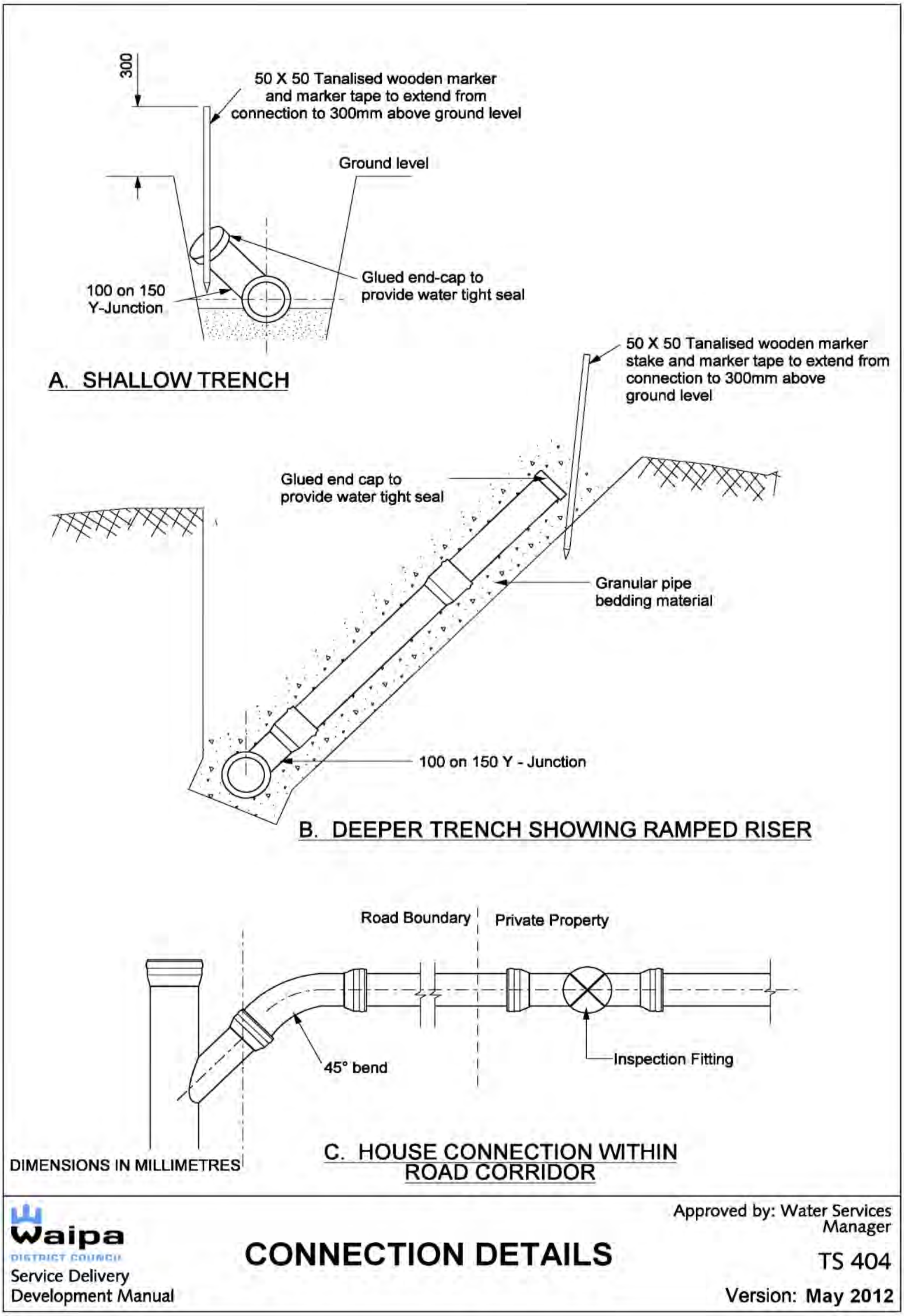


Figure 96: TS 404 Connection details

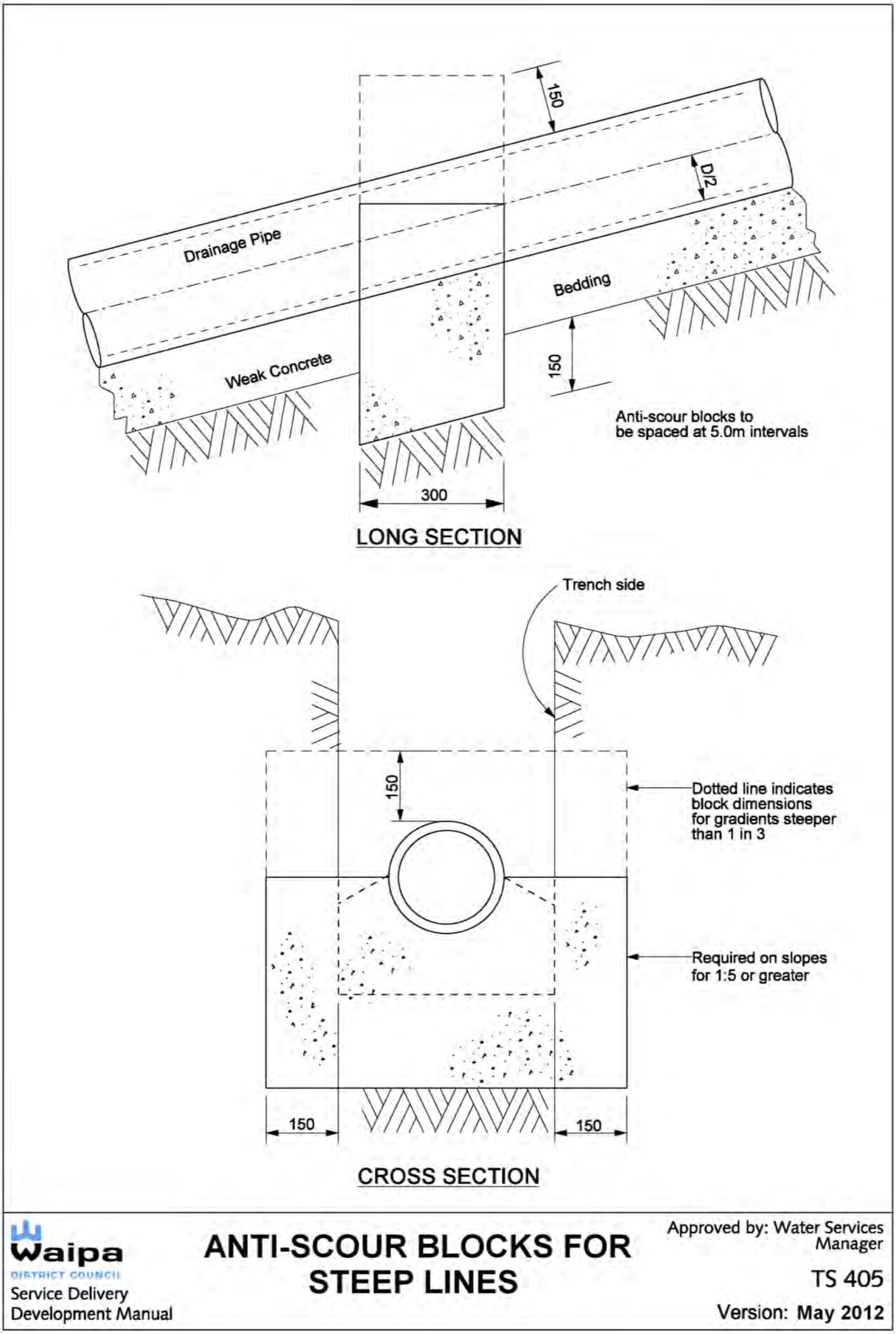


Figure 97: TS 405 Anti-scour blocks for steep lines

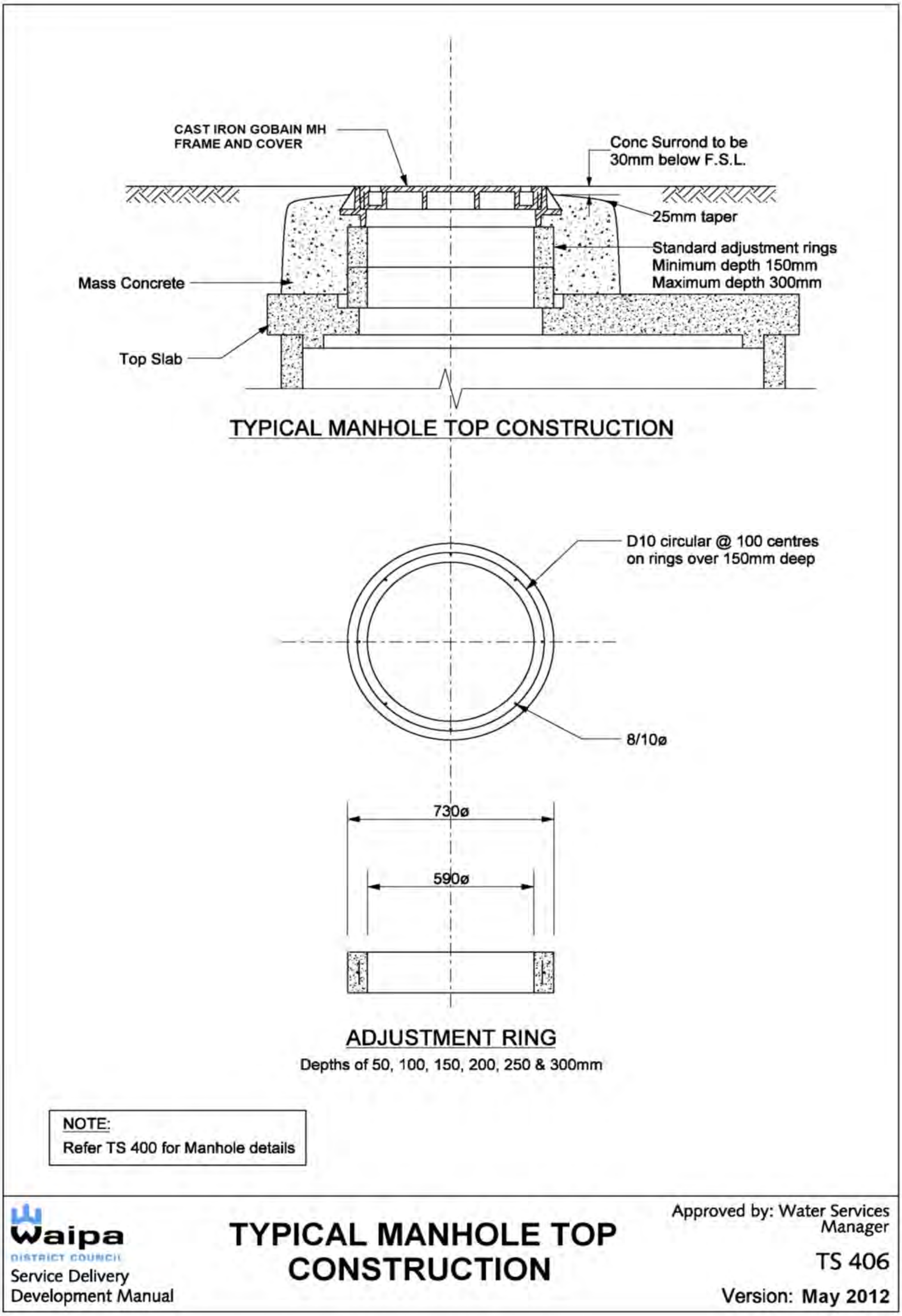


Figure 98: TS 406 Typical manhole top construction

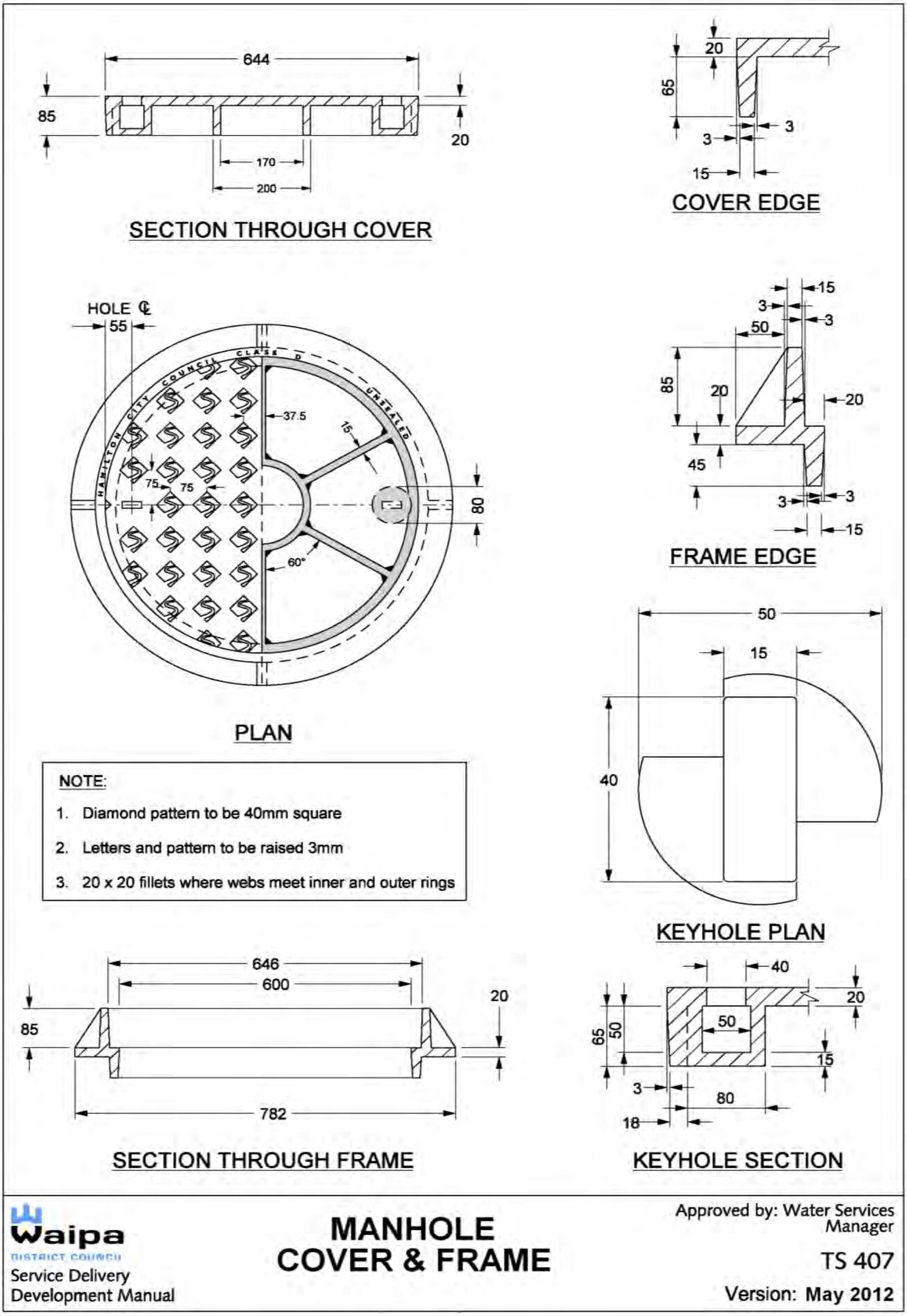
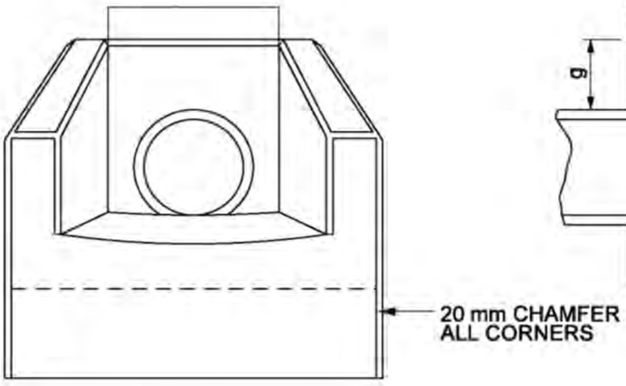
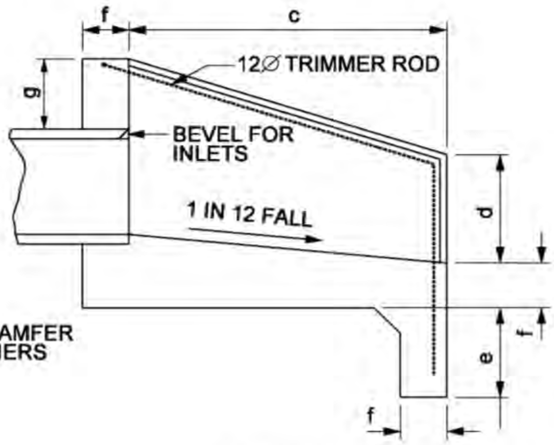


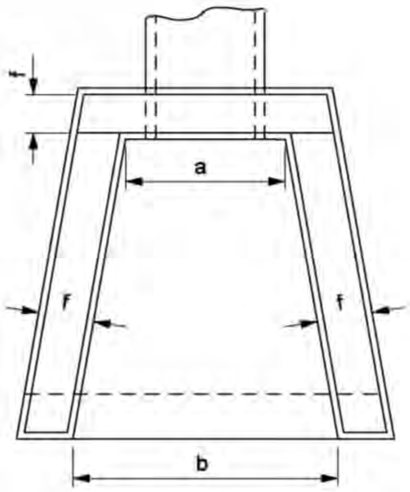
Figure 99: TS 407 Manhole cover and frame



END ELEVATION



SECTION



PLAN

PRINCIPAL DIMENSIONS (mm)							
DIA OF PIPE	a	b	c	d	e	f	g
150	300	450	600	200	150	100	150
225	380	600	700	250	200	100	150
300	450	750	750	300	200	100	150
375	550	900	850	350	200	100	150
450	630	1100	900	400	230	150	230
525	700	1200	1000	450	230	150	230
600	800	1400	1100	550	230	150	230
750	1000	1700	1200	600	300	150	300
900	1170	2000	1450	650	300	150	300
1050	1380	2300	1700	750	450	150	300
1200	1520	2600	2100	750	450	150	450
1350	1680	2800	2400	750	450	150	450

1. Reinforce floor & walls with;
   150 - 375 665 Mesh
   450 - 600 663 Mesh OR 10 dia. rods @ 250 crs.
   615 - 900 12 dia. rods @ 250 crs.
   1050 - 1350 12 dia. rods @ 150 crs.
2. All reinforcing shall be placed centrally in walls and floor, and shall be continuous between walls and floor.
3. Laps in structural grade bars to be 300mm minimum.
4. There shall be at least two bars whether mesh or MS over the top of the pipe.
5. Concrete is to be ordinary grade (17.5 MPa) in accordance with NZS 3108:1983.
6. Inlet Structures to have reverse apron fall.

Waipa
DISTRICT COUNCIL
Service Delivery
Development Manual

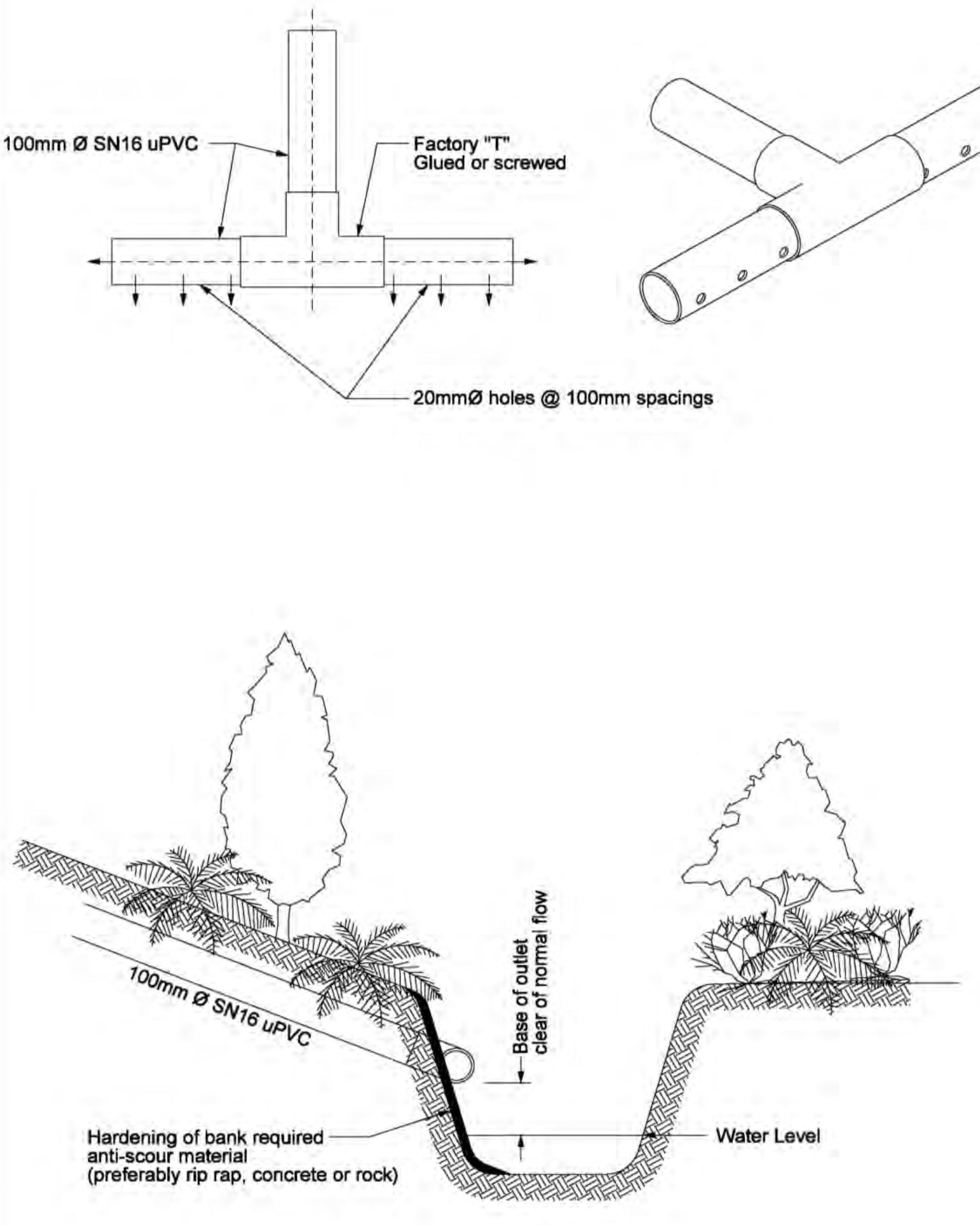
INLET AND OUTLET STRUCTURE

Approved by: Water Services Manager

TS 409

Version: May 2012

Figure 100: TS 409 Inlet and outlet structure



Waipa District Council
Service Delivery
Development Manual

100mm Ø STORMWATER OUTLET STRUCTURE

Approved by: Water Services Manager

TS 409 B

Version: **May 2012**

Figure 101: TS 409B 100mm stormwater outlet structure

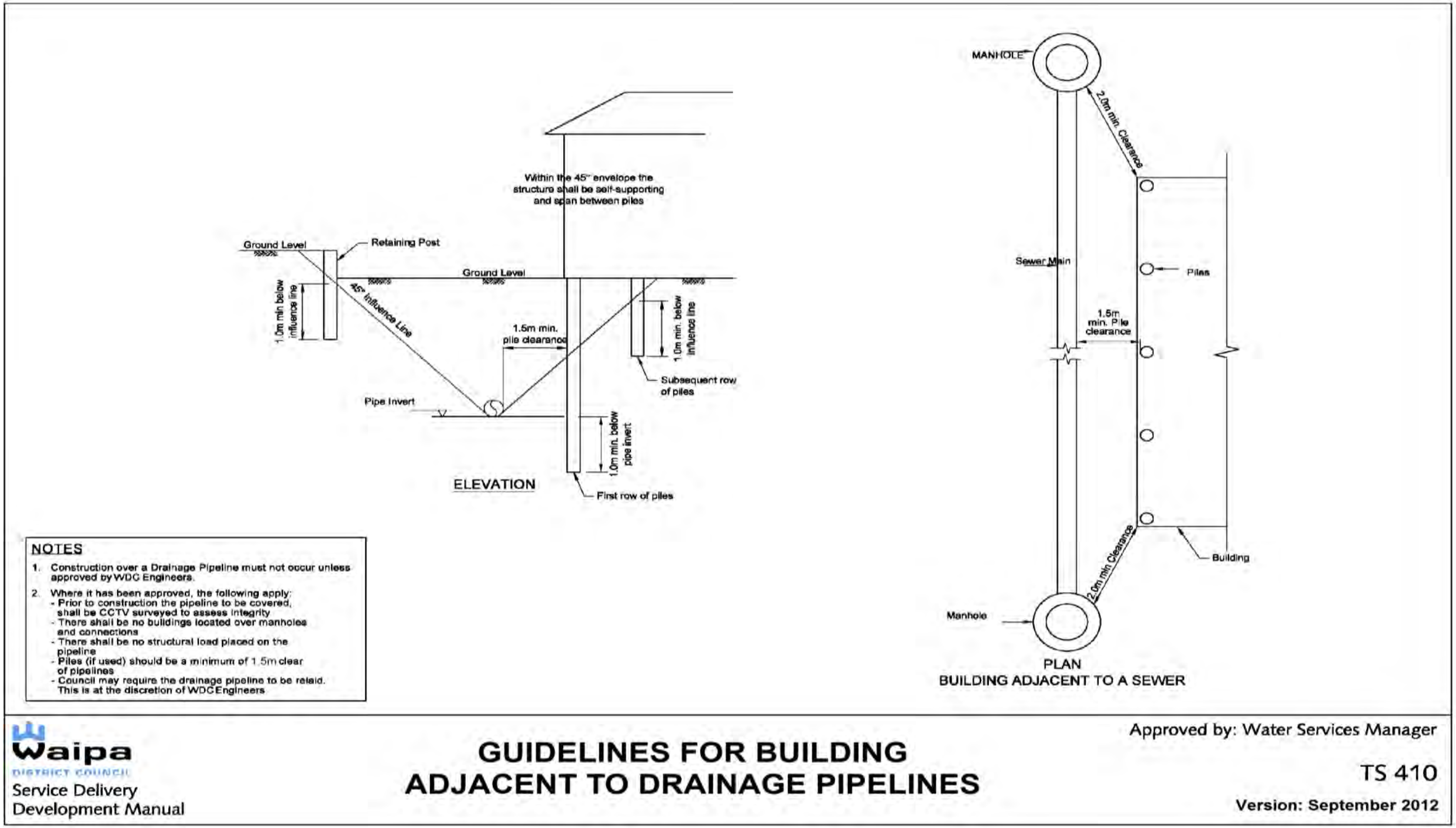


Figure 102: TS 410 Guidelines for building adjacent to drainage pipelines

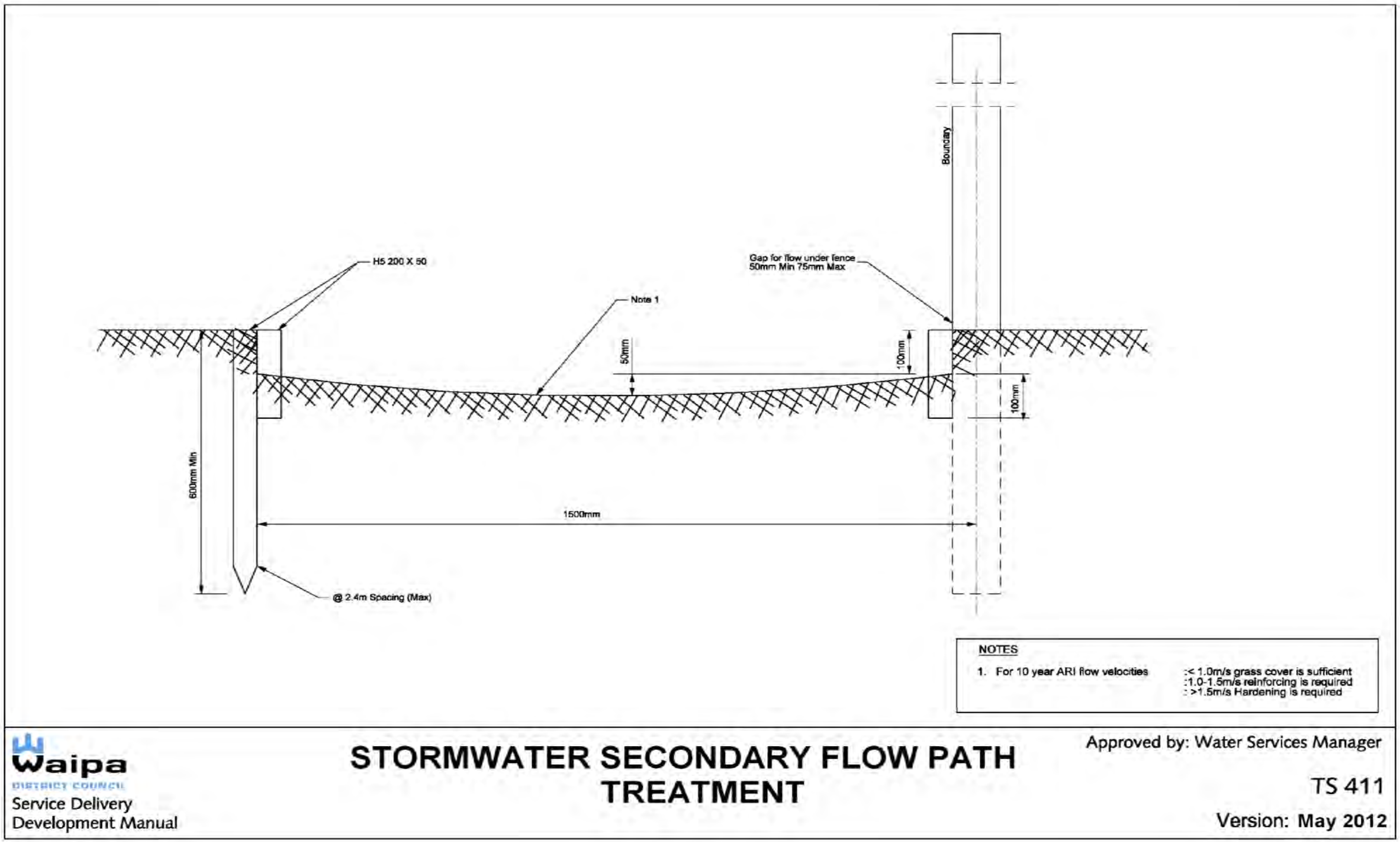
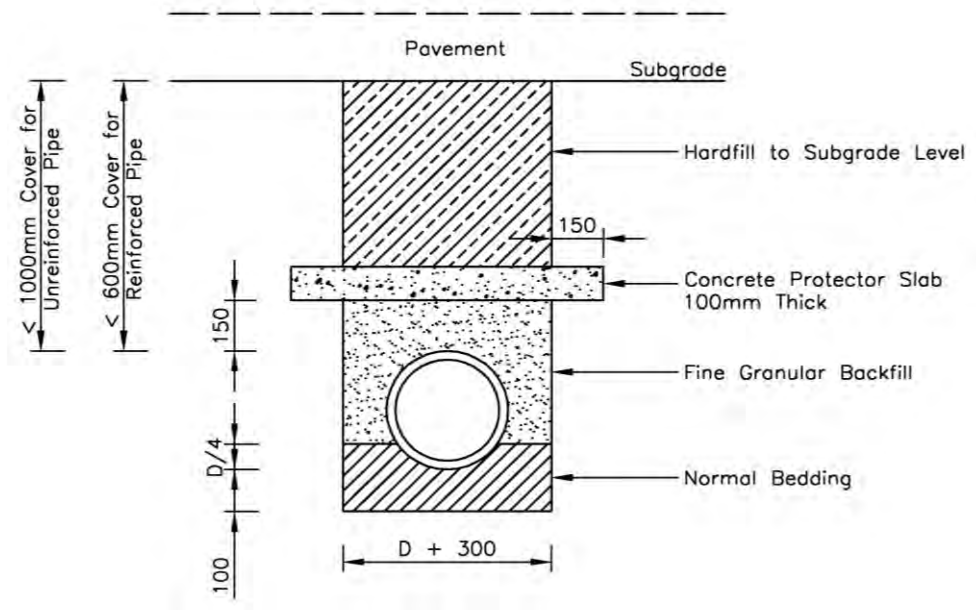


Figure 103: TS 411 Stormwater secondary flow path treatment



Waipa DISTRICT COUNCIL
SERVICE DELIVERY

PROTECTION FOR SHALLOW PIPES UNDER CARRIAGEWAYS

DEVELOPMENT MANUAL
TS412
Approved: Manager Water Services
Version: May 2012

Figure 104: TS 412 Protection for shallow pipes under carriageways

Part 5: Wastewater Drainage

Table of Contents

Standard Figures

Part 5 – Section 1: Acceptable Fittings and Materials

5.1.1 Scope

5.1.1.1 This specification covers the list of materials acceptable for use within the Waipa District Council Sanitary Sewer network, and covers materials (up to the boundary) which Council has, or will, assume responsibility for. Fittings not in accordance with this list will be rejected unless written approval from Council is obtained prior to installation. Rejected products and materials will be subject to removal at the Contractor or Subdivider's cost.

5.1.1.2 This list of Acceptable Fittings and Materials will be updated in July and December each year or at other times when four or more acceptable products need to be incorporated into the list.

5.1.1.3 All applications to the Acceptable Fittings and Materials list must be accompanied by the pro-forma Volume 4: Quality Checklists & Appendices, Part 9, Appendix 6: Application for Acceptance of Water or Drainage Product for Use in the Waipa District Council Water Supply Area or Drainage District.

5.1.1.4 Requirements for acceptance of materials are as follows:

(a) Conforms to appropriate New Zealand, Australian or British standards with evidence of the licence number issued;

(b) Manufacturer operates to an acceptable quality assurance standard;

(c) Details of composition, dimensions, specific use and design life are supplied by the manufacturer;

(d) Details of acceptance by other New Zealand local authorities;

(e) Details are supplied by the manufacturer on how the product should be installed; and

(f) The product is acceptable to Waipa District Council (taking into account such factors as compatibility with other approved products, ease of use, availability of supply, etc.).

5.1.1.5 Where there is no standard, the manufacturer will be required to supply copies of their quality assurance procedures and producer statements to support their performance and composition claims for the products concerned.

5.1.1.6 Completed applications and supporting information should be addressed to:

The Manager
Water Services
Waipa District Council
Private Bag 2402
Te Awamutu 3840

5.1.1.7 Council reserves the right to refuse any material or fitting from the Acceptable Fittings and Materials list for any reason and at any time. In such circumstances, Council will provide written notification, stating reasons why the material or fitting has been refused or removed from the Acceptable Fittings and Materials list.

5.1.2 Pipe Materials

Table 36: Pipe materials including manufacturer

Pipe Materials	Manufacturer/Product ID
Centrifugally Spun Manufactured Concrete Pipes (manufactured to AS/NZS 4058:2007)	
Note: pipes intended for wastewater applications shall be manufactured using a sulphate resistant concrete mix and, in addition to the standard thickness of concrete mix around steel reinforcing, the pipes shall have a 25mm thick internal sacrificial lining of concrete mix.	
Rubber Ring Jointed Class 2, 3 & 4	Humes (Licence #2618)
225mm diameter – 2500mm diameter	Hynds (Licence #2586)
Flush Jointed Class S 1, 2 & 3	Humes (Licence # 2618)
600mm diameter – 2500mm diameter	Hynds (Licence # 2586)
Skid Ring Joint Class 2, 3 & 4	Hynds (Licence # 2586)
600mm, 675mm – 1200mm and 2100mm diameter.	Hynds (Licence #2618)
PVC PIPE	
AS/NZS 1260:2009 Class SN16 RRJ	Marley(Licence # 2365)
100mm dia – 225mm dia and associated fittings	Iplex (Licence # SMK P2012
	Keyplas (Licence # 2622)
	RX Plastics STORM-LOCK (Licence #003)
POLYPROPYLENE PIPE (SEWERBOSS)	
AS/NZS 5065:2005 Class SN16 RRJ	Waters and Farr
225mm dia – 450mm dia and associated fittings	
MANHOLE RISERS	
1050 dia – 2500 dia	Humes
300mm – 2400mm	Hynds
MANHOLE LID AND FRAME	
Cast Iron Lid and Frame	
AS 3996 - 2006 compliant Class D	Hygrade Products Ltd
600mm diameter manhole lid & frame	(BV licence # 2546)
	Surecast Metals Ltd
	(Licence # SMK02728)
Cast Iron Lid and Frame	
AS 3996 – 2006 compliant	Webforge (supplied by Humes)
Class D 600 diameter manhole lid and frame	(DCC6DWISRHZ)

Pipe Materials	Manufacturer/Product ID
AS 3996 – 2006 compliant	Webforge (supplied by Humes)
Class D 600 diameter manhole lid and frame with Spigot Frame	(DCC6DWISRHZ)
Manhole Snapring riser	Webforge (supplied by Humes)
50mm, 75mm and 100mm	
MANHOLE STEPS	
Stainless Steel	Costavic
MWT253 Plastic encapsulated Stainless Steel	Nextep Miyama
Safety Step	(Licence#JP-JQA-QM6570)
MANHOLE CHANNEL FORMS	
EEZI Liner (polyethylene U shaped channel form)	NZ Channel Forms Ltd
Earthenware	Refer to Ceramic Pipe below
Ceramic Pipe AS1741:1991	Naylor (supplied by Humes - Kiterack 20173)
Vitrified Clay Pipes and Fittings with Flexible Joints – Sewer Quality or BS EN 295	Keramo Steinzeug (supplied by Hynds – Lic # KM22656)
	Hepworth (supplied by Mico License # KM14092)
100mm dia. – 300mm dia pipe and associated fittings	Clarks Potteries (License # 010151)

Part 5 – Section 2: Construction Specification

5.2.1 General

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

5.2.2 Materials

5.2.2.1 ***Standards***

(a) All materials used shall conform with Part 5, Section 1.

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

5.2.2.2 ***Pipes***

(a) Pipes shall be of the type and class shown on the Figures.

5.2.2.3 ***Concrete***

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

(b) All concrete shall have a minimum crushing strength of 20.0 Mpa at 28 days unless otherwise specified or detailed.

5.2.2.4 ***Roading Materials***

(a) Roading materials, chips, sealers, etc. shall comply with Volume 3, Part 3, Section 1.

5.2.2.5 ***Storage of pipes, material and plant***

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

5.2.3 Street Openings

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

5.2.3.2 All excavations in road reserves shall comply with the requirements of Volume 3, Part 3, Section 13.

5.2.4 Existing Utility Services

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

5.2.5 Excavation

5.2.5.1 *General*

(a) Pipe laying shall be carried out in open cut except where permission has been obtained from Council for alternative methods.

5.2.5.2 *Trench Outlines*

(a) The purpose of trench outlines is to avoid over-break or lifting of sealed surfaces or stabilised sub-base material where trenches are located in sealed pavement.

(b) Outlines are to be cut using an abrasive type cutting wheel or other approved means.

5.2.5.3 *Trench Protection*

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

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

(c) All timber used in trenching shall be removed before backfilling.

5.2.5.4 *Subsoil Water*

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

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

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

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

5.2.5.5 ***Trench Excavation***

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

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

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

5.2.5.6 ***Extra Excavation***

(a) Where, in the opinion of the Engineer, the ground below the specified bedding level is not suitable, it shall be excavated to a depth directed by the Engineer and backfilled with the crushed metal mix specified in Clause 5.2.8 of this Specification, or approved free draining granular material as specified by the Engineer and compacted in layers not exceeding 300mm using mechanical tampers or vibrating plate compactors as is appropriate to the material type being compacted.

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

5.2.5.7 ***Excavated Material Unsuitable for Backfill***

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

5.2.5.8 ***Excavated Wet Material***

(a) Where, in the opinion of the Engineer, excavated material is too wet for immediate re-use as backfill, but will be suitable if allowed to dry, such material shall be stockpiled at any site that may be agreed and, when ready, replaced in the trench as backfill in accordance with Clause 5.2.8.3 or 5.2.8.4 (if the excavation is in a carriageway area) of this Specification.

5.2.5.9 ***Disposal of Excavated Material***

(a) All excavated material which is not required for backfilling, or which has been deemed unsuitable for backfilling under Clause 5.2.8.3 of this Specification, shall be removed from site and disposed of at the Contractor’s own expense and the rates tendered in the Schedule of Prices shall be deemed to have allowed for this.

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

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

5.2.6 Licenced Drain layers

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

5.2.7 Bedding, Pipe laying and Jointing

5.2.7.1 ***Bedding***

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

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

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

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

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

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

5.2.7.2 ***Pipe laying and Tolerances***

(a) *General*

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

(b) *Grade Control*

(i) Pipes shall be accurately laid to the lines, levels and gradients shown on the Figures using pipe-laying laser equipment. The variation between specified invert level and invert level as laid shall not exceed 5mm.

(ii) The variation from the grade of one pipe to the next shall not exceed 3mm. Where the variation exceeds the tolerance the Engineer may order the removal and relaying of the pipes affected.

(c) *Service Connections*

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

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

(iii) Up until a service connection is utilised (i.e. connected to private drains), it shall be indicated on site as shown in Figure 96: TS 404 Connection details .

(iv) For 100mm diameter service connections onto existing PVC Council sanitary sewer pipes, a PVC, RJ, Y-junction shall be installed into the existing pipe using RRJ Slip Couplers.

(v) For service connections onto existing Council sanitary sewer pipes, other than PVC pipes, a RJ, uPVC saddle shall be fixed on to pipes up to pipes greater than 300mm diameter with stainless steel wire-ties or straps and dynabolted on to pipes greater than 300mm diameter with stainless steel dynabolts. A single bead of silicon sealer shall be applied on the inside of the outside edge of the saddle. This bead is required to squeeze out and form a visible run around the outside edge of the saddle. A second bead shall be applied to the spigot opening edge of the saddle to form a second internal water-proof barrier.

5.2.7.3 *Jointing*

(a) *Rubber Ring Joints*

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

5.2.8 Backfilling

5.2.8.1 *General*

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

5.2.8.2 *Pipe Surround Material*

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

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

5.2.8.3 *Bulk Backfill Material Outside of Carriageway Areas*

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

(b) Subject to the approval of the Engineer, previously excavated material shall be used as 'bulk backfill material' above the 'pipe surround material'. Where previously excavated material is found to be unsatisfactory for bulk backfilling purposes, 'pipe surround material' (Clause 5.2.8.2 of this Specification) shall be used.

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

(d) Compaction tests (or substituted scala penetrometer tests) shall be carried out for the full depth of the trench to within 300mm of the pipeline (subsequently referred to as the 'test area').

(e) There shall be at least one test area per 50m of trench length, or, at least one test area per 50 cu.m of trench backfill, whichever method returns the greater number of test areas.

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

5.2.8.4 *Bulk Backfill Material in Carriageway Areas*

(a) For backfilling and trench reinstatement in carriageways, see Volume 3, Part 3, Section 13.

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

5.2.9 Manholes

5.2.9.1 *Types*

(a) Manholes shall be constructed in the position and to the details as shown on the Figures.

(b) Precast concrete manhole components may be used for the works subject to them complying in all respects to details specified hereafter and the details for finished manholes shown on Figure 105: TS 500.1 Manhole top and chamber slabs, Figure 106: TS 500.2 New manhole on existing line (sheet 1), Figure 107: TS 500.4 New install manhole and Figure 110: TS 500.6 Shallow chamber manhole.

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

5.2.9.2 ***Channels and Benching***

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

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

(c) In wastewater pipelines, the channel shall be lined with ceramic half pipes, or alternative channel forms listed in Table 36: Pipe materials including manufacturer. Ceramic half pipes shall be saw cut to form mitred joints around bends, if necessary.

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

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

(f) The construction tolerance for drop through the manhole shall be:

(i) No less than the Manhole Drop as shown on figures; or

(ii) No more than 5mm more than the Manhole Drop as shown on figures.

5.2.9.3 ***Flexible Joints***

(a) All pipe lines shall have a flexible joint adjacent to the manhole on all incoming and outgoing pipes as shown on Figure 106: TS 500.2 New manhole on existing line (sheet 1), Figure 107: TS 500.4 New install manhole, Figure 108: TS 500.4A Internal manhole drop inlet: Elevation, Figure 109: TS 500.4B Receiving manhole detail for connections from wastewater pump station. The base of the manhole shall extend up to these flexible joints. The upper part of the pipe inside the manhole shall be cut back to the wall, the reinforcement cut out and the ends plastered with a cement mortar to a neat finish. Manholes not located at changes of line or gradient or at junctions with existing or proposed pipeline may be moved sufficiently to utilise existing pipe joints.

5.2.9.4 ***Drop Connections***

(a) Drop connections at manholes must be constructed as internal drops only in a manner similar to the illustrations in Figure 106: TS 500.2 New manhole on existing line (sheet 1), Figure 107: TS 500.4 New install manhole, Figure 108: TS 500.4A Internal manhole drop inlet: Elevation, Figure 109: TS 500.4B Receiving manhole detail for connections from wastewater pump station.

(b) External drops are not permitted.

5.2.9.5 ***Manhole Steps***

(a) *Manhole Step Location*

(i) Manhole steps shall be provided at 300mm centres vertically (refer Figure 107: TS 500.4 New install manhole). The top step shall not be more than 300mm below the top of the top slab, and the lowest step shall be not more than 375mm above the bench, or such lower level if detailed on other than standard manholes.

(b) *Bolt-Through Type Manhole Steps*

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

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

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

5.2.9.6 ***Manhole Tops***

(a) Manhole tops shall be constructed as detailed on Figure 105: TS 500.1 Manhole top and chamber slabs. The manhole frames and covers shall be to Figure 115: TS 507 Class D manhole cover and frame. The frame shall be set over the openings and adjusted to the correct height and slope using adjustment rings and mortar so as to conform with the surrounding surface – refer Figure 114: TS 506 Typical manhole top construction. They shall be held in place with a bold fillet of concrete, the top of which shall be 40mm below the top edge of the frame.

5.2.10 Site mortar jointing of pipes into manholes or pipelines or catch pits

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

(a) All screeded concrete surfaces to accept mortar shall be thoroughly scrubbed clean.

(b) All contact surfaces to accept mortar showing signs of contamination with oil, grease or any other non-water soluble agent shall be cleaned with "Expandite Mistic Acid" or an acceptable equivalent, applied and neutralised in accordance with the manufacturer’s directions.

(c) All mortar used for the 'on-site' jointing of drainage components shall be Expocrete "UA" or an approved equivalent. The surface priming, mixing of components, application and cure period to be in accordance with the manufacturer's directions.

5.2.11 Field concrete bandage

5.2.11.1 Not permitted on wastewater reticulation.

5.2.12 Culvert Inlet and Outlet Structures

5.2.12.1 Not Applicable.

5.2.13 Pavement surface conditions

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

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

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

5.2.14 Soak holes

5.2.14.1 Not Applicable.

5.2.15 Stormwater Pipes to Kerb and Channel

5.2.15.1 Not Applicable.

5.2.16 Testing

5.2.16.1 ***General***

(a) All wastewater pipes and branch pipelines, including extended connections greater than 6m, are to be flushed, CCTV inspected, then tested using either low or high pressure air test as set down in the BIA Verification Method E1/VM1 Sections 8.2 or 8.3 respectively (as quoted below).

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

5.2.16.2 ***Low Pressure Air Test***

(a) Introduce air to the pipeline till a pressure of 300mm of water is reached. (This shall be measured by a manometer such as a ‘U’ tube, connected to the system).

(b) Wait until the air temperature is uniform (indicated by the pressure remaining steady).

(c) Disconnect the air supply.

(d) Measure pressure drop after 5 minutes.

(e) The pipeline is acceptable if the pressure drop does not exceed 50mm.

(f) Comment:

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

(ii) Failure to soak ceramic and concrete pipes can cause highly variable results.

5.2.16.3 ***High Pressure Air Test***

(a) Pressure pipelines to 25 kPa.

(b) Wait at least 2 minutes to ensure temperature stabilisation.

(c) Disconnect air supply.

(d) Measure the time taken (minutes) for the pressure to drop to 17 kPa.

(e) The pipeline is acceptable if the time does not exceed that given for the appropriate pipe size in the following table:

Table 37: High pressure air test timing

Internal pipe diameter (mm).	*Time for permissible pressure drop (minutes)*
90	*3*
100	*3*
150	*4*
225	*6*

5.2.16.4 ***Infiltration Test***

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

5.2.17 Cleaning Pipelines

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

5.2.18 Reinstatement

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

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

5.2.18.3 The Contractor shall be solely responsible for all damages that may result from their operations, and shall satisfy the Engineer that they have made proper reinstatement.

5.2.18.4 Should no satisfactory efforts be made by the Contractor within a reasonable period of time, the Engineer may seek another Contractor to carry out the reinstatement to the full requirements of the Engineer. All costs resulting from the work will be deducted from any monies due, or which may become due, to the Contractor.

5.2.19 As-built records

5.2.19.1 An accurate "as-built" record shall be maintained as work progresses in accordance with Volume 1, Part 2 of this Manual and Section 3 of this Specification.

5.2.20 Work on in-service wastewater sewers & manholes

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

(a) Before any person enters any operating manhole or pipeline, a safety plan, incorporating Confined Space Entry aspects, shall be accepted by Council.

(b) Before making any connection, the new line to be brought into use shall be properly cleaned out and approved by Council as complying with all specifications.

(c) As soon as possible after the connection has been made and flow has been diverted the benching shall be finished off to its new form.

(d) No concrete or any other debris shall be permitted to enter the sewer at any stage during connection or diversion.

Part 5 – Section 3: Works Completion and Clearance

5.3.1 As-built plans

5.3.1.1 Upon completion of construction work, copies of "As-built" plans and data recording information about the completed works, as listed in Table 38: Asset Specific Data 2 shall be provided to the Waipa District Council. Separate plans are required for wastewater, stormwater, and water supply. Responsibility for providing the plans and associated data shall lie with:

(a) The Developer, in the case of land development (urban and industrial sub-division).

(b) The Contractor, in the case of works constructed for Council under contract to Council.

5.3.1.2 Plans presented in fulfilment of this requirement shall be shown as "As-Built" in the amendments part of the figure title block and signed-off as 'approved for issue' by a person having responsibility for the quality assurance aspect of the as-built information.

5.3.1.3 As-built plans and associated data shall be sent to:

(a) In the case of subdivisions:

The Manager
Development Engineering
Private Bag 2402
Te Awamutu 3840

(b) Include the Council Subdivision Consent Number, subdivision name and stage number.

(c) In the case of Council contracts, send to the Engineer for forwarding to the appropriate Council asset manager.

5.3.2 Data presentation formats

5.3.2.1 The as-built data is required in three formats:

(a) Conventional hard copy plans using line formats as indicated in Volume 1, Part 2, Clause 2.4, figure sheet size A3 and plan scale 1:500 preferred.

(b) Electronic Microsoft Excel spread sheets listing various attributes of the assets constructed - refer blank template files accessed from the Table of Contents page of this Part.

(c) Where as-built plans are prepared using computer aided design software, DXF format export files of the hard copy plans are required. The specification for the format is laid out in Volume 4, Appendix 7.

5.3.2.2 Hard copy plans are used in updating Council's records. The DXF format files facilitate data upload to the GIS.

5.3.2.3 The spread sheet lists of asset data facilitate data upload to the asset information database. As well as recording dimension and materials information, this database is used to manage asset condition information.

5.3.3 Asset values

5.3.3.1 This requirement has been suspended pending review. Refer to Volume 4, Part 9, Appendix 8.

5.3.4 Datum's and units of measurement

5.3.4.1 Only metric units are to be used in as-built data. Principally, these are millimetres *(mm)*, meters *(m)*, litres/sec *(L/s)*, cubic meters /day *(m^3/day)*. All levels are to be in terms of Moturiki Datum and to two decimal places.

5.3.4.2 Geographic coordinates shall be:

(a) New Zealand Geodetic Datum 2000 (NZGD2000).

5.3.4.3 Coordinates should be presented in standard 6-digit format to two decimal places. e.g. 305718.97, 643728.35.

5.3.5 Asset component types and as-built data requirements

5.3.5.1 As-built data shall be accompanied by the following list of project specific data:

(a) Works construction contractor.

(b) Project name or subdivision name (including subdivision stage number).

(c) Waipa District Council contract number (Council projects).

(d) Waipa District Council project ledger code (Council projects).

(e) Name of person responsible for preparing the as-built data.

(f) Date of preparing the as-built data.

5.3.5.2 The following list of asset specific data shall be supplied and shown on the figures.

Advice Note: Occasionally privately owned assets need to be shown on as-built plans; such assets shall be clearly labelled 'Private ...*'name and details of asset'*.

Table 38: Asset Specific Data 2

Asset Component Type	Asset Attribute Required	Shown on plans	Comment
Wastewater Pipelines	Plan ID	Yes	Plan number used to identify as-built plan
	Upstream MH ID	Yes	Use 'pipe-end ID' if pipeline is simply blanked-off
	Downstream MH ID	Yes	

Asset Component Type	Asset Attribute Required	Shown on plans	Comment
	Street Name	Yes	If street name is not applicable, use a property deposited plan (DP) number
	Street Type	Yes	Qualifier to street name e.g. Crescent, Road, Lane, etc.
	Location		Private property, roadway, berm, reserve
	Pipe Diameter	Yes	Nominal bore in millimeters
	Pipe Length	Yes	Length upstream MH to downstream MH
	Pipe Gradient	Yes	Record as 1: ??? or ??.?? %
	Pipe Material	Yes	Material and strength classification e.g. uPVC SN16
	Joint Type		e.g. RRJ
	Invert Level Upstream	Yes	Pipe invert level
	Invert Level Downstream	Yes	Pipe invert level
	Service Status	Yes	Abandoned and decommissioned pipelines are required to be identified on as-built records Show "A" for abandoned pipes "D" for deleted/decommissioned pipes
	Asset Value		Refer Clause 5.3.3 of this section
	Comments		Any pertinent comments (particularly water table depth and soil conditions)
Wastewater service pipelines	Plan ID	Yes	Plan number used to identify as-built plan
	Upstream MH ID	Yes	Use pipe-end ID if pipeline is simply blanked-off
	Downstream MH ID	Yes	
	Property ID	Yes	Either property number or legal description
	Street Name	Yes	If street name is not applicable, use a property deposited plan (DP) number
	Street Type	Yes	Qualifier to street name e.g. Crescent, Road, Lane, etc.
	Service Pipe Diameter		Nominal bore in millimeters
	Service Pipe Length	Yes	
	Service Pipe Material		Material and strength classification
	Invert level at private end	Yes	Pipe invert level
	Depth at Private End		Depth from ground level to Invert Level
	Eastern coordinate end 1		Coordinate of upstream end of service pipeline

Asset Component Type	Asset Attribute Required	Shown on plans	Comment
	Northern coordinate end 1		Coordinate of upstream end of service pipeline
	Distance from left (LB) or right (RB) boundary	Yes	Left-hand or right-hand boundary facing the property from the street
	Distance from front (FB) or back (BB) boundary	Yes	
	Asset Value		Refer Clause 5.3.3 of this section
	Comments		Any pertinent comments (particularly water table depth and soil conditions)
Wastewater Manholes	Plan ID	Yes	Plan number used to identify as-built plan
	MH ID	Yes	
	Property ID	Yes	Either property number or legal description adjacent to manhole
	Street Name	Yes	If street name is not applicable, use a property deposited plan (DP) number
	Street Type	Yes	Qualifier to street name e.g. Crescent, Road, Lane, etc.
	Lid Level	Yes	Top edge and northern part of rim casting
	Invert Level	Yes	Invert levels of all pipes entering manhole
	MH Diameter		Nominal Bore of MH risers
	Eastern coordinate		Location as per lid level
	Northern coordinate		Location as per lid level
	Asset Value		Refer Clause 5.3.3 of this section
	Comments		Any pertinent comments (particularly water table depth and soil conditions)
Wastewater Pump Station			Refer Volume 3, Part 5A, Section 3

5.3.6 Threshold matrix for as-built data

5.3.6.1 For small developments, the provision of separate as-built plans for each service, separate data sheets and DXF data is not justified. Therefore the following matrix has been developed to guide when each type of data presentation is required. If the data presented is not clear, Council may request additional information.

Table 39: Threshold matrix for as-built data

	Small development (2 – 5 lots)	Medium development (5 - 10 lots)	Large development (10 + lots)	Contract
Separate plans for each service	No	Not required if adequate clarity is possible on same plan	Yes	As per large development or contract documents
DXF data	Please supply if available	Yes	Yes	As above
Separate data spreadsheets	No, include information on plans	WW or SW if >2 manholes or 10 lots Water if more than 5 hydrants or valves	Yes	As above
GST invoice on vesting	Yes	Yes	Yes	As above
Plan size	A3	A3	A3	As above

5.3.6.2 As-built figures must be scalable. Refer to Volume 1, Part 2, Clause 2.4.3.

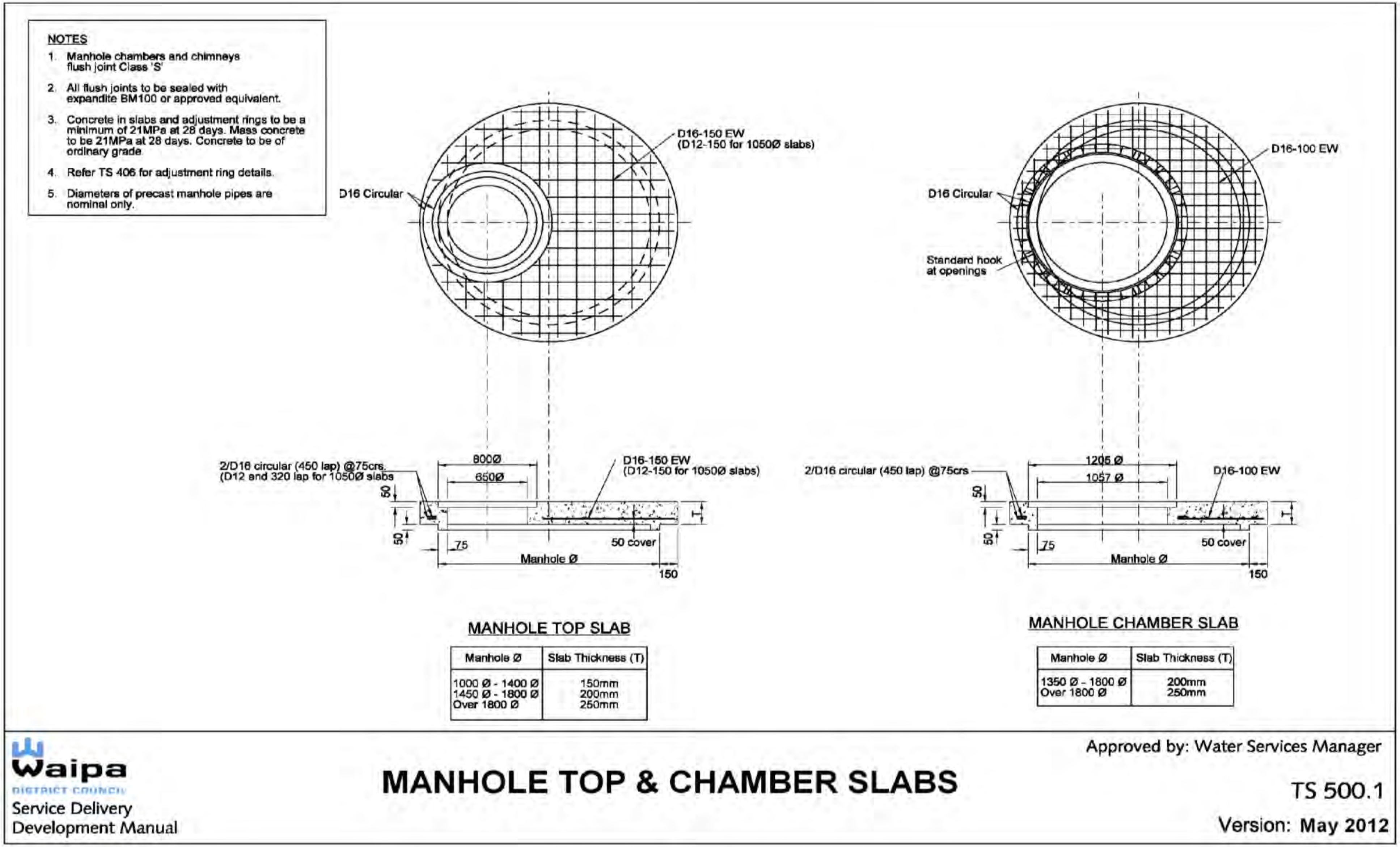
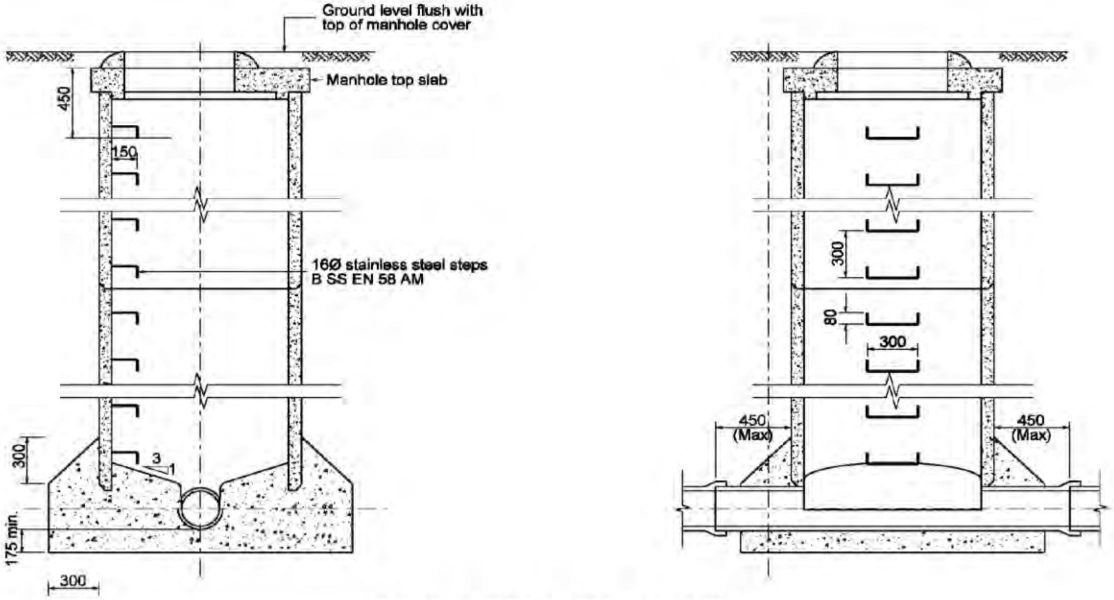


Figure 105: TS 500.1 Manhole top and chamber slabs

NOTES

1. Manhole chambers and chimneys flush joint Class 'S'
2. All flush joints to be sealed with expandite BM100 or approved equivalent.
3. Concrete in slabs and adjustment rings to be a minimum of 21MPa at 28 days. Mass concrete to be 21MPa at 28 days. Concrete to be of ordinary grade.
4. Drop manholes are to be used on inlet lines with a max diameter of 225mm and where the difference between the soffit of outlet is greater than 600mm.
5. If further internal drop connections are expected, design manhole diameter may be increased (ie. 1050Ø → 1200Ø)
6. Refer TS 406 for adjustment ring details.
7. Diameters of precast manhole pipes are nominal only.



DETAILS 1050Ø & 1200Ø MANHOLES

Waipa District Council
Service Delivery
Development Manual

NEW MANHOLE ON EXISTING LINE
SHEET 1

Approved by: Water Services Manager

TS 500.2

Version: May 2012

Figure 106: TS 500.2 New manhole on existing line (sheet 1)

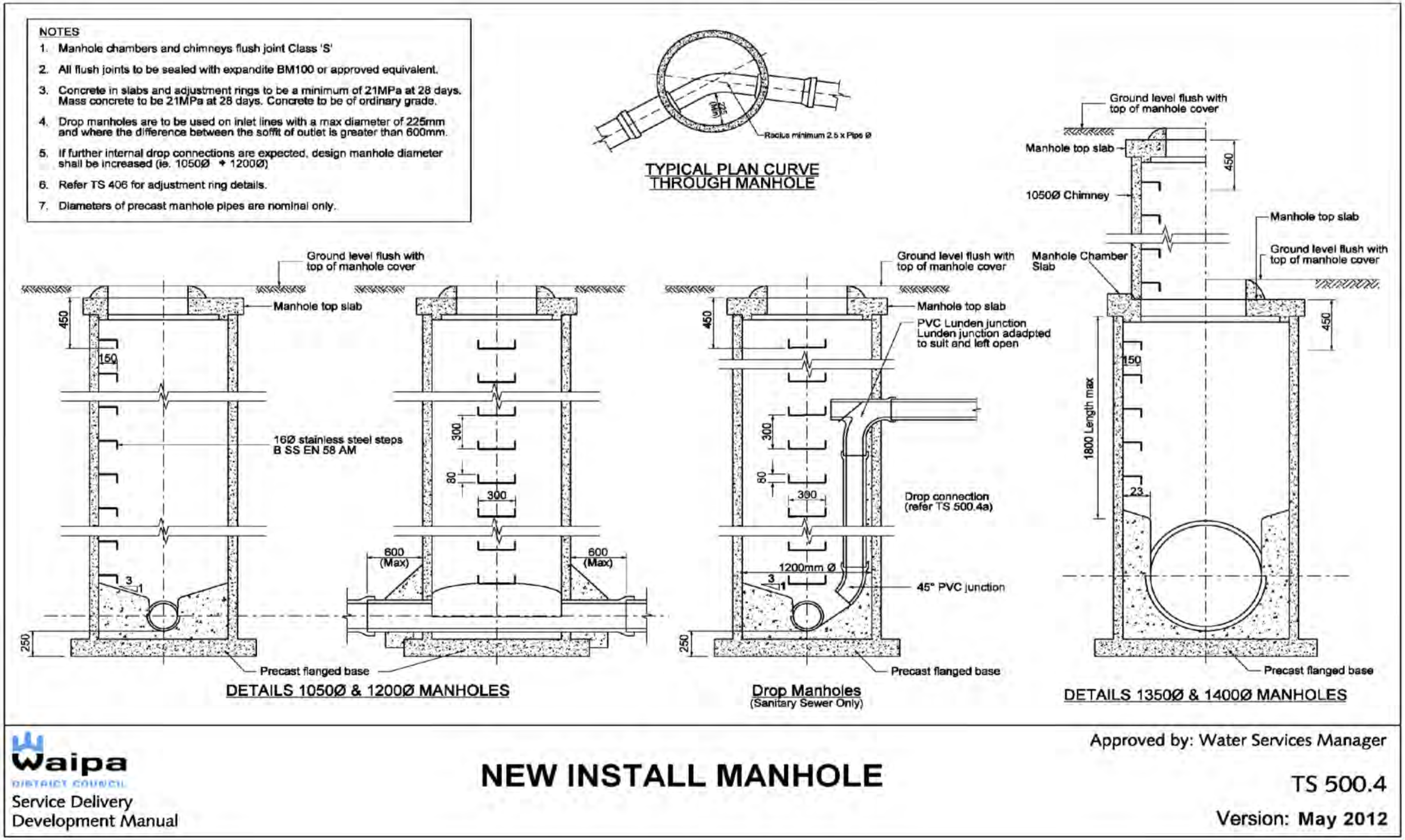


Figure 107: TS 500.4 New install manhole

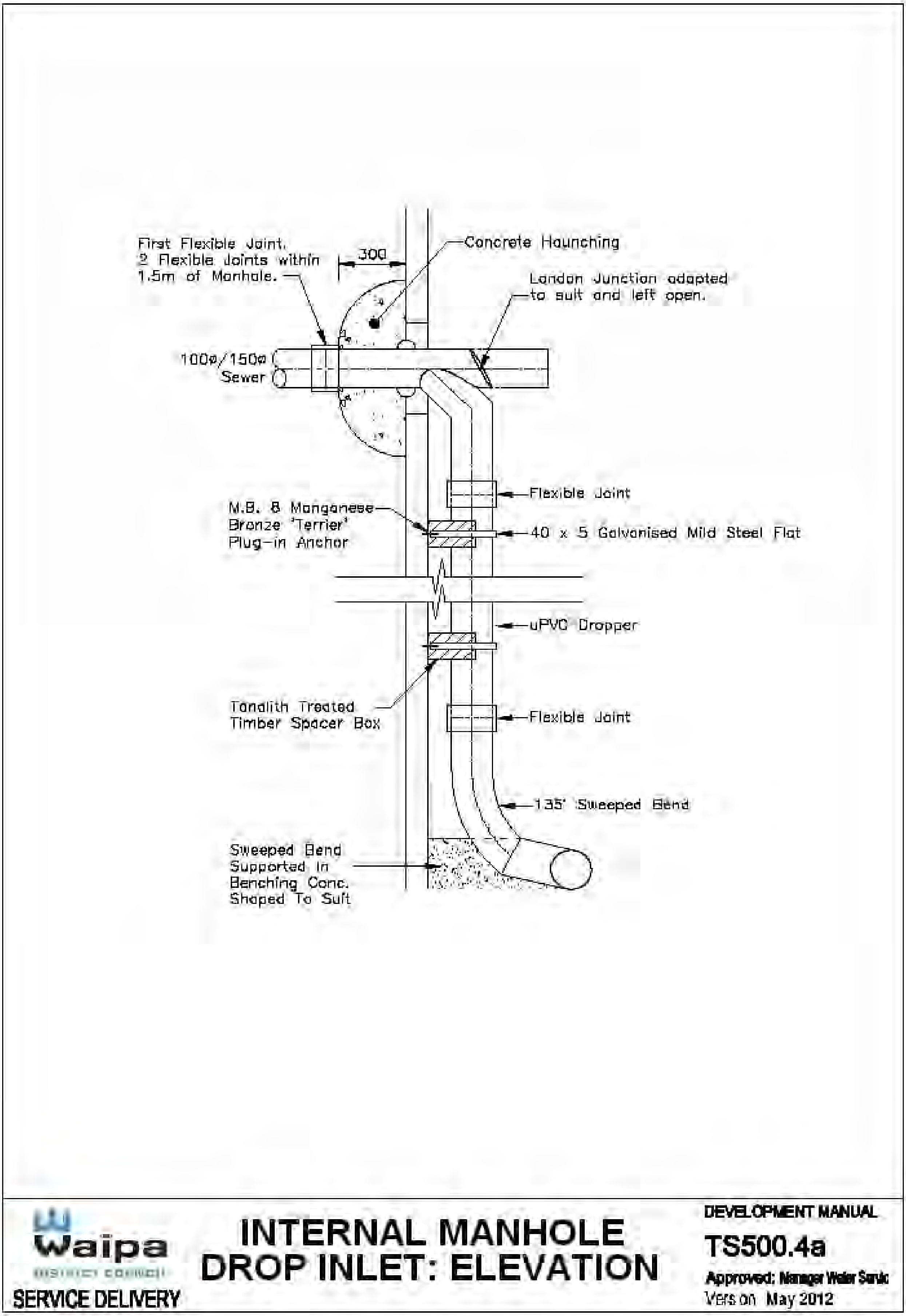
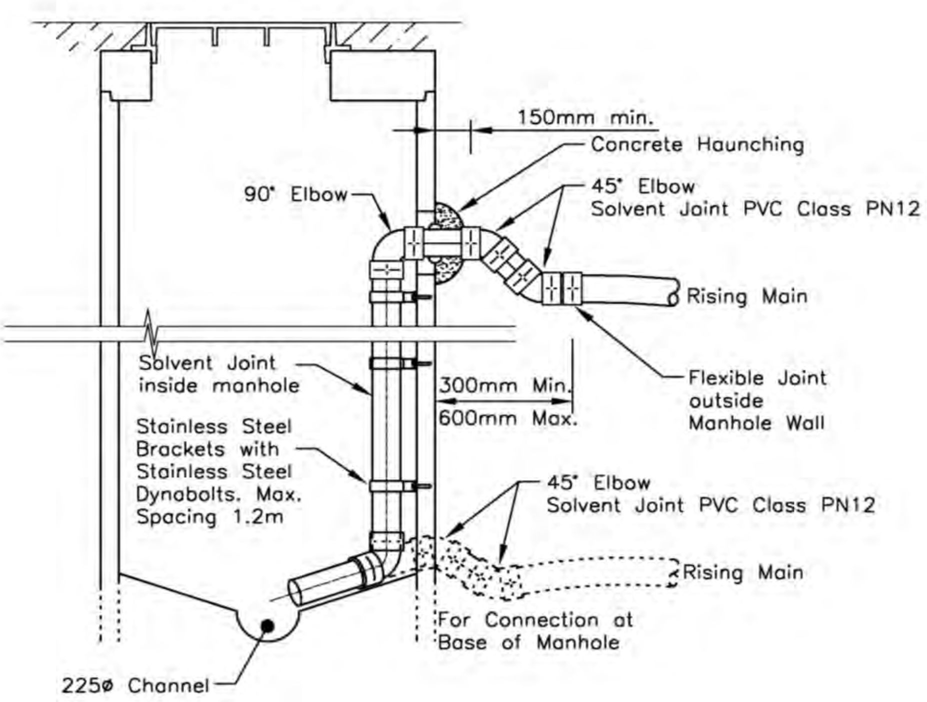


Figure 108: TS 500.4A Internal manhole drop inlet: Elevation



Waipa DISTRICT COUNCIL
SERVICE DELIVERY

RECEIVING MANHOLE DETAIL FOR CONNECTIONS FROM WASTEWATER PUMP STATION

DEVELOPMENT MANUAL
TS500.4b
Approved: Manager Water Services
Version: May 2012

Figure 109: TS 500.4B Receiving manhole detail for connections from wastewater pump station

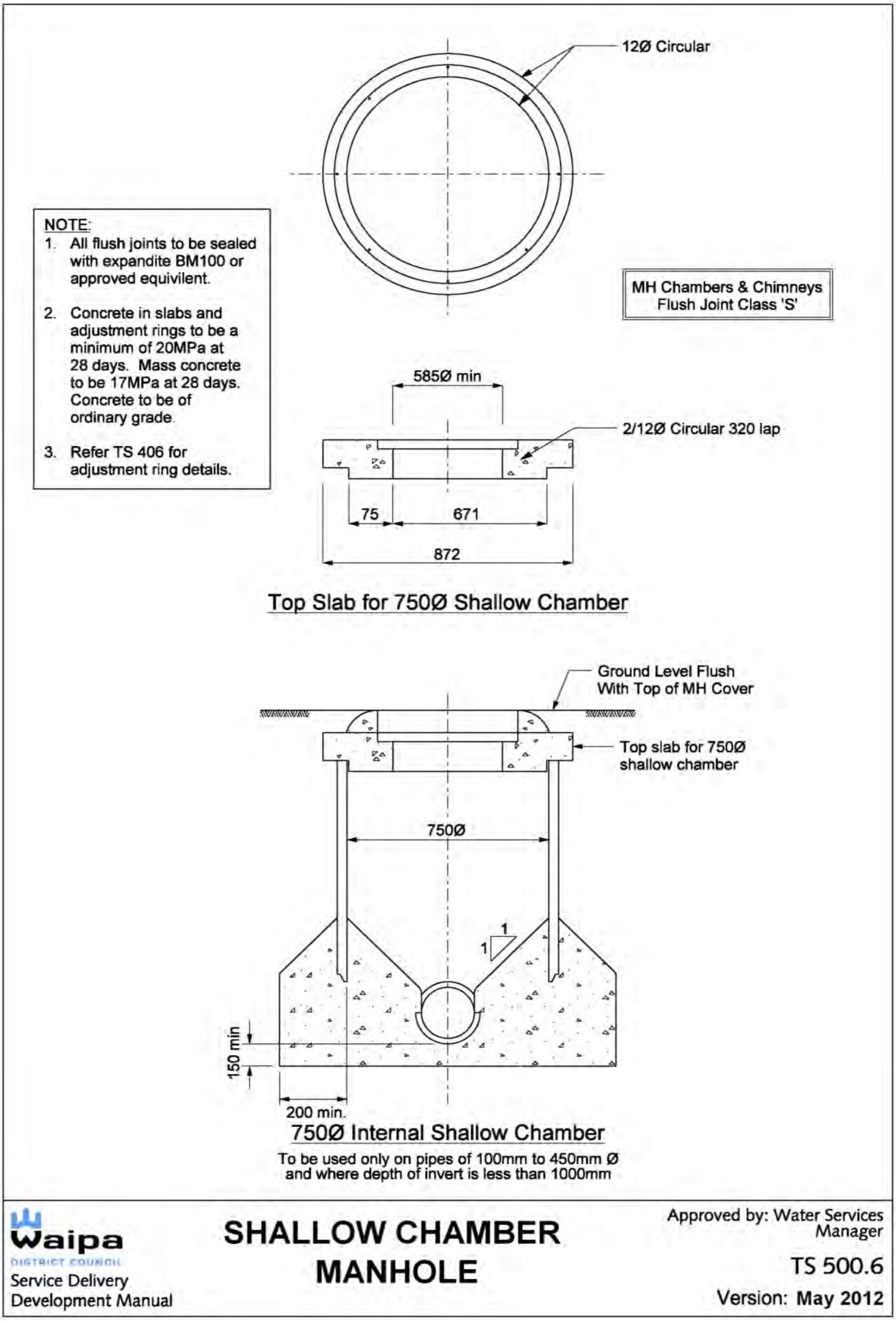


Figure 110: TS 500.6 Shallow chamber manhole

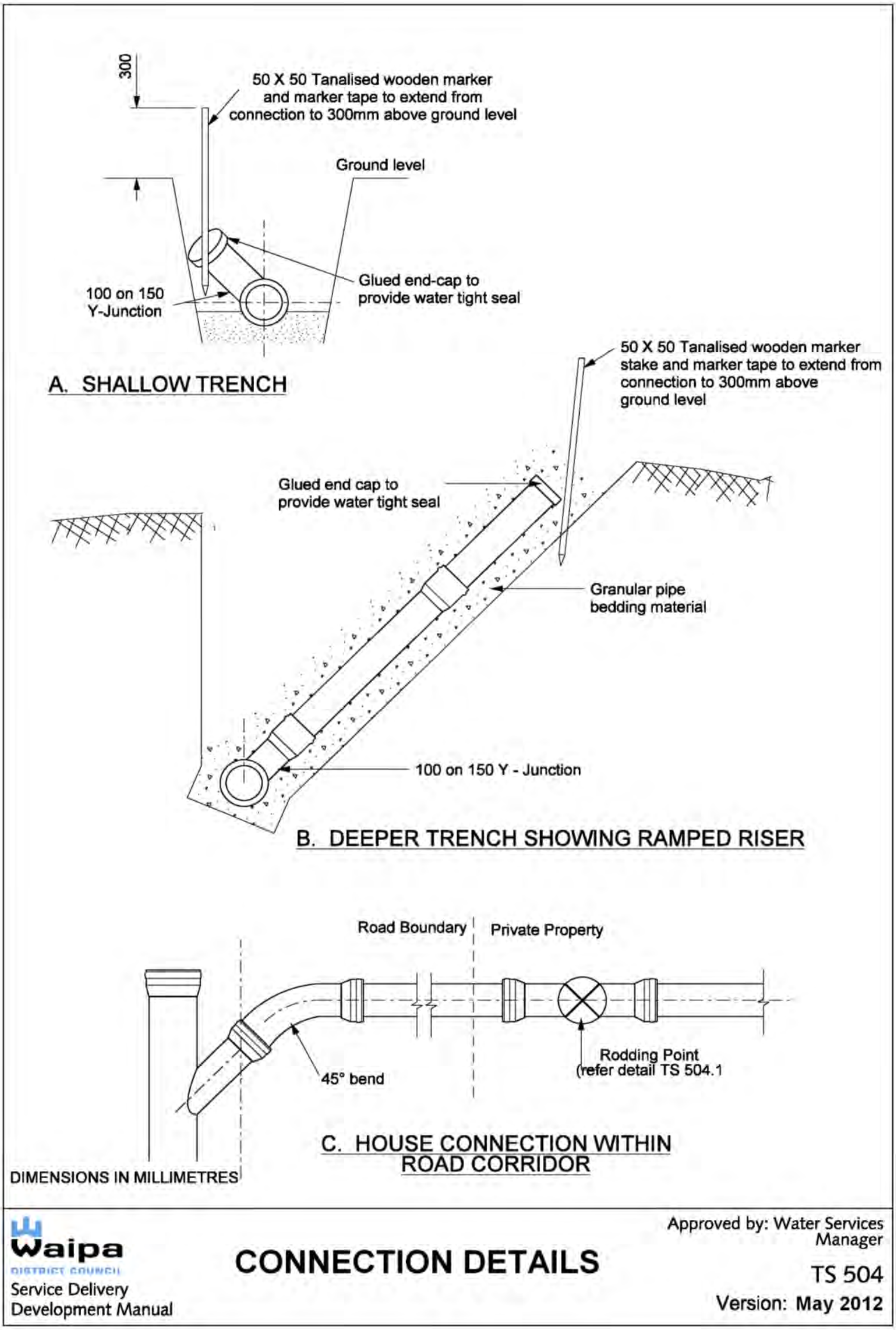


Figure 111: TS 504 Connection details

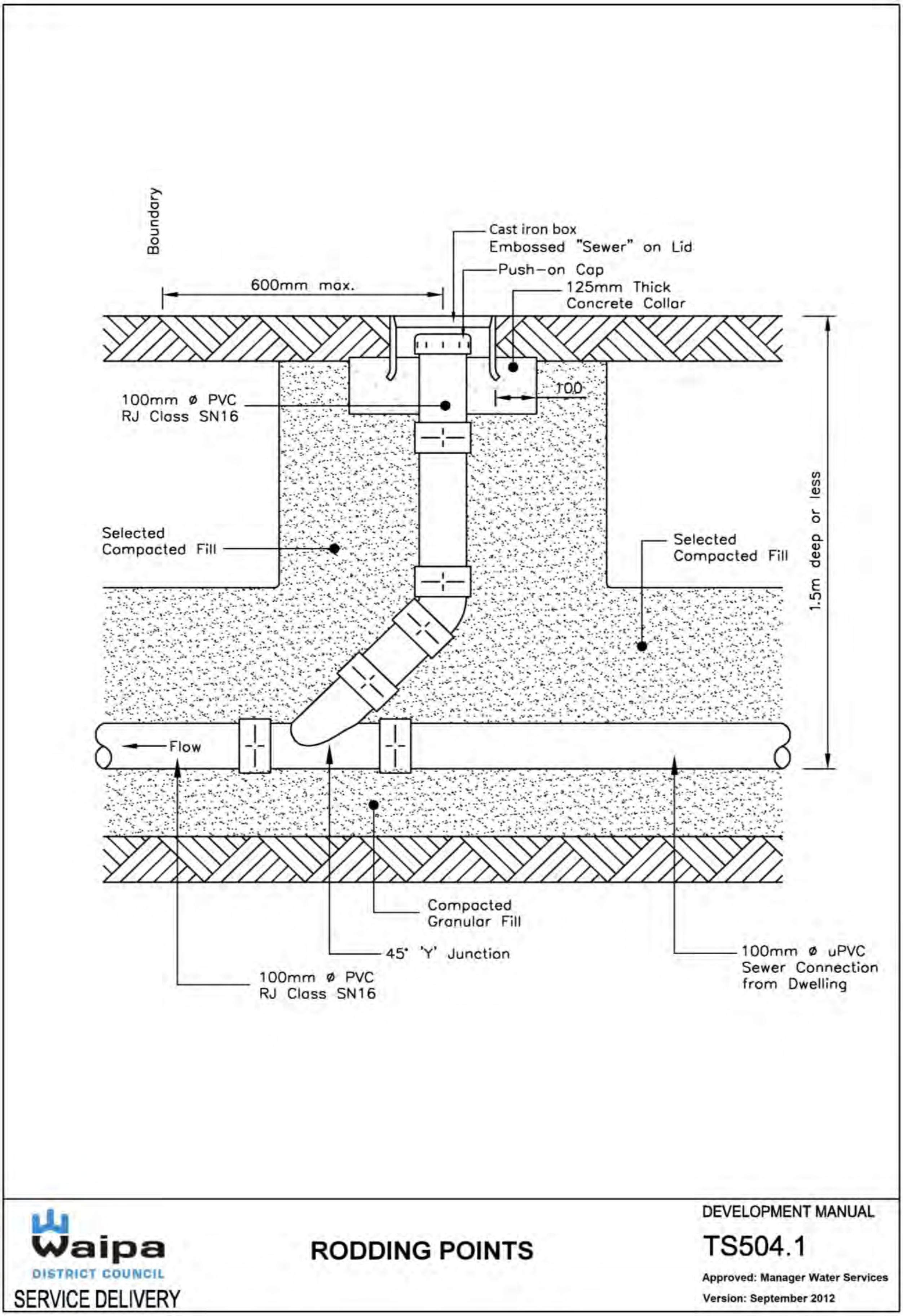
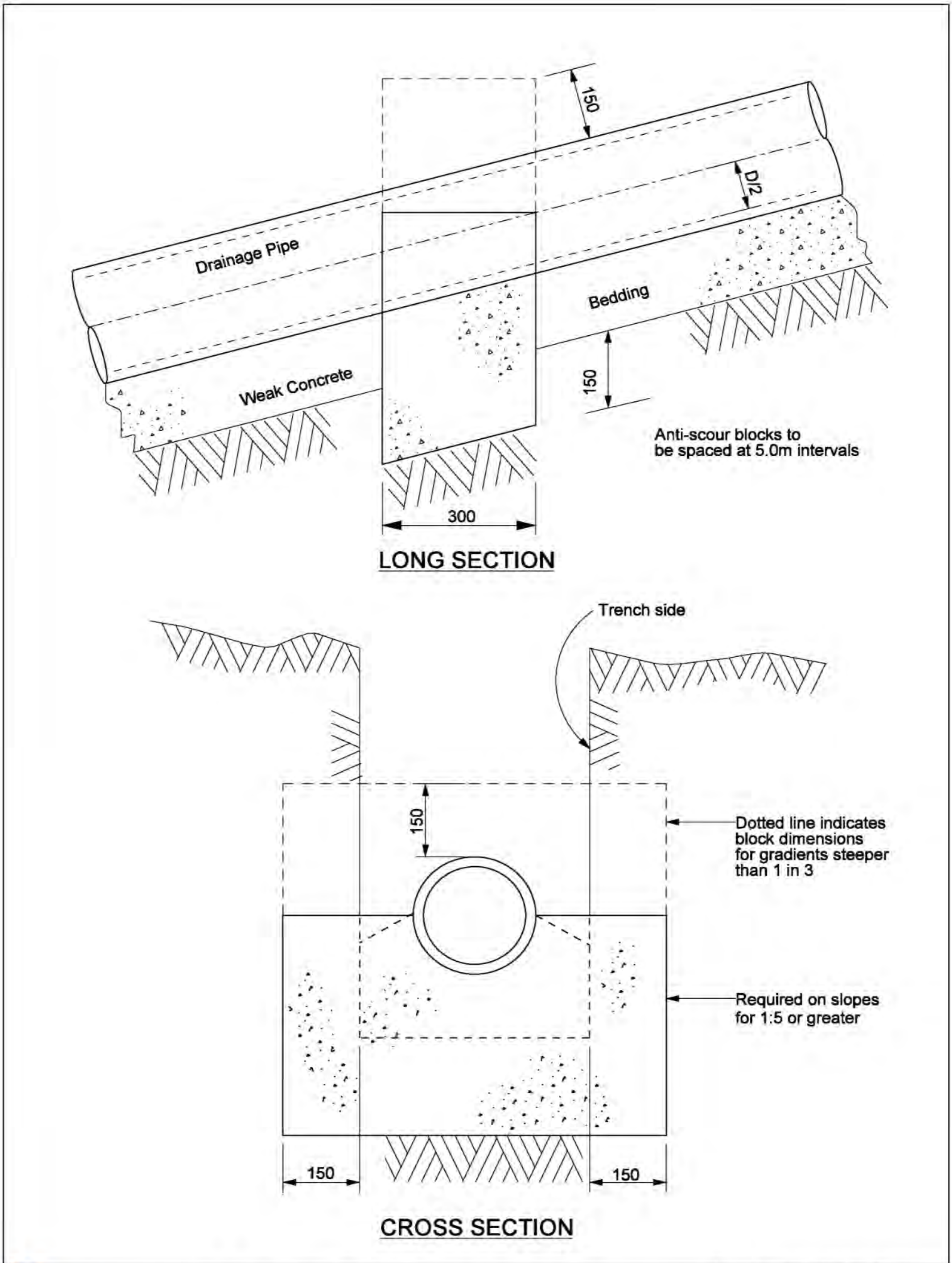


Figure 112: TS 504.1 Rodding points



Waipa District Council
Service Delivery Development Manual

ANTI-SCOUR BLOCKS FOR STEEP LINES

Approved by: Water Services Manager

TS 505

Version: **May 2012**

Figure 113: TS 505 Anti-scour blocks for steep lines

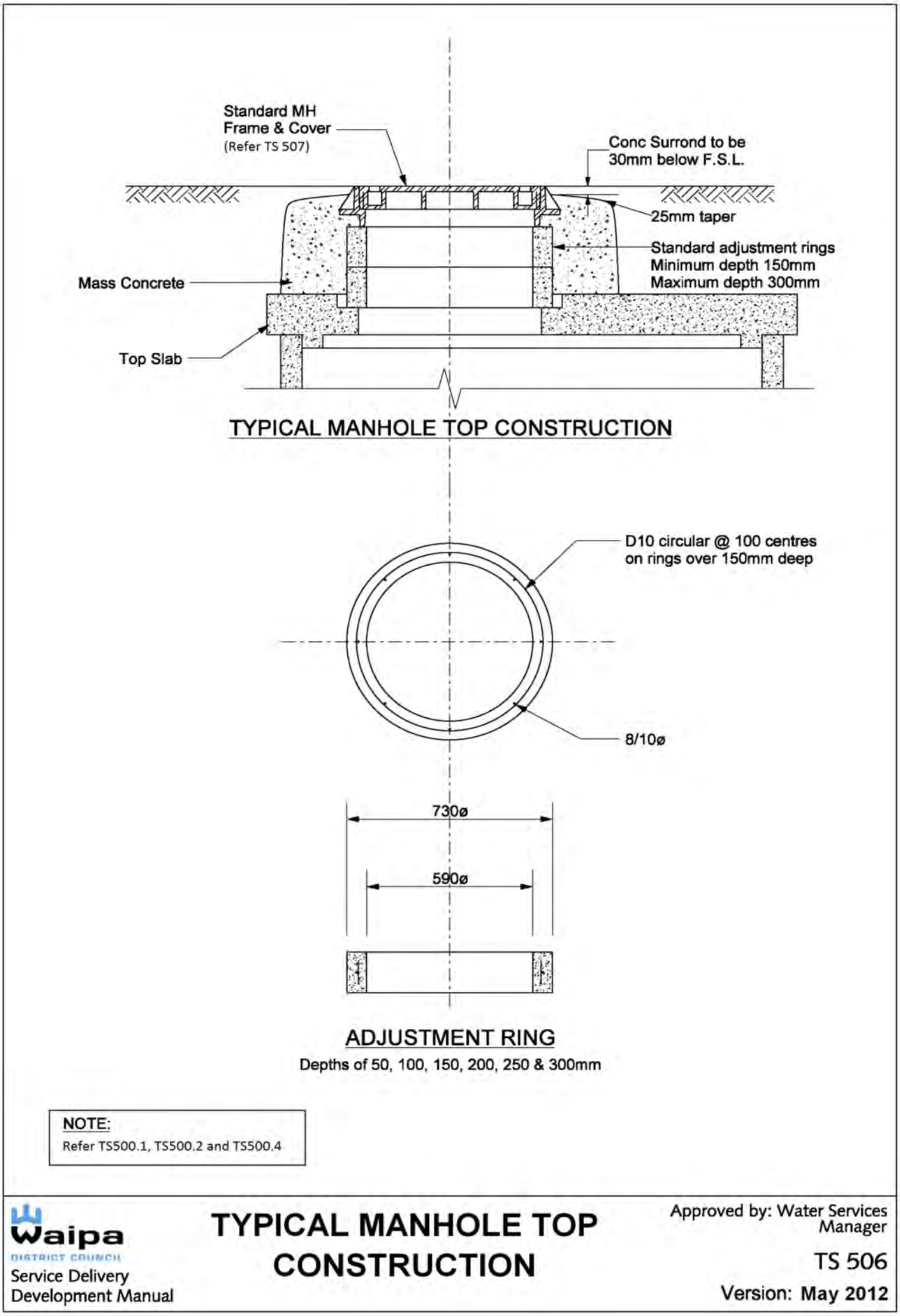


Figure 114: TS 506 Typical manhole top construction

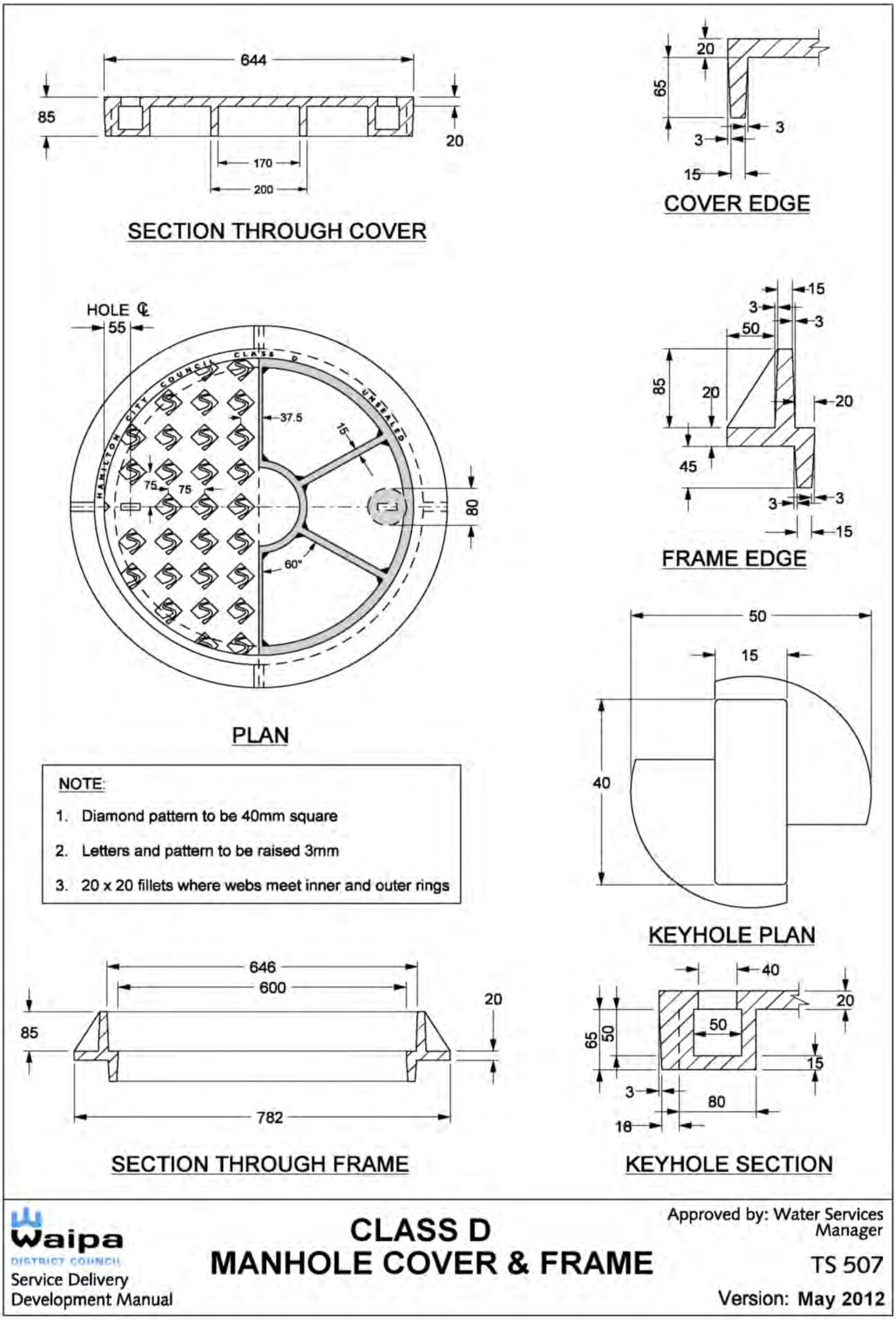


Figure 115: TS 507 Class D manhole cover and frame

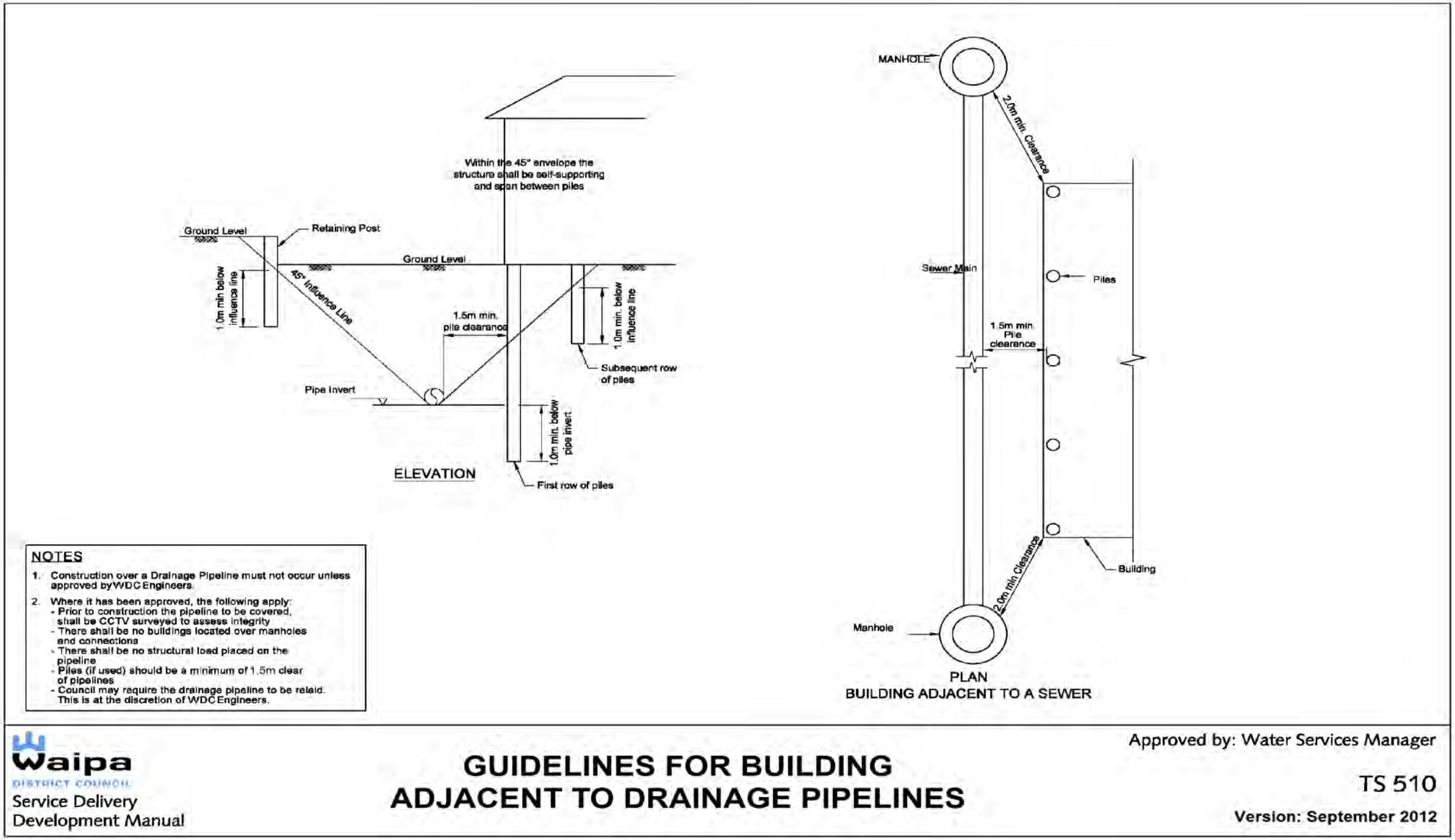
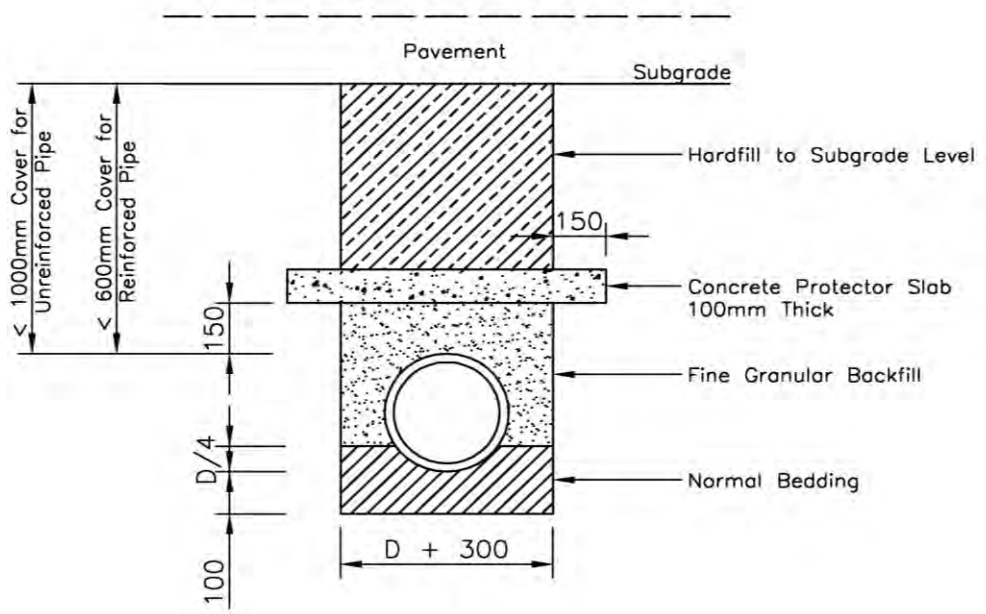


Figure 116: TS 510 Guidelines for building adjacent to drainage pipelines



Waipa DISTRICT COUNCIL
SERVICE DELIVERY

PROTECTION FOR SHALLOW PIPES UNDER CARRIAGEWAYS

DEVELOPMENT MANUAL
TS512
Approved: Manager Water Services
Version: May 2012

Figure 117: TS 512 Protection for shallow pipes under carriageways

Part 5A: Wastewater Pump Stations

Table of Contents

Standards Figures

Part 5A – Section 1: Acceptable Fittings and Materials

5A.1.1 Scope

5A.1.1.1 This specification covers the list of materials acceptable for use in Waipa District Council wastewater pump stations, and covers materials which Council has or will, assume responsibility for. Fittings not in accordance with this list will be rejected, unless written approval from Council is obtained prior to installation. Rejected products and materials will be subject to removal at the Contractor or Developer's cost.

5A.1.1.2 This list of Acceptable Fittings and Materials will be updated in July and December each year or at other times when four or more acceptable products need to be incorporated into the list.

5A.1.1.3 All applications to the Acceptable Fittings and Materials list must be accompanied by the proforma Appendix 6 on page on page 661.

5A.1.1.4 Requirements for acceptance of materials are as follows:

(a) Conforms to appropriate New Zealand, Australian or British standards with evidence of the licence number issued.

(b) Manufacturer operates to an acceptable quality assurance standard.

(c) Details of composition, dimensions and specific use and design life are supplied by the manufacturer.

(d) Details of acceptance by other New Zealand local authorities.

(e) Details are supplied by the manufacturer on how the product should be installed.

(f) The product is acceptable to Waipa District Council (taking into account such factors as compatibility with other approved products, ease of use, availability of supply, etc.).

5A.1.1.5 Where there is no standard, the manufacturer will be required to supply copies of their quality assurance procedures and producer statements to support their performance and composition claims for the products concerned.

5A.1.1.6 Completed applications and supporting information should be addressed to:

The Manager
Water Services
Waipa District Council
Private Bag 2402
Te Awamutu 3840

5A.1.1.7 Council reserves the right to refuse any material or fitting from the Acceptable Fittings and Materials list for any reason and at any time. In such circumstances, Council will provide written notification stating reasons why the material or fitting has been refused or removed from the Acceptable Fittings and Materials list.

5A.1.2 Pump station materials and equipment

5A.1.2.1 The material and equipment standards below represent minimum requirements.

5A.1.2.2 ***Wet-well chamber***

(a) Reinforced Centrifugally Spun Manufactured Concrete Pipes, Flushed Jointed, Class 4 pipes manufactured with an approved Pozzolanic Cement to resist common forms of corrosion from sulphates.

(b) Nominal Diameter: 1800mm. Size may be varied by agreement with Waipa District Council.

5A.1.2.3 ***Valve chamber walls***

(a) 20 Series concrete block.

(b) All cells filled masonry construction.

(c) Reinforcement Seismic 300 (300E) or Seismic 500 (500E) to AS/NZS 4671:2001.

5A.1.2.4 ***Wetwell & valve chamber floor***

(a) Cast insitu concrete manufactured with an approved Pozzolanic Cement to resist common forms of corrosion from sulphates.

(b) Strength: 20MPa at 28 days.

(c) Sizing and layout by specific design where wetwell and/or valve chamber cover slab located in commercial/industrial driveway or road carriageway. PS1 Producer Statement required confirming design.

5A.1.2.5 ***Pump & valve chamber top slab***

(a) Cast insitu or precast concrete manufactured with an approved Pozzolanic Cement to resist common forms of corrosion from sulphates.

(b) Strength: 20MPA at 28 days.

(c) Reinforcement Seismic 300 or Seismic 500. Sizing and layout by specific design where wetwell and/or valve chamber cover slab located in commercial or industrial driveway or road carriageway. PS1 Producer Statement required confirming design.

(d) Reinforcement Seismic 300 or Seismic 500. Sizing and layout by specific design where wetwell and/or valve chamber cover slab located in commercial or industrial driveway or road carriageway. PS1 Producer Statement required confirming design.

5A.1.2.6 ***Access lids***

(a) 5mm aluminium tread plate (Alloy 5251 F), braced with 50x10mm aluminium flats welded on edge.

(b) Central support across opening to be 100x100x4mm Grade 350 Rolled Hollow Section, stainless steel channel section.

(c) Lid frame 50x50x10mm Equal Angle, Grade 316 stainless steel, cast into slabs with D10 rags welded to angle section.

(d) Access openings shall be positioned to give access to valves directly above and to provide 150mm minimum pump clearance all round.

5A.1.2.7 ***Pump guide rails***

(a) Shall be Schedule 10, Grade 316 stainless steel pipe. Any pipe joints to be an internal pressed fit stainless steel sleeve. Minimum diameter shall be 50mm. Bracing will be required on 50mm guide rail to prevent flexing.

5A.1.2.8 ***Upper guide rail brackets***

(a) Flygt stainless steel.

(b) Bolts.

(c) Grade 316 grade stainless steel greased with anti-freeze grease.

(d) Cable Brackets.

(e) Grade 316 stainless steel.

5A.1.2.9 ***Riser pipes in wetwell and valve chamber***

(a) Schedule 10, Grade 316L stainless steel. Pressure rating shall be PN16 or similar approved.

(b) Grade 316 stainless steel support brackets.

5A.1.2.10 ***Rising main***

(a) mPVC PN12 (Series 1 dimensions – rubber ring joints) manufactured to AS/NZS 4765:2007. Pressure rating to be confirmed by specific design.

(b) uPVC PN12 (Series 1 dimensions – rubber ring joints) manufactured to AS/NZS 1477:2006. Pressure rating to be confirmed by specific design.

(c) PE 100 polyethylene pipe manufactured to AS/NZS 4130:2009, pressure rating PN12 SDR17 with welded or flanged joints. Pressure rating to be confirmed by specific design.

5A.1.2.11 ***Valves***

(a) Ductile Iron Resilient Seated Sluice Valves PN16 to AS/NZS 2638.2:2011. Integral flanges to AS 2129:2000 Table D. Epoxy coated internally and externally to AS/NZS 4158:2003.

(b) Ductile Iron Ball Check Valves PN10, epoxy coated internally and externally to AS/NZS 4158:2003. Integral flanges to AS 2129:2000 Table D.

(c) Ductile Iron Fittings – to AS 4794:2001. Epoxy coated internally and externally to AS/NZS 4158:2003.

5A.1.2.12 ***Pumps***

(a) Flygt submersible wastewater pumps, minimum pump size equivalent to Flygt 3085 and can be wired direct on line.

(b) Pumps sizes 3.0 kW to 5.4 kW can be fitted with a Variable Speed Drive Unit. (Altivar 71 or approved equivalent) will require specific Council approval.

(c) Pumps over 5.5 kW must be fitted with Soft Start Units (Altistart 48 or approved equivalent).

(d) Pumps over 13 kW size to be provided with thermistors.

5A.1.2.13 ***Cable ducts***

(a) PVC Orange Electrical Cable Duct (Solid Wall), to AS/NZS 1254:2010.

(b) One 150mm diameter duct for pump cables.

(c) One 50mm diameter duct for ultrasonic and alarm cables.

5A.1.2.14 ***Water supply***

(a) 50mm PE80B PN12.5 pipe and fittings or DN40mm uPVC RJPN12 pipe and fittings.

(b) 40mm Elster Class C water meter or similar.

(c) Wilkins Zurn 975XL Backflow Preventer or similar.

(d) 40mm Strainer.

(e) 40mm Brass Gate Valve.

(f) Hot dipped galvanized pipework support.

(g) 40mm Aglex Coldwash WP10 hose; female camlock end and nozzle outlet end, minimum length 4m.

5A.1.2.15 ***Water supply cabinet***

(a) Aluminium cabinet.

5A.1.2.16 ***Gravity system collection manhole***

(a) 1050mm Standard RCFJ risers, 150mm precast flanged base slab, 150mm thick lid with standard 530mm opening, heavy duty frame and cover.

5A.1.2.17 ***Upstream sampler manhole***

(a) Depth of MH <1.4m

(i) 1200mm Standard RCFJ risers, 150mm precast flanged base slab, 150mm thick lid with standard 530mm opening, heavy duty frame and cover.

(b) Depth of MH ±>1.4m

(i) 1200mm Class X RCFJ risers, 150mm precast flanged base slab, 150mm thick lid with opening >750mm, heavy duty frame and cover to suit larger size lid opening.

5A.1.3 Electronic components approved equipment list

5A.1.3.1 Contractor shall submit details of all components for approval prior to any site works.

Table 40: Electronic components approve equipment list

Description	Manufacturer	Model	Part Number
Main Switch Isolator or Main Switch (MCCB)	Merlin Gerin Terasaki	NS INS	
Mains/Generator Changeover Switch	Kraus & Naimer		KG64BT904NZ007VE KG100T904NZ007VE
Distribution Board	Vynco	VCP Range	VCP18
Control Enclosure	Vynco/DSE	HIBOX Don 3	NEAG 3030
Soft Starter Enclosure	Vynco/DSE	HIBOX Don 3	NEAT 3030
MCB's	Merlin Gerin GE	C60 Redline	As Required
RCD Power Point	PDL	600 Series	691RCD-30
Light Switch	PDL	600 Series	661VH& 681M20
Light	Thorn	R960 Minipak	ML8S
Pump Motor Isolators	PDL	56 Series	56SW4XX
Overloads	Allen Bradley	Bulletin 193	193-EE
Soft Starter	Snider Electrical	Altivar or approved	
Auto/Off/Manual Switches Extra N/O Contacts	Allen Bradley	800 FP	800 FP-SM32PX20 800FP – X1O
Push Buttons – Illuminated	Allen Bradley	800 FP	800FP-LF-5 800FP-LF-6 800FP-N3Y 800FP-N3B 800F-ALP / 800F-X10
Amp meters	Carrel & Carrel	CEQ-72	To Suit Motor Size
Terminals	Allen Bradley Weidmuller Contra Clip	1492-J Series WDU Series RK Series	As Required
Fuse Terminals	Allen Bradley Weidmuller Contra Clip	1492-WFB4 ASK1 STK Series	As Required
Control Relays	Omron	G2R LY	G2R-1-SN DC12 G2R-2-SN DC12 G2R-1-SN AC230 G2R-2-SN AC230 LY4N DC12
Power failure Relay	TELE Automation Components	ENYA	E3PF400VSY02
Power Factor Correction Capacitors	Metalect		To Suit Motor Size
Level Floats	Flygt	ENM	ENM 10-13
Level Ultra Sonic	ABB/ Pulsar	Black Box	130-D
Level Ultra Sonic	ABB/ Pulsar		DB6/10
Solenoid Transformer	ATCO		100VA
Thermostat	Seitron		TAM011
Heater	Hbar		HB1613
Generator Inlet Socket	Scame	3P+N+E	As per Specification

Description	Manufacturer	Model	Part Number
Flow meter	ABB	Mag Master	Sized as required

Part 5A – Section 2: Construction specification

5A.2.1 Wet-well and valve chamber

5A.2.1.1 The Pumping Station chamber shall be constructed from flush jointed Class 4 reinforced concrete pipes installed as shown on Figure 119: TS 521 Standard sewer pump station details.

5A.2.1.2 All concrete must be blended with an approved Pozzolanic Cement to resist common forms of corrosion from sulphates.

5A.2.1.3 The mass concrete slab shall be constructed of 17.5MPa concrete. The final depth of the concrete shall be determined based on accepted engineering design principles, allowing for buoyancy affects.

5A.2.1.4 The base slab shall be constructed of ordinary grade 20MPa concrete.

5A.2.1.5 Pipe joints shall be sealed and made watertight using “Expocrete UA” or an acceptable equivalent. The mortar shall be used strictly in accordance with the manufacturer’s instructions.

5A.2.1.6 Care shall be exercised to ensure that the pump chamber is vertical and set to the correct levels before the station floor is poured. A precast base may be used provided flotation of the chamber is prevented.

5A.2.1.7 All reinforcing steel bars shall be Seismic 300 (300E) or Seismic 500 (500E) deformed bars complying with AS/NZS 4671:2001.

5A.2.1.8 The Valve Chamber block work mortar joints shall be pointed inside and outside and all cores filled with grout. The outside of the block work shall by painted with two coats of “Mulseal” or acceptable equivalent in accordance with the manufacture specifications.

5A.2.2 Cover slab

5A.2.2.1 The top slab shall be cast as shown on Figure 120: TS 522 Standard sewer pump station details. The placement of reinforcement shall be carefully controlled to ensure adequate cover.

5A.2.2.2 All concrete shall be ordinary grade 20MPa crushing strength and blended with an approved Pozzolanic Cement to resist common forms of corrosion from sulphates.

5A.2.2.3 Concrete shall be supplied by a ready-mix plant with a current quality Certificate of Audit by an Auditing Engineer.

5A.2.2.4 The top surface of the slab shall be finished to F4 (refer NZS 3114:1987).

5A.2.2.5 The top slab level shall be finished to be not less than 25mm above surrounding ground levels to prevent stormwater ingress. The exceptions to this requirement are when the cover slab is located in a footpath, driveway or carriageway.

5A.2.3 Lid covers

5A.2.3.1 The lid and frame are specified on Figure 121: TS 523 Miscellaneous cover details. The frame fabrication, including welding to angle of D10 rags, shall be carried out in the workshop and then hot dip galvanized after fabrication.

5A.2.4 Pump installation

5A.2.4.1 The pump discharge holding down bolts shall be epoxy bonded into the base slab using the Chemset system or equivalent approved, and accurately positioned so that the pump guide rails stand vertically between the guide rail brackets and the discharge connection. Care is to be exercised in grouting in the bolts to ensure that they will not vibrate loose with use.

5A.2.4.2 All nuts, bolts, washers and concrete anchors shall be grade 316 stainless steel. Where concrete is to be poured around polyethylene pipe, the pipe shall be first wrapped with 1.5mm thick butynol sheeting.

5A.2.5 Cable bracket

5A.2.5.1 The float and motor cables shall be secured by a grade 316 stainless steel bracket and insulators. The bracket shall be mounted in such a position as to be easily accessible from the lid opening.

5A.2.5.2 All nuts, bolts and washers shall be grade 316 stainless steel.

5A.2.6 Water supply

5A.2.6.1 A 40mm diameter (ID) water supply, or standard 50 (OD) PE80B (PN 12.5) pipeline (Refer Volume 3, Part 6, Section 4: Installation of MDPE Pipelines) shall be provided to the pump station. Wastewater pump stations are a "High Hazard" risk requiring reduced pressure zone type backflow prevention devices installed above ground level (refer BIA Acceptable Solution G12/AS1 and AS/NZS 2845.1:2010). The backflow prevention device is to be positioned adjacent to the electrical control cabinet, in a separate secure cabinet, as shown on Figure 124: TS 526 Water supply to pump station.

5A.2.6.2 The cabinet shall be supplied with a staple lock securely fixed to the cabinet, to enable locking of the cabinet door with a padlock. Upon Council’s acceptance of the pump station, Council will provide the lock, keyed to their own system.

5A.2.6.3 A 40mm male camlock fitting shall be installed through the end of the cabinet, positioned sufficiently to enable a hose to be connected externally. A sufficient length to reach the pump well and valve chamber of 40mm Agflex Coldwash WP10 water hose shall be supplied with a female camlock fitting at one end and a high pressure jet nozzle at discharge end.

5A.2.7 Gravity collection manhole

5A.2.7.1 A 1050mm diameter standard RCFJ collection manhole shall be installed upstream of the sampler manhole. This manhole shall collect all incoming flows from the catchment area, and shall also be the location of the emergency storage chamber discharge point.

5A.2.7.2 The pipe size between the collection MH and the sampler MH shall be determined by hydraulic design, and shall be subject to approval by Council.

5A.2.8 Upstream sampler manhole

5A.2.8.1 A 1200mm diameter standard RCFJ sampler manhole shall be installed upstream of the pump station wetwell. This manhole shall have one inlet and one outlet. All wastewater from the pump station catchment shall be directed to a single point upstream of this sampler MH, and then directed to the pump station via the sampler MH.

5A.2.8.2 The sampler MH shall not be located in a road or commercial/industrial driveway. Where the manhole is greater than 1.4m deep from surface level to invert level, the size of the opening in the lid, frame and cover shall be increased to 750mm minimum size.

5A.2.8.3 The pipeline between the sampler MH and the wetwell shall be no smaller than the pipe between the collection MH and the sampler MH.

5A.2.9 Inlet to wet well

5A.2.9.1 The gravity inlet pipe from the sampler manhole shall be terminated with a standard Council internal dropper. Refer to Figure 107: TS 500.4 New install manhole.

5A.2.10 Emergency storage

5A.2.10.1 The emergency storage chambers shall be constructed where the required storage cannot be contained with the pump station wetwell and the gravity reticulation system. Refer to Figure 122: TS 524 Sewer emergency storage chamber details and Figure 123: TS 525 Sewer emergency storage chamber details continued for further details.

5A.2.10.2 The chamber sizes shall be a nominal 1800mm diameter, but may be varied by agreement with Council.

5A.2.11 Electrical specifications

5A.2.11.1 ***Scope of Electrical Works***

(a) The sewer pump station shall be constructed and tested to provide Council with a complete working installation, as set out in the figures and this section.

(b) The specific requirements for the electrical systems include, but are not limited to:

  (i) Make arrangements for the supply and installation of a 400 V underground mains cable from the local Network Supply Company reticulation and pay all costs.

(ii) Supply and construction of a reinforced concrete mounting pad for pillar box set 100mm above finished wetwell lid level.

(iii) Supply and installation of a freestanding pillar box complete with revenue metering, level and pump controls, soft starters, flow metering, monitoring, telemetry and radio transmitter, complete with aerial.

(iv) Supply and installation of all cabling and control wiring between the pillar box and the pump chamber.

(v) Supply and installation of all cable support mechanisms, conduits and underground ducts necessary for the completion of these works.

(vi) Liaison with the nominated Council telemetry contractor to ensure a co-ordinated installation of telemetry and radio equipment. Work associated with the supply, installation, connection and programming of the telemetry, radio link and base station will be the responsibility of the Developer, but shall be carried out directly by the Council nominated telemetry contractor.

(vii) Testing, commissioning and certification of these works, including Certificate of Compliance.

(viii) As-built figures and equipment manufacturer's information.

(ix) Defects liability.

(x) Guarantees and warranty.

5A.2.11.2 ***Regulations and standards***

(a) Comply with all statements and Regulations applicable to the work of this contract.

(b) In particular, comply with the following Relevant Statutory Acts, Regulations and Bylaws:

(i) Standards stated herein.

(ii) Local Authority Regulations and Requirements.

(iii) New Zealand Electricity Regulations 1997.

(iv) New Zealand Electricity Codes of Practices.

(v) AS/NZS 3000:2007 Wiring rules.

(vi) NZ ECP 4 Supply by LV Generating System.

(vii) NZ ECP 11 Testing.

(viii) NZ ECP 36 Harmonics.

(ix) NZ ECP 14 Control Protection & Switchboards.

(x) NZ Radio Interference Regulations and Interference Notices (Radio and Television).

5A.2.11.3 ***Guarantees***

(a) Only guarantees required by this code will be acceptable.

5A.2.11.4 ***Maintenance (defects liability period)***

(a) Maintain the installation free of charge for a 6 month period from the date of takeover by Council.

(b) Provide an on call 24 hour fault correction service.

(c) Make all adjustments and corrections found necessary and carry out maintenance as specified in the Operation and Maintenance Manual.

(d) Provide all materials, plant, equipment and labour necessary to carry out all maintenance.

5A.2.11.5 ***Materials & work not specified but required***

(a) Materials and work not specifically mentioned shall be supplied as required by normal trade practice to enable completion of the work to a standard of workmanship required by Council's Engineering Manager.

5A.2.11.6 ***Equipment installation***

(a) All equipment shall be new and installed to the manufacturer's instructions, relevant statutes and standards.

5A.2.11.7 ***Access to equipment***

(a) All equipment requiring adjustment, cleaning, changing or modification in its normal use shall be readily accessible and its function clearly identifiable.

5A.2.11.8 ***Seismic restraints***

(a) *Seismic Restraint Criteria*

(i) All equipment shall be provided with seismic restraints to comply with the Electrical Supply Regulations Earthquake requirements.

(b) *Acceleration Forces*

(i) The complete installation, including all fixings, shall be able to withstand normal operating loads plus acceleration forces of not less than 1.0 g in a horizontal direction through the centre of gravity of the item fixed.

5A.2.11.9 ***Safety devices***

(a) All safety devices required by statutes, regulations or local authority bylaws or those which are consistent with good trade practice, shall be fitted. These shall include, but not be limited to, such items as guards, cover plates, electrical-mechanical interlocks, isolators and warning notices, etc.

(b) All parts of the system shall "fail-to-safety", wherever practicable.

5A.2.11.10 ***Corrosion protection***

(a) Make every attempt to limit corrosion.

(b) Gland plate between cubicle and wetwell ducts shall be sealed to prevent sewage gas from invading the cubicle. Easily removable foam rubber product or similar.

(c) Do not place metals in direct contact with concrete except where steel is cast-in for supports or hangers.

(d) Eliminate pockets that could hold water.

(e) Fastenings to have equivalent or better corrosion resistance than the materials joined.

5A.2.11.11 ***Existing services***

(a) *Disruption or Disconnection*

(i) Obtain approval before disconnecting or disrupting any existing service. Keep all necessary disruptions to a minimum and at such times as will avoid unnecessary inconvenience to others.

(b) *Underground Services*

(i) Take all reasonable precautions to locate all underground services prior to commencement of any excavations.

(ii) Any damage to underground services during excavations shall be repaired at no cost to Council.

(iii) Services found during excavation which have not been previously located shall be reported.

(iv) Report immediately any services that are damaged.

(v) No excavating machine shall be used closer than 200mm to any buried services.

5A.2.11.12 ***Power supplies & earthing***

(a) *Service Connections*

(i) The pump station shall be supplied with an underground main supply cable from the Electricity Network Operator nominated point of supply. The main supply cable shall be sized to suit the station design and length of run from the point of supply, but not less than 16mm CU conductors.

(ii) The cable manufacturer's general recommendations for installation and current ratings shall be complied with unless specified otherwise.

(iii) No cost shall be payable by Council for connection of electricity supply to the suppliers network.

(b) *Tariff Metering Provisions*

(i) Revenue metering and any associated current transformers provided by others shall be accommodated in the pillar box.

(ii) Arrange supply and installation of all fuses, test links, wiring and all items necessary for the correct operation of the revenue metering equipment.

(iii) Provide space and mounting arrangements to the requirements of the owner of the revenue tariff metering.

(iv) Disconnection points shall be provided adjacent to all bus bars or cable mounted current transformers to permit the easy removal of the current transformers.

(v) Contact Council's Operations Engineer for current power supplier.

(c) *Earth Continuity Conductors*

(i) Earth continuity conductors shall be installed with the wiring to all switches, power or other connection points. All earth linking or bonding conductors shall be green or green/yellow.

(d) *Main Earth*

(i) The main earth shall be by driven earth electrodes.

(e) *Bonding of Other Services and Metal Work*

(i) All exposed metals shall be earth bonded as appropriate. Include wetwell items where appropriate.

(ii) The minimum size for runs up to 20m shall be 2.5mm², runs longer than 20m shall be minimum 4mm².

(f) *Test Results*

(i) The earth resistance of the main earth shall be measured using approved instruments and methods.

(ii) All test results shall be approved by the Electricity Supply Authority.

5A.2.11.13 ***Pillar box & controls***

(a) The following requirements shall be allowed for:

(i) *Pump Control*

- Automatic start/stop control shall be via connection to an ultrasonic level controller. ABB ultrasonic level controller or approved similar.
- The ultrasonic level controller shall alternate pump duty after each start.
- Set start 1, start 2 and stop levels as determined on site in conjunction with Council.
- A high level alarm shall be activated by an ultrasonic with backup Flygt float switch and both connected to the telemetry system.

(ii) *Telemetry*

- Council's Control sub-contractor shall be used as a sub-contractor for the supply, installation and commissioning of a complete, operational telemetry link between Council base station and this new outstation.
- Work includes but not limited to:
  - Supply and installation of a telemetry unit.
  - Supply and installation of a radio transmitter with a directional aerial and battery backup.

- Configuring and adding of the new outstation telemetry signals to the existing Council Base station, including upgrading of Base station equipment to accommodate new outstation.

(iii) *Telemetry Inputs*

- Provide rail mounted terminals for the connection of the following inputs to the telemetry unit:
  - Pump 1 – Run
  - Pump 2 – Fault
  - Pump 2 – Run
  - Pump 2 – Fault
  - Pump 1 – Hours run
  - Pump 2 – Hours run
  - Pump 1 – Run amps (4-20mA)
  - Pump 2 – Run amps (4-20mA)
  - High sewage level alarm
  - Phase failure indication
  - Clearly label all telemetry input terminals

(iv) *Pillar Box Manufacture*

- The manufacture of the pillar box and control cubicle shall be by a firm approved by Council and who specialises in this type of work. All work to be to a standard accepted in New Zealand and proven equivalent to or better than the current NZS or AS documents.
- Complete as separate Certificate of Compliance for the switchboards.

5A.2.11.14 ***Construction details***

(a) Design of the cubicle and layout of equipment and instruments shall generally be as shown on the figures.

(b) Dimensions shown on the switchboard design are typical only. However, the Developer shall ensure the boards, as-built, will fit into the space available and suitable for its intended purpose.

(c) Pillar boxes shall be free standing, weatherproof, lockable, totally enclosed and constructed to exclude dust and vermin.

(d) Switchboards shall be built so as to withstand a maximum prospective fault current for the site for a period of one second.

(e) All mechanical supports for internal equipment shall be aluminium and all fixings shall be stainless steel.

(f) Where possible, equipment shall be din rail mounted and all wiring contained within snap-on cap trunking. All outgoing circuits shall be wired to designated terminals for connection of the field cabling and/or remote monitoring interfacing circuitry with the exception of the incoming mains, generator and pump power cabling.

(g) Interior panel mounted equipment shall be flush mounted in PVC boxes.

(h) MCB/HRC panel shall be enclosed within the pillar box.

(i) Stiffen, where necessary, to prevent panel deformation due to weight of equipment or stresses of switching operations.

(j) Non-ferrous metal gland plates shall be used with single core cabling.

(k) No live metal shall be exposed to touch or accessible to tools under normal conditions when the panel or cubicle door is open.

5A.2.11.15 ***Circuit identification charts***

(a) Circuit identification charts for all distribution boards shall give full circuit information and identification i.e. phase protection size, equipment served, and equipment location.

5A.2.11.16 ***Equipment layout***

(a) Equipment layouts shall by symmetrical.

(b) Ensure that sufficient space is provided to allow all internal components such that they are mounted to their manufacturer's requirements.

5A.2.11.17 ***Equipment mountings***

(a) Mounting of equipment, inside the cubicle, shall be on standard DIN mounting rails.

5A.2.11.18 ***Connections***

(a) Fit coded plastic ferrules on all wiring for control wiring. The coding system shall make it possible to identify both ends of a length of wire where the circuit loops between several connection points.

(b) External connections of non-earthed conductors shall be at rail mounted terminals at the cable entry compartment.

(c) Mount neutral and earth bars in the cable entry compartment.

(d) All terminals and live metal shall be shrouded with clear plastic.

5A.2.11.19 ***Main switch***

(a) Main switches shall be of the rotary type contact for mains and off generator facility and lockable in the off position. Switches to be sized to suit the pump loading with minimum mains loadings of 60 amps.

5A.2.12 Wiring

5A.2.12.1 Internal wired connections shall be PVC insulated and shall be:

(a) Suitably coloured to indicate their function.

(b) Supported adequately using plastic ties or PVC trunking.

(c) Low voltage and control cables shall be colour coded as per the figures.

5A.2.12.2 ***Finish***

(a) Surfaces are to be powder coated green to the manufacturer's standard finish.

(b) Clean boards on completion.

(c) Repair satisfactorily any internal or external paint damage or any other defect.

5A.2.12.3 ***Labels***

(a) All electrical control equipment shall be labelled, including all identification information necessary for the system operation and maintenance.

(b) Material: Laminated plastic.

(c) Engraved.

(d) Coloured: Black with white lettering.

5A.2.13 Accessories

5A.2.13.1 All rated breading capacity of protection devices shall be correctly graded to ensure co-ordination with upstream and downstream protection devices.

5A.2.13.2 ***MCB protection***

(a) Miniature circuit breakers shall have a minimum rated breaking capacity of 6kA.

5A.2.13.3 ***Isolation switches***

(a) Type shall be rotary switches shall be suitable for on load operation at a speed independent of the operator.

(b) Terminals and contacts fully shrouded.

(c) Control switches shall be 10A minimum rating and be fitted with teardrop operating handles.

5A.2.13.4 ***Terminal blocks***

(a) Type shall be rail mounted complete with mounting rail, supports and identification accessories. Connectors, where used, shall provide the following facilities:

   (i) Testing of circuits connected to the terminal.

   (ii) Linking of adjacent terminals.

   (iii) Screw clamp type connections.

   (iv) Cross-linking facilities where terminals are associated with current monitoring facilities. This facility shall allow the current source to be short-circuited.

   (v) Isolation facilities where the terminals are associated with voltage monitoring facilities.

   (vi) Segregation barriers between extra low voltage and low voltage terminals.

   (vii) Provide terminal blocks correctly sized for the conductors connected thereto.

5A.2.13.5 ***Instrumentation***

(a) Instruments shall be:

(i) Industrial grade to BS 89 or approved equivalent standard.

(ii) Flush mounted.

(iii) Accuracy shall be + 2.5% of full-scale reading.

(iv) Calibrated to show full load current at approximately midscale.

5A.2.13.6 ***Current transformers***

(a) Current transformers shall comply with BS 7626-1:2011 or approved equivalent standard.

(b) Shall have an accuracy class of:

(i) Class 1 for check meter and revenue metering applications.

(ii) Class 3 for general purpose metering applications.

(iii) Class 10P for protection applications.

(c) Be of a 5VA minimum burden unless specified otherwise.

(d) Test links shall be provided in switchboards for all current transformers.

5A.2.13.7 ***Starters/contactors***

(a) Electronic Soft Starters:

(i) Where required by the Power Supply Network Company, constraints or pumping system operational requirements shall be of a proprietary brand, Telemecanique Alti- start or approved similar.

5A.2.13.8 ***Relays***

(a) Relays shall:

(i) Be plug in type front connected.

(ii) Have accessible standard terminations.

(iii) Incorporate clear plastic dust-excluding covers.

(iv) Contact rating shall be suitable for the connected load and in no case shall it be less than 10A.

(v) Interchangeable relays shall have coils operating on the same voltages.

5A.2.13.9 ***Extra low voltage power supplies***

(a) Extra low voltage supplies for controls shall be supplied from a 230V to 24V transformer or other secondary voltage if required.

(b) The secondary winding shall be fully isolated.

(c) Both legs shall have HRC glass fuse protection or approved equivalent.

(d) Rating shall be suitable for the connected load.

5A.2.14 Sub-circuit wiring

5A.2.14.1 ***General***

(a) Cables and flexible cords shall be:

(i) Stranded conductor type unless otherwise indicated.

(ii) Minimum size $1.5mm^2$ for cables.

(iii) Minimum size $32/0.20mm^2$ for flexible cords.

(iv) Run parallel with building lines.

(b) Joints in point to point cable runs are prohibited.

(c) Heat resistant wiring shall be used where ends are exposed to temperatures above 35^oC.

5A.2.14.2 ***Outside areas***

(a) Install circuit wiring in ducts and circuits.

5A.2.14.3 ***Sub-circuit cable installation***

(a) Sub-circuit cables shall be installed:

(i) Flat and free from twists.

(ii) Enclosed in conduit when buried in concrete or plaster.

(iii) Arranged so that they can easily be removed and replaced.

5A.2.15 Wiring in conduit or ducting

5A.2.15.1 Installation of wiring shall be:

(a) Simultaneous for all wires in the same conduit.

(b) Fed as well as pulled into conduits.

(c) Without crosses or twists.

(d) Friction reducing substances shall not be used when pulling wiring into conduits.

5A.2.15.2 ***Underground***

(a) Cables installed underground shall comply with the requirements of the Electricity Regulations 1997 and NZECP28.

(b) Report immediately any services exposed or damaged during trenching.

(c) Excavations shall be open for the minimum possible time and shall be kept free of water and shored up as necessary.

5A.2.15.3 ***Cable ducts***

(a) Cable ducts shall be checked to ensure they are clear of obstructions, have draw wires fitted and are installed to allow easy figure in of cable.

(b) Cables in a duct shall be pulled in simultaneously.

(c) To prevent gases from the chamber entering the cabinet, ducts shall be plugged with cotton waste and capped with polystyrene.

5A.2.15.4 ***Backfilling and reinstatement***

(a) Polythene signal strip 100mm wide and coloured orange with a printed warning shall be laid at a depth of 150mm.

(b) Complete backfilling and consolidation to finish not more than 25mm above normal ground level,

(c) Finish to match original surface.

5A.2.15.5 ***Terminations***

(a) Proprietary cable glands shall be used for “making off” all metal sheathed, armoured, and neutral screened cables.

(b) Cable bends shall be followed by a minimum of 50mm of straight cable before the cable enters a gland where practical.

(c) Fit neoprene or PVC insulating sleeves over all exposed cable tails within switchboard enclosures. Cut back PVC serving on cables the minimum necessary. Terminate serving with PVC tape wrapping close to the cable gland.

(d) Fully shroud connections and terminals of switchgear.

5A.2.16 Conduits

5A.2.16.1 ***General***

(a) Installations shall not be:

   (i) Embedded partially in concrete or plaster.

   (ii) Installed complete with the cabling.

   (iii) Installed such that the cabling cannot be removed and re-installed.

(b) Bends or other changes of directions may be set on site to suit local conditions.

5A.2.16.2 ***Conduit types***

(a) Conduits shall be:

   (i) Rigid PVC class B conduit to AS/NZS 2053.1:2001 or an approved equivalent standard.

   (ii) Non-metallic flexible conduit to BS 4607-1:1984 Part 3 + A2:2010 and BS EN 60998 Part 1:2004 or an approved equivalent standard.

(b) Flexible conduit shall not be used in any run of rigid conduit except where a conduit is terminated at an appliance or accessory that may be subject to movement and/or vibration.

5A.2.16.3 ***Embedded Conduit***

(a) Cover not less than 40mm in concrete or 5mm in plaster.

(b) Position all runs as close as possible to the centre of concrete slabs or columns.

(c) Brace conduits to prevent movement when concrete is poured.

5A.2.17 Accessories

5A.2.17.1 *Switches, socket outlets & fixed outlet*

(a) *Surface Type*

(i) Surface wiring type shall be:

- Enclosures of the impact resistant, corrosion resistant, surface mounted type.
- Switch operators of the weatherproof rotary type.
- Covers secured by brass screws into blind holes on the enclosures.

(b) *Small Power Outlets*

(i) Generally small power outlets shall be a flat three-pin 10A socket 30mA RCD type incorporating a suitably rated switch for single-phase applications.

(c) *Generator Inlet Socket*

(i) The generator appliance inlet shall be:

- A minimum of 500 volts 3 phase 5 pin PDL 56 series or similar approved. Refer to schedule on figure for rating to suit pump station design.
- Surface mounted on outside pillar box.

5A.2.17.2 *Lighting*

(a) Install an 8 watt 'Mini Lite' or similar at top of cabinet and control via the extra switch on the socket outlet.

5A.2.17.3 *Cabinet heater*

(a) Shall be flat or round low wattage (60 watt) protected by aluminium or metal expanded metal grille to prevent fire risk of contact with element.

5A.2.17.4 *Lightning protection*

(a) *Commissioning & testing*

(i) All pumping stations shall undergo a commissioning test. Council shall be present at the test. A minimum of 24 hours' notice shall be given to Council prior to the test taking place. Any defect found or non-conformance to agreed standards shall be rectified prior to acceptance of the pumping station by Council.

5A.2.18 Testing and commissioning of rising main

5A.2.18.1 *General*

(a) The new rising main shall be pressure tested to demonstrate the pipeline has been constructed satisfactorily.

5A.2.18.2 *Method for pressure testing – all materials*

(a) *Definitions*

(i) Design Pressure (DP): The pressure that the designer expects to act on the pipeline in service.

(ii) DN: nominal pipe bore diameter in millimetres.

(iii) Maximum Design pressure (MDP): The DP plus a pressure surge allowance (preferably calculated), or a fixed allowance of 200-500 kPa or such other allowance as the pipeline designer may decide is appropriate.

(iv) Operating pressure: The internal pressure that occurs at a particular time and at a particular point in the water reticulation system.

(v) Nominal Pressure Rating (PN): The pressure marked on the pipe or component and the maximum pressure that it can operate at throughout its design life.

(vi) System Test Pressure (STP): The hydrostatic pressure to be applied to a newly laid pipeline (measured at the lowest point) to ensure its integrity and water tightness.

(b) *Accuracy of Pressure & Volume Measurement*

(i) The equipment used to determine the make-up volume shall be capable of measuring the quantity of water to an accuracy of ± 2% or better.

(ii) The precision of the pressure measurement will have an effect on the accuracy of the volume measurements, especially if a significant amount of air remains in the pipeline. The precision with which the STP is set and restored will also have an effect on the test results. Measurement of the volume drawn off may be more precise and controllable than the volume pumped in.

(iii) The pressure range of the gauges used shall be such that the STP falls within the range 50-90% of the full-scale range of the gauge. The main gauge shall have been calibrated within 6 months of use and have a minimum dial diameter of 100mm (preferably 150mm).

(c) *Presence of Air in the Pipeline*

(i) Air trapped in a pipeline during the test will affect the test results. As much air as possible should be expelled from the pipeline during filling and before the pressure test is commenced. Air removal may necessitate swabbing.

(d) *Filling the Pipeline*

(i) New pipelines should preferably be filled from the low end of the line. The rate of flow and time of day for filling may be controlled by the availability of water. Where the pipeline is to be charged with water from the existing reticulation network, the filling rate of flow should not cause a pressure drop that will be noticeable or cause inconvenience to consumers. Water from an alternative source shall not be used to fill pipelines for testing purposes unless the quality of the water complies in all respects with grade B (or better) for water Source and Treatment of the Public Health Grading of Drinking-Water Supplies.

(ii) It may be necessary to carry out the filling, flushing or swabbing operations at times that do not coincide with peak demands on the reticulation network. The pipeline designer should specify the filling times and rates of flow, especially where large diameter pipelines are involved.

(iii) Suitable means of introducing flushing water, including temporary facilities for launching and release of swabs (as appropriate) shall be installed as part of the testing procedure and a means provided for the safe disposal of any water that is flushed from the pipeline.

(iv) A suitable backflow preventer shall be used on any connection made to fill, flush out or to drive a swab or swabs through a new pipeline. A dual check valve (without test facilities) will be suitable provided its effectiveness is confirmed prior to use.

5A.2.18.3 ***Specific requirements for uPVC & mPVC***

(a) *Pressurising the Pipeline*

(i) Pressurising of the pipeline above the DP (or 75% of the STP) shall not begin until Council and Designer (if appropriate) are on site to witness the test, unless Council has given prior approval.

(ii) The pressure shall be raised steadily and smoothly to the STP and shall not be raised to more than 1.5 x PN of the lowest rated component in the line.

(iii) Maintain the STP, by pumping at 15-30 minute intervals (if necessary) for the specified test duration (usually at least one hour). Measure and record the quantity of make-up water added at each occasion, either by the volume pumped in or volume drawn off method as detailed in the Developer's approved test methodology. Restore the STP whenever the pressure drops by more than 5%.

(iv) The volume of water drawn off may be measured by any suitable device. A 15 or 20mm class C or D water meter may be appropriate, provided the outflow rate is within the meters' Qmin and Qmax.

(b) *Acceptance Criteria*

(i) The pressure test shall be satisfactory if:

- There is no failure of any thrust block, pipe, fitting or other pipeline component.
- There is no visible leakage – if a leak is suspected but not visible, use aural or ultrasonic assistance to locate.
- The make-up water volume does not exceed the maximum allowable quantity as calculated from the equation:

$$\boxed{Q\ (L/h) < (0.14 \times L \times D \times H)}$$

Where: L = Length of pipeline under test (km)
D = Internal diameter of pipe (m)
H = Average value of head in the pipeline (m)

Equation 9: Wastewater acceptance criteria - pressure test

(c) *Failure of Test*

(i) Should the test fail, the cause shall be located and rectified and the section re-tested until satisfactory results are obtained.

(ii) Failure to allow adequate "soak" time for a cement mortar lined pipe or if there is a significant amount of entrapped air in the pipeline may result in an inconclusive test or a marginal failure. In such a case, the test period may be extended for a further one to two hours, as may be agreed between the Developer and Council.

(iii) Provided the quantity of make-up water meets the acceptance criteria during the last hour of this extended period, the pipeline will pass the test.

(d) *Reporting*

(i) On satisfactory completion of the test, the test report shall be prepared by the Developer and signed off by the Developer, Council and Designer witnessing the test. The test report shall include the following:

- Full details of the pipeline section tested (including details of pipe material, diameter and pressure class, pressure rating, pipe manufacturers identification details, jointing system, pipeline profile showing any changes in elevation, pipe material or diameter, as well as the location of valves and fittings, and the extent of the test section).
- Date and time of testing (both start and finish).
- Failure of any thrust block, pipe, fitting or other component and its location.
- Any visible leakage detected and repaired.
- A detailed record of the pressure in the pipeline at appropriate time intervals, preferably a data logger output with logging intervals of 1 minute or less.
- Whether the pipeline passed or failed the test criteria.
- Names of key personnel and observers.

5A.2.18.4 ***Specific requirements for PE100 – Modified Rebound Method***

(a) *General*

(i) Pressurising of the pipeline above the DP (or 75% of the STP) shall not begin until Council is onsite to witness the test, unless Council has given prior approval.

(ii) A Pressure transducer and data logger is the preferred means for monitoring the pressure during this test method. However, manual reading of a pressure gauge that complies with the requirements of Clause 5A.2.18.2(b) at 2-5 minute intervals will be acceptable.

(b) *Preliminary Phase*

(i) This preliminary phase is necessary before proceeding to the subsequent phases. It is intended to set up the prerequisites for volume alterations that are dependent on pressure, time and temperature.

- After flushing/swabbing and thoroughly venting the pipeline, depressurize to just above atmospheric at the highest point of the line and allow a relaxation period of at least 60 minutes to release pressure related stress.
- Ensure that no air enters the line.
- After the relaxation period, raise the pressure smoothly to the STP in less than 5 minutes. Maintain the STP for a period of 30 +5 /-0 minutes by pumping continuously or at short intervals. Take care not to exceed the STP. During this time, carry out an inspection to identify any obvious leaks.
- Stop pumping and allow the pressure to decay by visco-elastic creep for 1 hour.
- Measure the remaining pressure at the end of the hour.
- If the pressure has dropped to 70% or less of the STP, the pipeline will not pass the test and the cause should be located and rectified. This could be due to leakage or temperature change. If the pressure at the end of the hour >70% of the STP, continue with phase two, the pressure drop test to prove the volume of air in the pipeline is sufficiently low to allow the main test phase to be carried out.

(c) *Pressure Drop Test*

(i) The main test phase requires the pipeline has been adequately vented and the volume of remaining air is less than the calculated maximum allowable. The procedure to confirm the air volume is described below. This test (pressure drop test) is carried out immediately after the completion of a successful preliminary phase.

(ii) Reduce the pressure remaining in the pipeline rapidly at the end of the preliminary phase by opening a metered "bleed" connection to produce a pressure drop (Δp) of 10-15% of the STP or to the DP (which ever produces the lowest pressure). The bleed time should be kept as short as possible, (preferably less than 2 minutes). A large diameter/volume test section will require a large connection and meter in order to achieve the bleed time requirement – this should be confirmed by calculation.

(iii) Measure accurately and record the volume of water "bled" from the line (ΔV).

(iv) Calculate the maximum allowable water loss (ΔVmax) using the following formula. The volume of water removed should not exceed ΔVmax.

(v) If ΔV is more than ΔVmax, stop the test and remove excess air.

Table 41: Bulk modulus of water at various temperatures

TEMPERATURE ˚C	BULK MODULUS (kPa)
5	2080000
10	2110000
15	2140000
20	2170000
25	2210000
30	2230000

Table 42: E modulus of PE100 at various temperatures

TEMP. ˚C	Pe100 – E Modulus (kPa) @ hrs.		
	1 hour	2 hours	3 hours
5	990000	930000	900000
10	900000	850000	820000
15	820000	780000	750000
20	750000	710000	680000
25	690000	650000	630000
30	640000	610000	600000

Advice Notes:

1. The value of ER should be rep-resentative of the temperature and duration of the test (see table above).
2. Δp and ΔV should be measured as accurately as possible, especially where the test section volume is small.

(d) *Main Test Phase*

(i) The visco-elastic creep due to the STP is interrupted by the rapid pressure drop described above. The rapid drop in pressure leads to the contraction of the pipeline. Observe and record the increase in pressure that results from the contraction of the pipeline for a period of 30 or 90 minutes.

(e) *Acceptance Criteria*

(i) The pressure test shall be satisfactory if:

- There is no failure of any thrust block, pipe, fitting or other pipeline component.
- There is no visible leakage.
- The pressure shows a rising tendency within the 30 minute period.
- If doubt exists about the pressure recovery, the monitoring period may be increased to 90 minutes and any pressure drop that does occur shall not exceed 20 kPa over the full 90 minute period.

- Repetition of the main test phase may only be done by carrying out the whole test procedure including the relaxation period of 60 minutes described in the preliminary phase.

(f) *Failure of Test*

(i) Should the test fail, the cause shall be located, rectified and the section re-tested until satisfactory results are obtained.

(g) *Reporting*

(i) On satisfactory completion of the test, the test report shall be prepared by the Developer and signed off by the Developer, Council and Designer witnessing the test.

(ii) The test report shall include the following:

- Full details of the pipeline section tested (including details of pipe material, diameter and pressure class, pressure rating, pipe manufacturers identification details, jointing system, pipeline profile showing any changes in elevation, pipe material or diameter, as well as the location of valves and fittings, and the location of the test section).
- Date and time of testing (both start and finish).
- Failure of any thrust block, pipe, fitting or other component and its location.
- Any visible leakage detected and repaired.
- A detailed record of the pressure in the pipeline at appropriate time intervals, preferably a data logger output with logging intervals of 1 minute or less.
- Whether the pipeline passed or failed the test criteria.
- Names of key personnel and observers.

5A.2.18.5 *Method for weld testing PE100*

(a) *General*

(i) Welds shall be evaluated on the following visual inspection criteria:

- Welding within agreed welding procedures.
- Weld records to be maintained so that checking of actual weld parameters used can be made against target weld parameters.
- Testing shall be made of two initial test welds for each pipe size, new machine or operator or new pipe source.
- Testing of 1% of all welds.
- Any welds that are made without the required records being made and supplied to Council will be rejected.
- Until the results of the initial test welds have been received the Developer may, entirely at his own risk, weld pipes but may not bury any pipe.

(b) *Visual Inspection*

(i) Each joint will be visually inspected to check that:

- Both fusion beads are of the same size and shape and project evenly above the outside diameter of the pipe.
- The bead width is within the parameters shown in Table 43.
- There are no cracks in the beads.
- There are no obvious inclusions or other faults present.

(ii) A check sheet shall be kept by the welder for each weld to show that the above items have been checked.

Table 43: Bead width

Minimum Wall Thickness (mm)	Width of Bead (mm)
11	9-12
13	10-14
16	11-15
18	12-16
19	12-18
22	13-18
24	14-19
28	15-20
30	16-22

(c) *Weld Procedure*

(i) All welding will be carried out within the Developer's specified welding procedures. The procedures shall define welding parameters for temperature, time and pressure for the various pipe sizes used. These will generally be consistent with the manufacturer's recommendations but may be modified to achieve consistently good welds as much as is reasonably possible.

(ii) All welds will be numbered and a specific weld record will be maintained for each weld. The record will record all weld parameters including (but not limited to) welder, date, time, temperature and pressure.

5A.2.18.6 ***Tensile strength tests***

(a) The Developer shall arrange for the welds to be tested by an IANZ Registered Laboratory.

(b) Tensile testing will be carried out on two test welds for each pipe size, new machine or operator or pipe supplier, to confirm the suitability of the weld procedure. These tensile tests must be accepted before commencement of further series fusion welding.

(c) It will also be used to test 1% of all other butt fusion welds.

(d) Tensile testing shall generally be carried out in accordance with ISO/FDIS 13953 but shall be modified as follows:

(i) The Type A test specimen shall only be used for all samples exceeding 20mm in thickness.

(ii) All test strips for Type A tests shall be machined down to 20mm thickness by removing material evenly from each side of the pipe and then tested in the Type A test apparatus.

(iii) Samples tested in the above manner are referred to as Modified Type A testing to avoid confusion with ISO/FDIS 13953.

(iv) A graph of load verses tensile extension shall be supplied with each test specimen to assist in interpretation of ductile and brittle failures. It is acceptable for the tensile extension to be measured on the machine clamps and not on the pipe itself if desired.

5A.2.18.7 ***Acceptance of butt welds***

(a) It is recognized that it is difficult to achieve consistent ductile ruptures of PE welds, for the Type A Tensile Test, when the wall thickness is greater than about 20mm. Random brittle results do occur in the thicker walled Type A test specimens, irrespective of the weld parameters used.

(b) The acceptance of tensile results will be based on the following:

(i) The weld record sheet shall show that the weld has been carried out within the tolerances of the weld procedure.

(ii) The visual inspection of the weld shall confirm that the weld is consistent with 5A.2.18.5(b).

(iii) Ultimate tensile strength of the weld shall be no less than 0.9 of the pipe strength.

(iv) The Type B test specimens shall rupture in a generally ductile manner.

(v) The Modified Type A test specimens shall rupture in a generally ductile manner but some degree of brittleness will be accepted provided that it occurs in no more than one of the total Modified Type A test specimens per weld and the nature of the brittleness does not extend over more than 25% of the surface of the weld area tested.

(vi) If more than 50% of the Type A test specimens form an individual weld on a pipe with a wall thickness of greater than 20mm, rupture in a brittle manner (a brittle/ductile or semi brittle classification shall be considered as ductile) then the weld shall be classified as a failed weld. It shall also be classified as a failed weld if the nature of the brittleness extends over more than 50% of the surface of the weld area tested.

5A.2.18.8 ***Supply of records to Waipa District Council***

(a) Any welds that are made without the required documentation being supplied to Council will be classified as failures and will have to be redone.

(b) All welding machines used shall have automatic logging facilities incorporated in them. As a minimum these shall record the following:

(i) Pipeline a location (accurate enough so that the weld location can be determined to 61m).

(ii) Weld number.

(iii) Weld date.

(iv) Welder ID number.

(v) Pipe Size.

(vi) Pipe SDR.

(vii) Wall thickness (e).

(viii) Annular area (A).

(ix) Cylinder area (a).

(x) Fusion Pressure (P).

(xi) Plate temperature (T).

(xii) Drag pressure (D).

(xiii) Bead pressure (P).

(xiv) Soak pressure (P).

(xv) Soak time (T).

(xvi) Changeover Time T3 – refer Auspoly POP 003 recommended parameters.

(xvii) Time to achieve welding pressure (Ramping Pressure Time) – T4 – refer Auspoly POP 003 recommended parameters.

(xviii) Weld pressure 1.

(xix) Cooling time 1.

(xx) Weld pressure 2 (if applicable).

(xxi) Cooling time 1 (if applicable).

(c) The results shall be given in tabular form. Graphical results are not acceptable.

5A.2.19 Commissioning of pumps

5A.2.19.1 This will involve but not be limited to the following:

(a) All tests and checks required for provision of a certificate of completion and fitness for use of the electrical installation by a registered electrician.

(b) Receipt of factory test certificate for the pumps.

(c) Ensuring all machines are clear of all debris and tools.

(d) Testing of equipment duty and performance.

(e) Operation of each piece of equipment singly and in their possible combinations to confirm system and component performance.

(f) Checking signal from all level control equipment to ensure safe operation and to ensure machines will not run dry.

(g) Vibrational checks.

(h) Ensuring that all overload systems are functioning.

(i) Running on automatic and turning mains off, then on, to test reset system.

(j) Setting to work in the normal automatic operational mode after the tests have been completed.

(k) Where any of the above fail to satisfy the requirements of the specification or Council, correct the defect and retest.

(l) Oversee operation and carry out adjustments, as necessary, throughout the defects liability period.

5A.2.19.2 ***Commissioning of electrical equipment***

(a) *General*

(i) Council shall be given the opportunity to be present at inspections and tests.

(ii) Responsibility for the commissioning shall belong to the Contractor who shall provide all labour, tools and instruments as required by Council.

(iii) Scope of the commissioning shall be to prove:

- Compliance with all statutory and design requirements.
- Safe and proper working of the installation in all respects.

(iv) Notice of tests shall be given to Council a minimum of 24 hours in advance of commission agreed to earlier in the contract period.

(b) *Commissioning Procedures*

(i) Commissioning procedures shall be in accordance with the following stages unless instructed otherwise by Council:

- Visual inspection at all construction stages.
- Static insulation tests of wiring and equipment.
- Checking and setting of all protection devices and safety interlocks.
- Setting installation to work, checking operations, taking readings and recording results.
- Completing all test sheets and including a copy with the As-built figures.
- All indications of outstation values at the Base Station Computer shall truly reflect those actual values and conditions occurring at the Outstation.

(c) *Acceptance*

(i) Acceptance of the completed installation will not be considered until satisfactory completion of all testing and commissioning, submission of approved test and commissioning results, including draft As-built figures and equipment manufacturer’s documentation.

(d) *Test Sheet Blanks*

(i) Test sheet blanks are included as information required. (Refer Checklist 5A.1).

5A.2.19.3 *Testing and commissioning of the control systems*

(a) This will involve but not be limited to the following:

(i) Ensure all mechanical, electrical and electronic systems are set to work and are 'on-line' to operate;

(ii) Simulate all level induced control functions;

(iii) Operate all control modes;

(iv) Check all remote control and monitoring functions;

(v) Where any of the above fail to satisfy the requirements of the specification or Council, correct the defect and retest; and

(vi) Oversee operation and carry out adjustments as necessary throughout the defects liability period.

Checklist 5A.1: Electrical Testing Example Sheet

Control Cubicle			
Manufacturer			
Serial No.		Date	
Type		Voltage	
Phases			
Incomer 1 - Rating	A	Setting	A
Incomer 2 - Rating	A	Setting	A
Incomer 3 - Rating	A	Setting	A

Pre-Commissioning Checks

External condition	Clean	Yes/No	Dry	Yes/No		
Internal condition	Clean	Yes/No	Dry	Yes/No		

Bus bar bolts torque tested	Yes/No
Main earth satisfactory	Yes/No
Wiring supported	Yes/No
Insulation resistance satisfactory	Yes/No
Phase rotation correct	Yes/No

Tests – Insulation resistance – Incomer Open – Circuit Switches Closed

Test	R-Y MΩ	Y-B MΩ	B-R MΩ	R-E MΩ	Y-E MΩ	B-E MΩ	Earth MΩ
Date:							
Date:							

Any Other Comments:

Part 5A – Section 3: Works Completion and Clearance

5A.3.1 As-built plans

5A.3.1.1 Upon completion of construction work, copies of "As-Built" plans and data recording information about the completed works, as listed in Table 44: Asset component types shall be provided to the Waipa District Council. Separate plans are required for wastewater, stormwater and water supply. Responsibility for providing the plans and associated data shall lie with:

(a) The Developer, in the case of land development (urban and industrial sub-division).

(b) The Contractor, in the case of works constructed for Council under contract to Council.

5A.3.1.2 Plans presented in fulfilment of this requirement shall be shown as "As-Built" in the amendments part of the figure title block and signed-off as 'approved for issue' by a person having responsibility for the quality assurance aspect of the as-built information.

5A.3.1.3 As-built plans and associated data shall be sent to:

(a) In the case of sub-divisions:

The Manager **Development Engineering** **Private Bag 2402** **Te Awamutu 3840**

(b) Include the Council Subdivision Consent Number, subdivision name and stage number

(c) In the case of Council contracts, send to the Engineer for forwarding to the appropriate Council Asset Manager.

5A.3.2 Data presentation formats

5A.3.2.1 The as-built data is required in 3 formats:

(a) Conventional hard copy plans using line formats as indicated in Volume 1, Part 2, Section 2, figure sheet size A3 and plan scale 1:500 preferred.

(b) Electronic Microsoft Excel spread sheets listing various attributes of the assets constructed - refer blank template files accessed from the Table of Contents page of this Part.

(c) Where as-built plans are prepared using computer aided design software, DXF format export files of the hard copy plans are required. The specification for the format is laid out in Volume 4: Appendix 7.

5A.3.2.2 Hard copy plans are used in updating Council's records. The DXF format files facilitate data upload to the GIS.

5A.3.2.3 The spread sheet lists of asset data facilitate data upload to the asset information database. This database is used to manage asset condition information, as well as recording dimension and materials information.

5A.3.3 Asset values

5A.3.3.1 This requirement has been suspended pending review. Refer to Volume 4, Part 9, Appendix 8.

5A.3.4 Datum's and units of measurement

5A.3.4.1 Only metric units are to be used in as-built data. Principally these are millimetres *(mm)*, meters *(m),* litres/sec *(L/s),* cubic meters /day *(m^3/day)*. All levels are to be in terms of Moturiki Datum and to 2 decimal places.

5A.3.4.2 Geographic coordinates shall be:

(a) New Zealand Geodetic Datum 2000 (NZGD2000).

5A.3.4.3 Coordinates should be presented in standard 6 digit format to 2 decimal places, e.g. 305718.97, 643728.35.

5A.3.5 Asset component types and as-built data requirements

5A.3.5.1 As-built data shall be accompanied by the following list of project specific data:

(a) Works construction contractor.

(b) Project name or subdivision name (including subdivision stage number).

(c) Waipa District Council contract number (Council projects).

(d) Waipa District Council project ledger code (Council projects).

(e) Name of person responsible for preparing the as-built data.

(f) Date of preparing the as-built data.

5A.3.5.2 The following list of asset specific data shall be supplied and shown on the figures.

Advice Note: Occasionally privately owned assets need to be shown on as-built plans; such assets shall be clearly labelled 'Private ...*'name and details of asset'*

Table 44: Asset component types

Asset Component Type	Asset Attribute Required	Shown on plans	Comment
Pump Station General	Plan ID	Yes	Plan number used to identify as-built plan
	Street name	Yes	If street name is not applicable, use a property deposited plan (DP) number
	Street type	Yes	Qualifier to street name, e.g. Crescent, Road, Lane, etc.

Asset Component Type	Asset Attribute Required	Shown on plans	Comment
	Pump Station Lot Location	Yes	Show the pump station Lot boundary and surround lots and roads, including the access way up to the Pump Station
	Maximum design flow rates		
	Design ADWF		ADWF average dry weather flow
	Design PWWF		PWWF peak wet weather flow
Pump Station Wet Well	Location	Yes	Show on a separate pump station site layout plan & cross-section plan at suitable scale
	Rising main discharge point	Yes	Manhole ID
	Rising main diameter	Yes	The rising main should appear as an item on the schedule of wastewater pipelines
	Overflow discharges to	Yes	Refer to the ID of the overflow pipe which should appear as an item on the schedule of wastewater pipelines
	Overflow level	Yes	RL at which overflow begins
	Length	Yes	Internal length dimension of wet well
	Width	Yes	Internal width dimension of wet well
	Diameter	Yes	Internal diameter of wet well (circular wet wells)
	Floor Elevation	Yes	Invert level of chamber
	Ground Elevation	Yes	RL of wet well access covers
	Inlet diameter	Yes	Repeat for each inlet
	Inlet elevation	Yes	Repeat for each inlet
	Asset Value		Refer Clause 5A.3.3 of this section
	Comments		Any pertinent comments (particularly water table depth and soil conditions)
Storage Chamber	Location	Yes	Show on a separate pump station site layout plan & cross section plan at suitable scale
	Length	Yes	Internal length dimension of chamber
	Width	Yes	Internal width dimension of chamber
	Diameter	Yes	Internal diameter of chamber (circular chambers)
	Floor Elevation	Yes	Invert level of chamber
	Ground Elevation	Yes	RL of storage chamber access covers
	Inlet diameter	Yes	Repeat for each inlet
	Inlet elevation	Yes	Repeat for each inlet
	Asset Value		Refer Clause 5A.3.3 of this section
	Comments		Any pertinent comments (particularly water table depth and soil conditions)
Valve Chamber	Location	Yes	Show on a separate pump station site layout

Asset Component Type	Asset Attribute Required	Shown on plans	Comment
			plan & cross section plan at suitable scale
	Water supply backflow prevention device	Yes	Make & Model
	Rising Main Check Valve	Yes	Nominal Bore - Repeat for each valve
	Rising Main Isolation Valve	Yes	Nominal Bore - Repeat for each valve
	Asset Value		Refer Clause 5A.3.3 of this section - Repeat for each valve
	Comments		Any pertinent comments
Bio Filter	Location	Yes	Show on a pump station site layout plan
	Length	Yes	Internal length dimension of chamber
	Width	Yes	Internal width dimension of chamber
	Inlet diameter	Yes	Repeat for each inlet
	Inlet elevation	Yes	Repeat for each inlet
	Asset Valve		Refer Clause 5A.3.3 of this section
	Comments		Any pertinent comments relating to the type of bio filter media used
Magflow Meter	Location	Yes	Show on a pump station site layout plan
	Manufacturer		
	Model Number		
	Magflow Serial number		
	Asset Value		
Pumps	Manufacturer		
(repeat for each pump)	Model Number		
	Performance Curve ID		
	Motor Serial Number		
	Motor Current Rating		Nameplate current in amps
	Motor Power Rating		Nameplate power rating in kW
	Asset Value		Refer Clause 5A.3.3 of this section - Repeat for each valve
	Comments		Any pertinent comments (particularly water table depth and soil conditions)
Level Controls	Manufacturer		
	Model Identification		
	Backup battery type		
	Start level		Repeat for each pump
	Stop level		Repeat for each pump

Asset Component Type	Asset Attribute Required	Shown on plans	Comment
	High alarm level		
	Low alarm level		
	Overflow alarm level		
	Asset Value		Refer Clause 5A.3.3 of this section - lump sum for whole level control system
	Comments		Any pertinent comments
Electrical Cabinet	Location	Yes	Show on a pump station site layout plan
	Pump Overload Setting		Repeat for each pump
	Pump Contactor Type		Repeat for each pump
	Pump Starter Type		Repeat for each pump
	Asset Value		Refer Clause 5A.3.3 of this section - lump sum for electrical cabinet
	Comments		Any pertinent comments
Telemetry	RT Brand		
	RT Model		
	Aerial Type		
	Module Model		
	Asset Value		Refer Clause 5A.3.3 of this section - lump sum for telemetry
	Comments		Any pertinent comments

5A.3.6 Threshold matrix for as-built data

5A.3.6.1 For small developments the provision of separate as-built plans for each service, separate data sheets and DXF data is not justified. Therefore the following matrix has been developed to guide when each type of data presentation is required. If the data presented is not clear, Council may request additional information.

Table 45: Threshold matrix for as-built data

	Small Development (2 – 5 lots)	Medium development (5 - 10 lots)	Large development (10+ lots)	Contract
Separate plans for each service	No	Not required if adequate clarity is possible on same plan	Yes	As per large development or contract documents
DXF data	No	Please supply if available	Yes	As above
Separate data spread sheets	No, include information on	WW or SW if >2 manholes or 10 lots	Yes	As above

	Small Development (2 – 5 lots)	**Medium development (5 - 10 lots)**	**Large development (10+ lots)**	**Contract**
		Water if more than 5 hydrants or valves.		
GST invoice on vesting	Yes	Yes	Yes	As above
Plan size	A3	A3	A3	As above

5A.3.6.2 As-built figures must be scalable. Refer to Volume 1, Part 2, Clause 2.4.3.

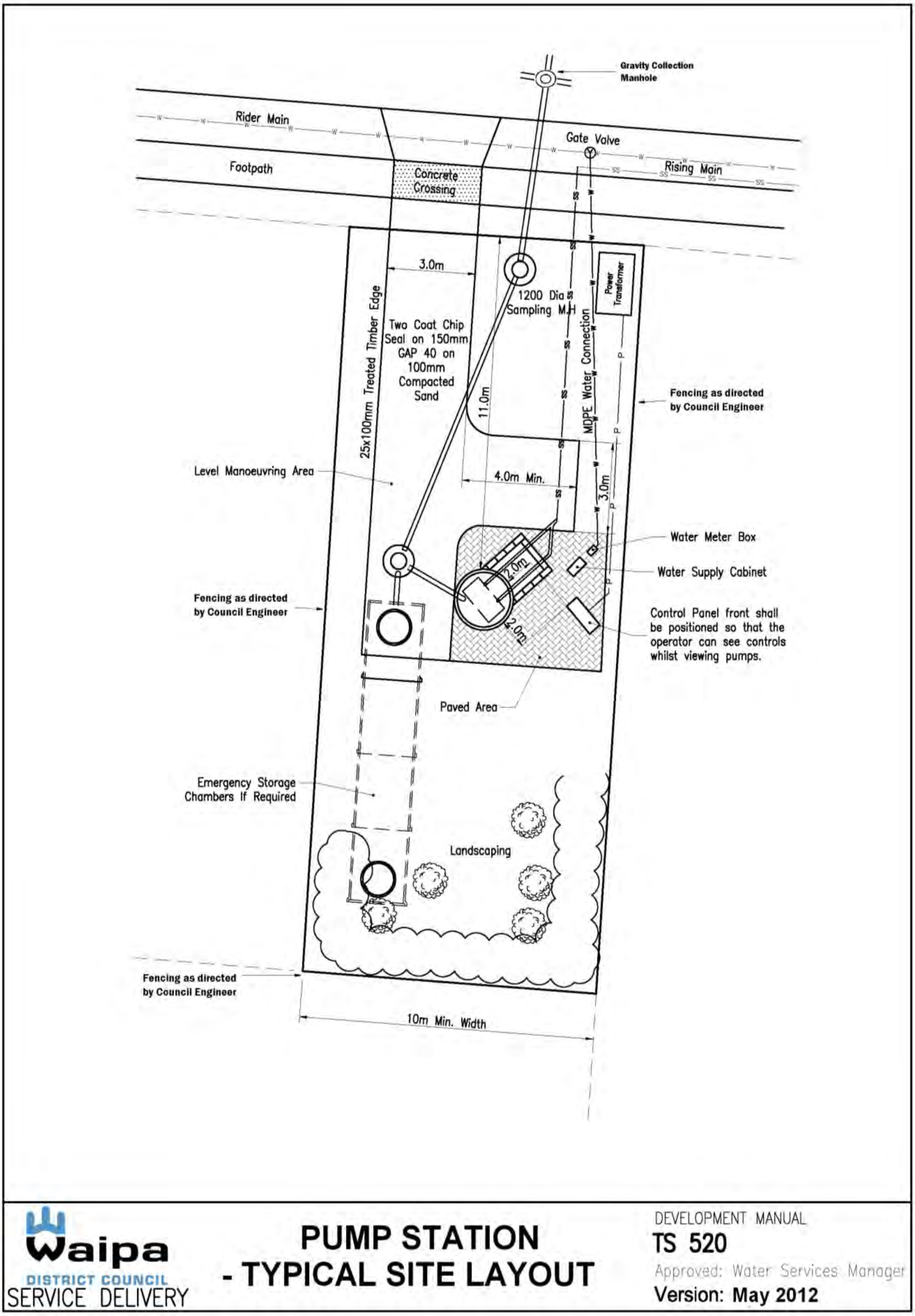


Figure 118: TS 520 Pump station - typical site layout

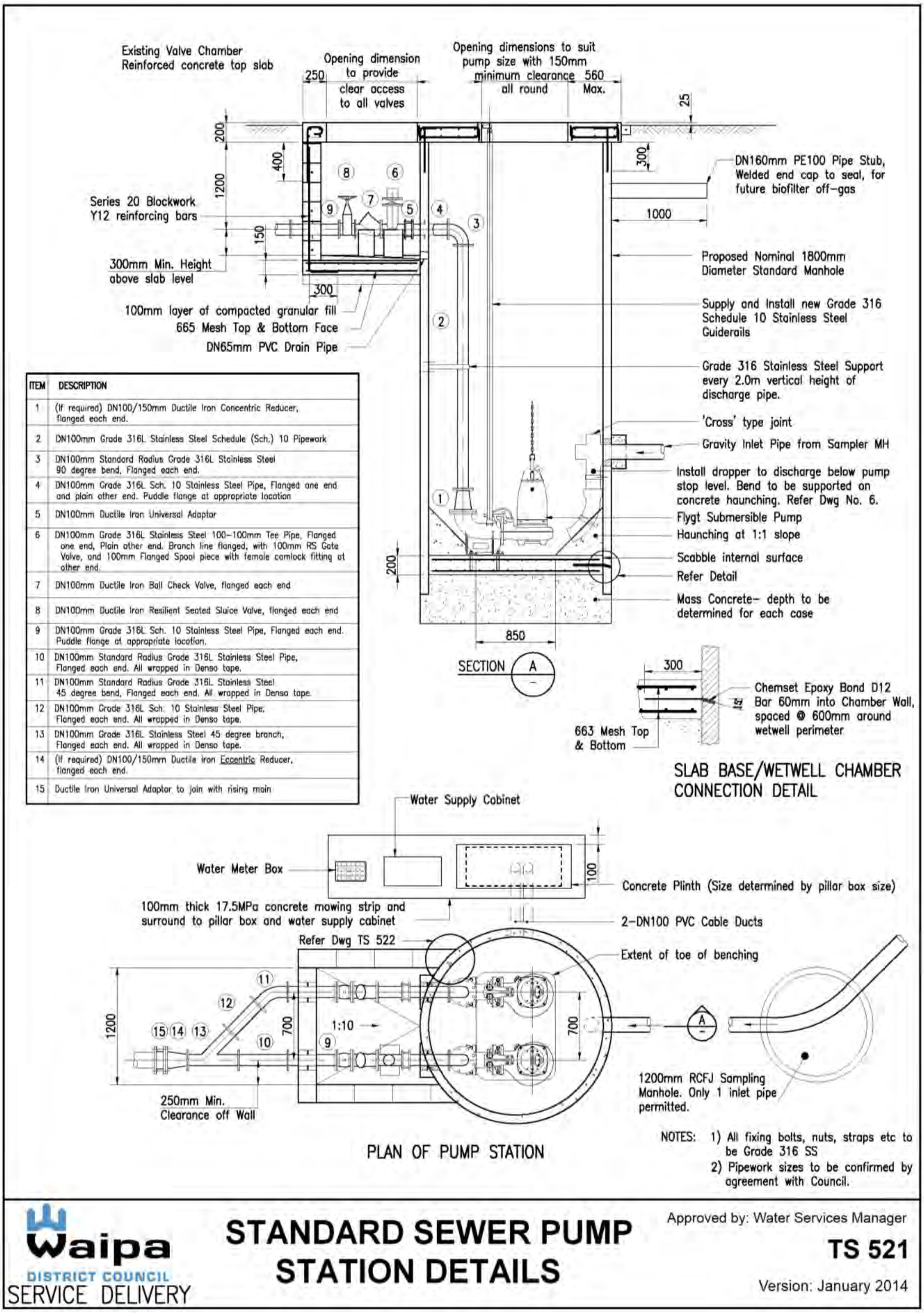


Figure 119: TS 521 Standard sewer pump station details

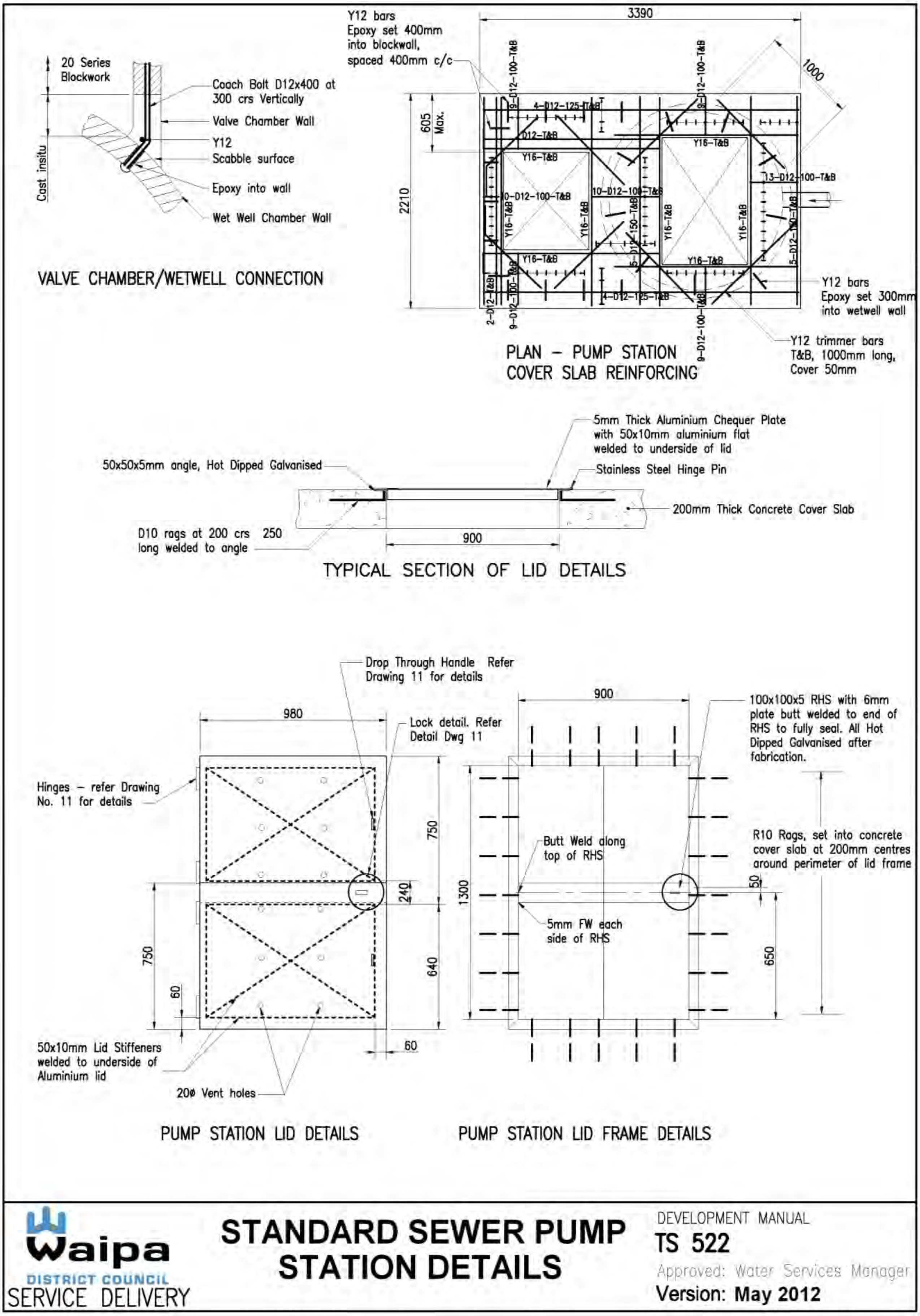


Figure 120: TS 522 Standard sewer pump station details

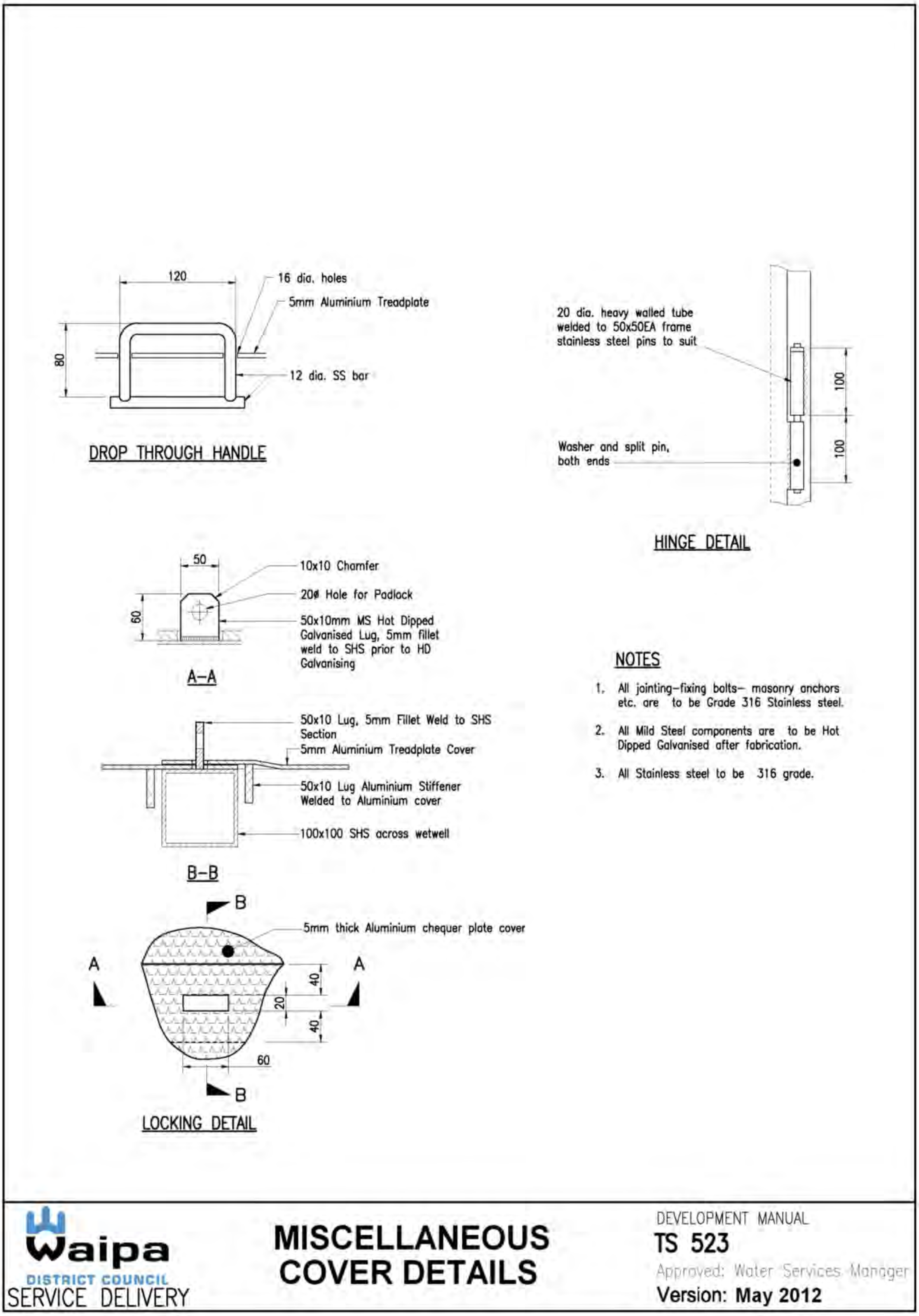


Figure 121: TS 523 Miscellaneous cover details

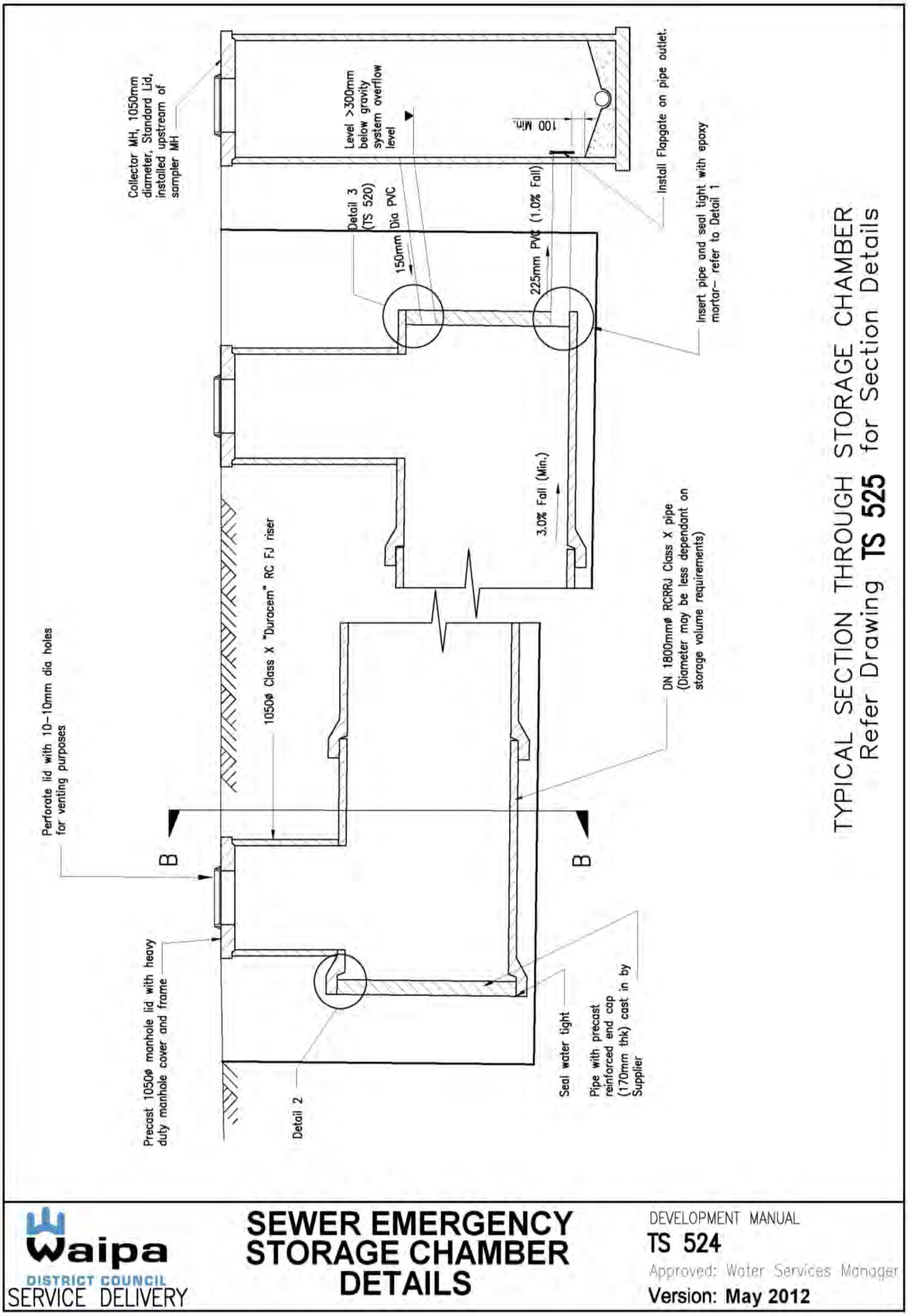


Figure 122: TS 524 Sewer emergency storage chamber details

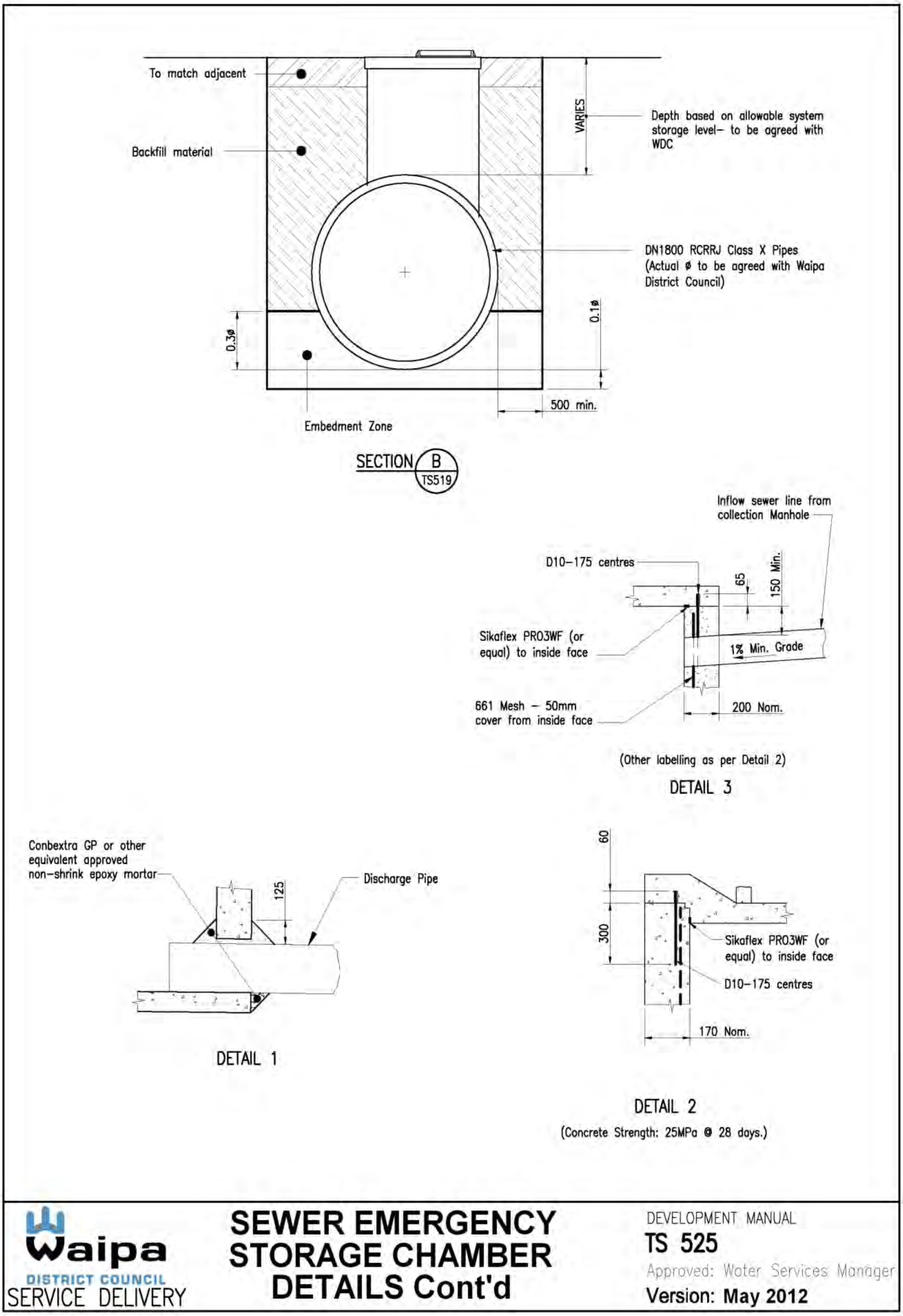


Figure 123: TS 525 Sewer emergency storage chamber details continued

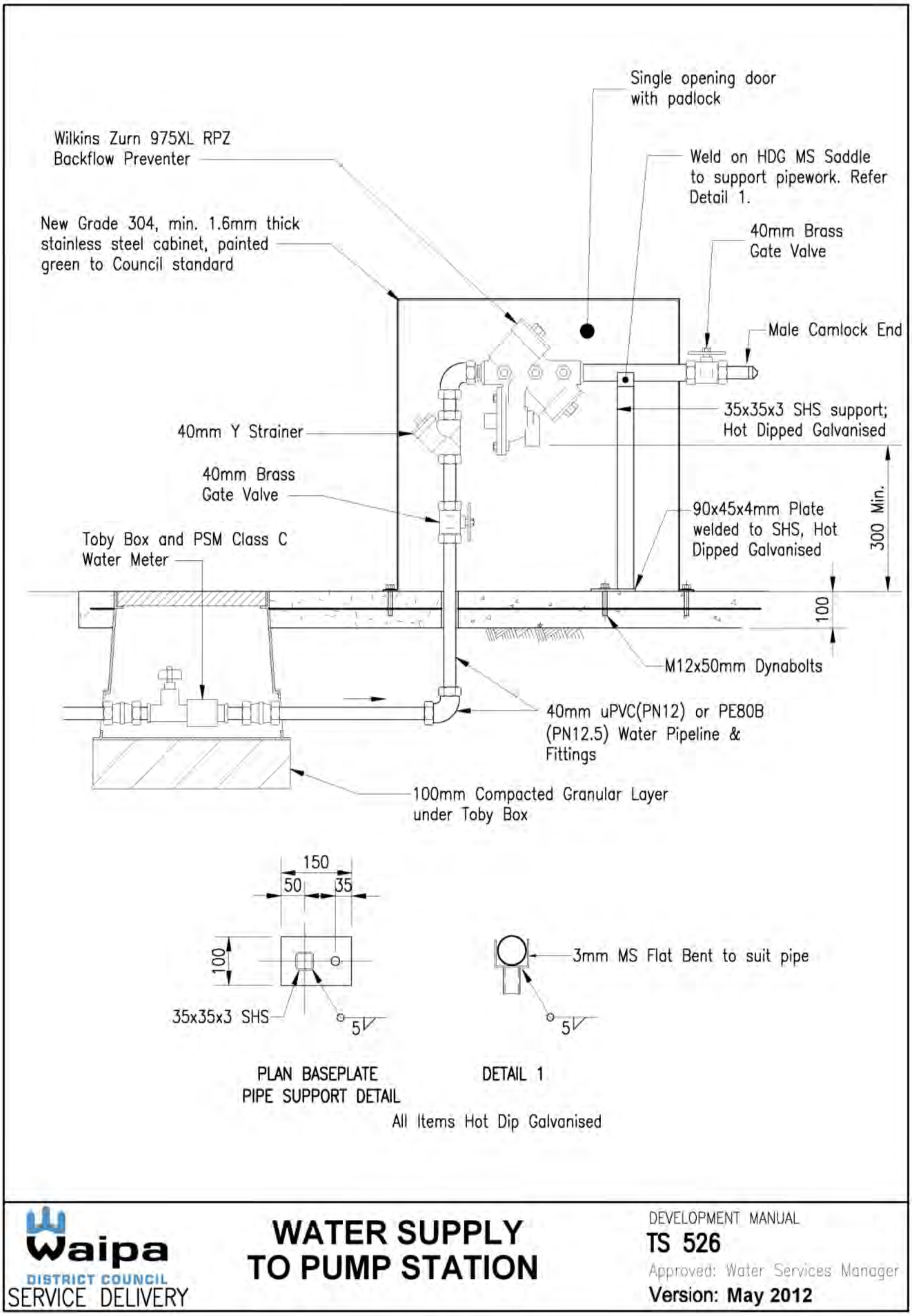


Figure 124: TS 526 Water supply to pump station

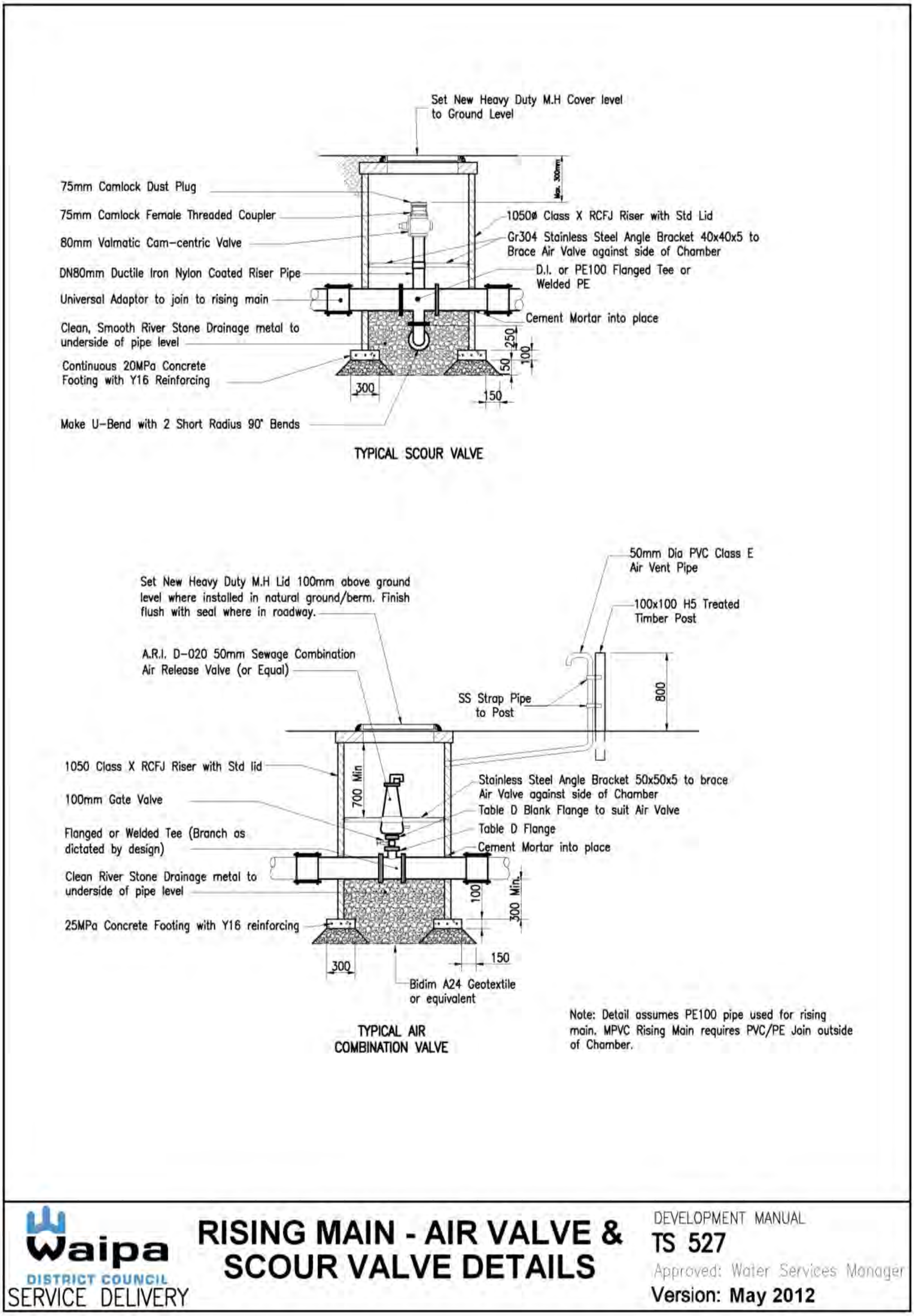


Figure 125: TS 527 Rising main - air valve and scour valve details

Part 6: Water Supply

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Standard Figures

Part 6 – Section 1: Acceptable Fittings and Materials

6.1.1 Scope

6.1.1.1 This specification covers the list of materials and fittings acceptable for use within the Council water supply network, and *covers* materials or fittings that Council has, or will, assume responsibility for. Fittings not in accordance with this list will be rejected, by Council unless written approval is given prior to installation. Rejected products and materials will be subject to removal at the contractor or Subdivider's cost.

6.1.1.2 This list of Acceptable Fittings and Materials will be updated in July and December each year or at other times when four or more acceptable products need to be incorporated into the list.

6.1.1.3 All applications to the Acceptable Fittings and Materials list must be accompanied by the pro-forma Volume 4: Quality Checklists & Appendices, Part 9, Appendix 6: Application for Acceptance of Water or Drainage Product for Use in the Council Water Supply Area or Drainage District.

6.1.1.4 Requirements for acceptance of materials are as follows:

(a) Conforms to appropriate New Zealand, Australian or British standards with evidence of the licence number issued.

(b) Manufacturer operates to an acceptable quality assurance standard.

(c) Details of composition, dimensions, specific use and design life are supplied by the manufacturer.

(d) Details of acceptance by other New Zealand local authorities.

(e) Details are supplied by the manufacturer on how the product should be installed.

(f) The product is acceptable to Council (taking into account such factors as compatibility with other approved products, ease of use, etc.).

6.1.1.5 Where there is no standard, the manufacturer will be required to supply copies of their quality assurance procedures and producer statements to support their performance and composition claims for the products concerned.

6.1.1.6 Completed applications and supporting information should be addressed to:

The Manager
Water Services
Waipa District Council
Private Bag 2402
Te Awamutu 3840

6.1.1.7 Council reserves the right to refuse any material or fitting from the Acceptable Fittings and Materials list for any reason and at any time. In such circumstances, Council will provide written notification, stating reasons why the material or fitting has been refused or removed from the Acceptable Fittings and Materials list.

6.1.2 Pipe materials

Table 46: Water Supply Pipe Fittings

Pipe Materials	Manufacturer/Product ID
WATERMAINS 300MM AND LARGER	
Materials for large diameter pipelines will be specifically approved and or specified by Waipa DC. The specification shown below for spiral-welded pipe, ductile iron pipe PVC-O and mPVC are indicative of what is likely to be approved. HDPE - PE100, PN16, SDR11	Steelpipe NZ Ltd Iplex (Licence #SMKP 20882) Pentair Marley
WATERMAINS 250MM DIAMETER	
286mm cement lined spiral welded pipe; 3.2mm wall thickness, rubber ring joints and Polyken YG 111 external wrapping or "Speed Steel" with polyethylene coatings to NZS 4442:1988 or AS 1579:2001.	Steelpipe NZ Ltd Iplex (Licence #SMKP20882)
286mm OD Biaxially Orientated PVC (oPVC) Series 2, PN 12.5, Design Material Class 355, conforming to AS/NZS 4441:2008.	
286.0mm Class K9 ductile iron, light cement lined with Tyton joints. External protection with greensleeve. Manufactured to AS/NZS 2280:2004 and amendments.	Tubemakers, Australia (as supplied by Humes (Licence #2280))
250mm Class PN12 mPVC RRJ coloured blue with compatible outside diameters to asbestos cement, ductile iron and spiral welded steel. Manufactured to AS/NZS 4765:2007 Series 2.	Iplex (Licence #SMK02570) Marley Genex Blue (Licence #2624) KeyplasMetro (Licence #2542)
TYTON EXCEL PN20 & PN35 Cement lined Ductile Iron Pipe with TYTON JOINT elastomeric seals and socket/spigot joints (with blue polyethylene sleeving). Manufactured to AS/NZS 2280:2004 and amendments.	Tyco Tyton Excel (Licence #SMK0883)
WATERMAINS 150MM & 200MM DIAMETER	
Class PN12, mPVC, RRJ, coloured blue with compatible outside diameters to asbestos cement, ductile iron and spiral welded steel. Manufactured to AS/NZS4765:2007 Series 2 (Licence #2624).	Iplex (Licence#SMK2570) MarleyGenex Blue KeyplasMetro Blue (Licence #2542)
121.9mm OD 177.4mm OD 232.2mm OD Biaxially Oriented PVC (oPVC) Series 2, PN 12.5, Design Material Class 356, conforming to AS/NZS 4441:2008.	Iplex (Licence #SMK20882)
177.3mm cement lined spiral welded pipe, 232.2mm cement lined spiral welded pipe, 3.2mm wall thickness, rubber ring joints and Polyken YG111 external wrapping or “Speed Steel” with polyethylene coatings.	Steelpipe NZ Ltd
177.3mm light cement lined manufactured Class K9 ductile iron, 232.3mm light cement lined manufactured Class K9 ductile iron Tyton joints with external protection with greensleeve.	Humes – Tubemakers, Australia (Licence #2029)

Pipe Materials	Manufacturer/Product ID
TYTON EXCEL PN20 & PN35 Cement lined Ductile Iron Pipe with TYTON JOINT elastomeric seals and socket/spigot joints (with blue polyethylene sleeving). Manufactured to AS/NZS 2280:2004 and amendments.	Tyco Tyton Excel (Licence #SMK0883)
RIDERMAINS 63MM OD	
63mm OD MDPE PE80B, PN125, SDR 11 blue or blue strip) pipe manufactured to AS/NZS 4130:2009 and amendments.	Iplex Blue Line (coloured)(Licence #SMKP20400) Marley Pushlok Pipe (Licence #2639) RX Plastics (Licence #002)
SERVICE LINES	
25mm, 32mm, 63mm OD MDPE PE80B, PN125, SDR11 (coloured blue or blue stripe) manufactured to AS/NZS 4130:2009 and amendments.	Iplex Blue Line (coloured)(Licence #SMK P20400) Marley Pushlok Pipe (Licence #2639) RX Plastics (Licence #002)
NOTE: mPVC or oPVC will be used for service lines requiring a larger flow capacity than that provided by 63mm OD MDPE pipe.	
Seal Rings Seal rings to comply with AS 1646 : 2007: Elastomeric seals for waterworks purposes.	
FITTINGS	
Reticulation	
Cast iron pipe flanged, socket and spigot fittings to AS 2129:2000 with flanges to Table D and coated to AS/NZS 4158:2003 and amendments. Rated at PN16 or higher.	Gillies
Ductile iron pipe flanged, socket and spigot fittings to AS/NZS 2280:2004 with flanges to Table D, or raised, faced and drilled to AS/NZS 4087:2011 and coated to AS/NZS 4158:2003 and amendments.	Crevet Griptite (Licence #943 & 950) Humes (Licence #2029) Surecast Tyco TYTON JOINT (Licence # PRD/r61/0412/1)
Stand Alone Flanges to Table D PVC; Ductile or Cast iron coated to AS/NZS 4158:2003 & amendments.	Iplex PVC Marley PVC Uniflange Adaptor DI (as supplied by Steel & Tube NZ Ltd)
Bolts, nuts and washers to be hot dipped galvanised with minimum of 15mm diameter in accordance with AS 1111.1:2000 “ISO Metric Hexagon Commercial Bolts and Screws” and AS1112.1:2000 “ISO Metric Hexagon Nuts, including Thin Nuts, Slotted Nuts and Castle Nuts”. Stainless steel bolts, nuts and washers are acceptable alternatives to hot dip galvanised fastenings provided they are 316 grade stainless steel with factory applied molybond coating.	Ajax
Gibaults	
Cast coated in accordance with ASNZS 4158:2003 & amendments and hot dipped galvanised bolts as per above. Gunmetal DR LG2 with ABS belly. M16 316 stainless steel, with clips fusion coated to	Gillies Viking Johnson Ltd – Maxifit (with Sheraplex coated bolts) Crevet Milnes Pty Ltd

Pipe Materials	Manufacturer/Product ID
AS/NZS4158:2003 and 316 stainless steel fasteners.	Tyco Vari-Big
MDPE Fittings	Durafuse (Licence #9603049) Iplex Plasson (Licence #2018) Marley-Philmac (Licence #1271) Marley-Push -Lok (Licence #1494) Plasson (Licence # 1494 & 1271) Plastic Systems – Alprene A16 Easygrip (Licence # 1157) PPI Corporation – GF + Compression Fittings (Licence # 1157)
Brass Fittings	McKechnie Metals Methven
SERVICE CONNECTIONS	
MDPE Fittings	Durafuse (Licence #9603049) Iplex – Plasson (Licence #2018) Marley-Philmac (Licence #1271) Marley-Pushlok -Lok(Licence #1494) Plasson (Licence # 1494 & 1271) Plastic Systems – Alprene A16 Easygrip (Licence # 1157) PPI Corporation – GF + Compression Fittings (Licence # 1157)
Manifold	RMC 20mm manifold
Ferrules Gunmetal with polyethylene fittings	Keyplas Milnes - Self Tapping (Licence # 1281) Talbot & Co Ltd - Self Tapping TB0020ST - Standard TB0019
VALVES	
Gate Valves for Reticulation Resilient Seated – manufactured to AS/NZS 2638.2:2011, clockwise closing with Teflon gland packing or 2 or more “0” ring seals and dust cover. External and internal protective coating to AS/NZS 4158:2003 & amendments. Rated at PN16. Flanges to be raised face and drilled to AS/NZS 4087:2011.	AVK Series 55 & 57 valves (Licence SAI #2420 & 2573) Gillies SF Series Tyco Figure 500 Series (Licence # PRD/R61/0412/2) Crevet Ltd Norcast (Licence # 1327) Hawle 4060E2 and 4500E2AS Series (Licence # SMKP20123).
Stop Taps 15, 20, 25, 40 & 50mm Gate valves. AS/NZS 2638:2011, clockwise closing with Dezincification resistant materials or LG2 gunmetal to BS 5154:1991 or AS 1628:1999 and amendments with Malleable (cast) iron T bar handles. PN16 or higher.	Kitz Fig AS-H (with handle retaining nut changed to DR type) (Licence #2054) Tour Andersson Series 64 MT DZR brass gate valve (Licence #0772) Maxiflo A59m JY-Zas gate valve (Licence #2766)

Pipe Materials	Manufacturer/Product ID
FIRE HYDRANTS	
Fire Hydrant Tall (median allowed on existing mains) pattern screw down standard with approved polyurethane cup washer. Pure PTFE gland packing (see below) or "0" ring sealing system and coated AS/NZS 4158:2003 & amendments. To be rated PN16 or higher. Teflon gland packing or 2 or more "0" ring seals and dust cover. External and internal protective coating to AS/NZS 4158:2003 & amendments. Rated at PN16. Flanges to be raised face and drilled to AS/NZS 4087:2011.	Crevet – Hydravalve Gillies AVK Series 29 Hydrant Tyco F502 Series
TAPPING BANDS & SADDLES Standards Australia MP 52- 2001 – 'Manual of Authorisation Procedures for Plumbing and Drainage Products', Chapter 6, Licence Specifications, Section 6.25 Specification number 025 – Tapping bands.	
40mm-80mm diameter	
LG2 gunmetal DR type – fully enclosed.	Milnes Pty Ltd (Licence #W134)
Glass filled NORYL two part moulded with stainless steel bolts.	"4N", Stockbrands, Ace Plastics (Licence #149588 A & B)
100mm-250mm diameter	
LG2 gunmetal DR type. Fully enclosed for mPVC, blue brute, superblue, cast iron and spiral steel (AC sizing). Swivel bolt Type with a flexible band for existing AC watermain.	Milnes Pty Ltd – Series 60B Milnes Pty Ltd - Series 61 Maintenance Milnes Pty Ltd Insulated type for ducile, cast or steel mains (Licence # W134)
Glass filled NORYL two part moulded with stainless steel bolts.	"4N", Stockbrands, Ace Plastics (Licence #149588 A & B)
WATER METERS	
Manufactured to OIML R49 – 'Water Meters intended for the meter of cold potable water' with Class C measuring accuracy. All meter installations, 50mm and above, are subject to specific approval by Council. Suppliers listed on the Acceptable Fittings & Materials list will be contacted to assist in selecting a meter which is fit for purpose (e.g. Class B or C or combination meter).	Actaris Meter Systems Actaris TD8 Class C water meter (20, 25, 32mm) Actaris Flostar M Class C water meter (50 to 150mm) Actaris Aquadis + Class C Co-Axial Qn 1.5 water meter AD Riley Ltd Elster Kent PSMT-T Class C in-line water meter (20 to 40mm) Elster Kent MSM (Qn 1.5) Class C coaxial water meter. Sensus 620 (20 to 40mm) meter (50 to 100mm) Meinecke WP-IR, PN16 watermeters >100mm where private fire hydrants are required Sappel Altair Volumetric 4.
BACKFLOW PREVENTION DEVICES	
Devices manufactured to satisfy the NZWWA publication	Wilkins 705 non-testable dual check valve (20 and

Pipe Materials	Manufacturer/Product ID
'Backflow Prevention for Drinking Water Suppliers Code of Practice'. AS 2845.1:2010 "Water Supply – Backflow prevention Devices Materials, Design and Performance Requirements', or; ASSE Standards (American Society of Sanitary Engineers Standards). Non-Testable dual check – low risk. Testable double check devices – medium risk. Testable Reduced Pressure Zone Device – **high risk**	25mm) **Taylors Transmark FCX** FEBCO Series 510 non-testable dual check valves (20 and 25mm) Wilkins 350 testable double check valve (20 to 300mm) **Taylors Transmark FCX** FEBCO MasterSeries 850 testable double check valve (20 to 250mm) **Tyco Flow Control** Tyco DC03 testable double check valve (20 to 150mm). Wilkins 375 testable reduced pressure zone valve (20 to 300mm) **Taylors Transmark FCX** FEVCO MasterSeries 860 testable reduced pressure zone valve (20 to 250mm) **Tyco Flow Control** Tyco RP03 testable reduced pressure zone valve (20 to 150mm)
VALVE, FIRE HYDRANT, METER BOXES, PACKERS AND VALVE MARKET PLATE	
Cast iron to Standard Figures TS601, TS607-612 and TS620-621. Polypropylene or polyethylene meter boxes with blue lids and embossed with the word 'meter'. **NOTE:** Only cast iron meter boxes may be used in driveways or carriageways.	**Hygrade Products Ltd** (except TS601) Surecast **Acuflo Industries Ltd** Acuflo polypropylene (AMB and AMBT Series) **Draper Enterprises Ltd** Draper polyethylene water meter boxes and lids (DRA40/2 Reverse Taper Tall)
CONCRETE PRODUCTS	
Fire Hydrant Concrete Surrounds - to Standard Figures TS613, 617 & 618.	Humes Pipelines Hynds Pipelines Newstead Concrete Products
Valve Concrete Surrounds - to Standard Figures TS614 & 616.	Humes Pipelines Hynds Pipelines Newstead Concrete Products
WOODEN PRODUCTS	
Wooden Valve Post - to Standard Figures DCS 601.	
TOBY BOXES	
Cast iron or Aluminium with a hinged lid and 150mm square concrete surround.	Hygrade Products Ltd Surecast

Part 6 – Section 2: Installation of Steel Pipelines

6.2.1 Introduction

6.2.1.1 All water main pipe laying and associated fitting installation shall only be carried out by a qualified Water Service Person holding the qualification of National Certificate in Water Reticulation.

6.2.2 Scope

6.2.2.1 This specification covers the laying of concrete lined spiral steel (CLSS) pipes for use within the Council Water Reticulation network and is to be read in conjunction with the following documents:

(a) Figures pertaining to the main to be laid (including service figures).

(b) Manufacturer's instructions for the handling, storage and laying of the pipe being used.

6.2.3 Materials

6.2.3.1 Acceptable materials are listed in Section 1 of this Specification.

6.2.4 Handling and storage

6.2.4.1 Procedures for the handling and storage of pipes (and pipe fittings) shall be as recommended by the pipe manufacturer.

6.2.4.2 Notwithstanding the above, the following shall apply:

(a) No hooks, wire slings or chains shall be used to lift the pipes.

(b) Pipes larger than 450mm in diameter shall not be stacked more than two pipes high.

(c) Defects in the lining or coating shall be repaired to the satisfaction of Council.

6.2.5 Pipe laying

6.2.5.1 ***Trench excavation***

(a) Trench widths in the region of the pipe invert to just above the top of the pipe shall be kept to a minimum consistent with good practice and safety to workers.

6.2.5.2 ***Bedding***

(a) Water main pipes shall be bedded on suitably fine, evenly-graded granular material, either natural or imported, of a minimum depth of 100mm.

6.2.5.3 ***Laying of pipes and fittings***

(a) Pipes shall be laid in accordance with the approved pipe manufacturers specifications.

(b) Pipes and fittings shall be free of defects (internally & externally) and dirt on the inside, prior to lowering them into the excavation. Pipes shall be set true to line and level and care taken to ensure that joints are kept free from dirt.

(c) Pipes shall be laid with product labelling uppermost in the trench.

(d) At any time when the Contractor is not actually working on the pipeline, open pipe ends shall be blanked off in a manner that prevents the ingress of animals and deleterious material.

6.2.5.4 *Backfill and reinstatement*

(a) Backfill material in the vicinity of the pipeline, haunch support, mid-section support and pipe cover, shall be of the same material as approved for the pipe bedding material in Clause 5.2.8 of this Volume. This material shall be compacted optimum density in layers not exceeding 100mm depth. This material shall provide pipe cover to a depth of at least 100mm.

(b) Trenches shall be backfilled and reinstated in accordance with the requirements of Volume 3, Part 3, Section 13.

6.2.6 Jointing

6.2.6.1 *Welded joints*

(a) Welding plant and equipment shall comply with the requirements of AS/NZS 4701:2000 and workmanship shall be in accordance with the latest editions of BS 499 Part 1:2009 & Part 2C:1999 and BS 2971:1991.

(b) All welding shall be carried out by fully certificated welders.

(c) Where access to the inside of the joint is feasible, then both this and the external joint shall be fully welded with 6mm fillet welds using standard welding bands.

(d) Once completed, all welds shall be hydrostatically tested to 100m head for 30 mins with no drop in test pressure or visible leakage. Completed welds shall be signed off on a suitable weld test sheet.

6.2.6.2 *Rubber ring joints (where applicable)*

(a) The joint shall be made in accordance with the manufacturer's recommendation and inspected internally (where feasible). All joints should be inspected externally to ensure that the rubber ring is in the correct position and is located at an even distance from the socket end of the pipe.

6.2.6.3 *Corrosion protection*

(a) On welded joints, the internal welds (where possible) shall be brushed clean and a cement mortar or other approved material applied to the joint to the same thickness as the pipe lining.

(b) The exterior of the pipe shall be completely protected by the manufacturer's applied coating or a heat shrink sleeve (Raychem WPC or similar) to provide corrosion resistance.

Part 6 – Section 3: Installation of PVC Pipes

6.3.1 Introduction

6.3.1.1 All water main pipe laying and associated fitting installation shall only be carried out by a qualified Water Service Person holding the qualification of National Certificate in Water Reticulation.

6.3.2 Scope

6.3.2.1 This specification covers laying of and repairs to the following pipes:

(a) mPVC service connections of varying diameters

(b) 100mm up to 300mm mPVC Principal and Trunk Mains for use within the Waipa District Council water reticulation and is to be read in conjunction with the following documents:

(i) Drawings pertaining to the main to be laid (including service drawings)

(ii) Schedule of fittings required.

(iii) Manufacturer's instructions for the handling, storage and laying of the pipe being used.

(iv) AS/NZS 2566.2:2002 – Buried Flexible Pipelines – Installation.

(v) AS/NZS 2032:2006 – Installation of PVC pipe systems.

6.3.3 Materials

6.3.3.1 Acceptable materials are listed in Section 1 of this Specification.

6.3.4 Pipe laying – installation of PVC pipes

6.3.4.1 To be carried out in accordance with AS/NZS 2032:2006, AS/NZS 2566.2:2002 and Volume 3, Part 6, Section 2, Clause 6.2.5.

6.3.4.2 Pipes shall be laid with product labelling uppermost in the trench.

6.3.5 Thrusting of pipes

6.3.5.1 The term thrusting means boring a hole (by directional drilling or similar) and then carefully inserting the PVC pipe through the hole by hand. Rubber ring joints are not well suited for thrusting, however, the method is approved for short lengths of pipe laying such as to pass under a concreted entranceway. Overly large boreholes do not adequately support PVC pipes so the borehole must be a neat fit to the outside diameter of the pipe (the pipe should be inserted with the spigot-end leading into the borehole). Soil must be cleaned from within the pipe and jointing faces prior to making the joint.

6.3.5.2 RRJ, PVC pipes cannot be jacked, i.e. pushed through the earth with no bore.

6.3.6 Ducting PVC pipes

6.3.6.1 Where a PVC pipe is to be threaded through a duct, Series 2 Solvent Cement Welded Pipes are to be used.

Part 6 – Section 4: Installation of MDPE Pipes

6.4.1 Introduction

6.4.1.1 All water main pipe laying and associated fitting installation shall only be carried out by a qualified Water Service Person holding the qualification of National Certificate in Water Reticulation.

6.4.2 Scope

6.4.2.1 This specification covers laying of and repairs to the following pipes:

(a) PE80B (MDPE) service connections of various diameters; and

(b) DN63 (63mm OD) MDPE rider mains.

6.4.2.2 And is to be read in conjunction with the following documents:

(a) Figures pertaining to the main to be laid (including service figures);

(b) Schedule of fittings required;

(c) Manufacturer's instructions for the handling, storage and laying of the pipe being used; and

(d) AS/NZS 2566.2:2002 Buried Flexible pipelines – Installation.

6.4.3 Materials

6.4.3.1 Acceptable materials are listed in Section 1 of this Specification.

6.4.4 Installation of MDPE pipes

6.4.4.1 To be done in accordance with AS/NZS 2566.2:2002 and Clause 6.2.5 of Section 2 of this Specification.

6.4.5 Ducting of rider mains

6.4.5.1 Should Council elect to thread a rider main through an abandoned pipeline, then the following shall apply:

(a) Suitable excavations shall be made along the length of the main to allow threading of the new pipe without distorting or stressing it;

(b) At each service connection, a section of the existing main shall be removed to allow the service connection to be made. The open ends of the existing main shall be blocked with concrete on completion. The MDPE rider main shall be wrapped with a protective membrane and all necessary measures taken to ensure the pipe is not damaged by sharp edges, stones, etc.; and

(c) Suitable temporary rider mains shall be installed to supply local residents with water should the need arise.

6.4.6 Anchor blocks/thrust blocks

6.4.6.1 Refer to NZS4404:2010, Page 214 – Figure WS 005 and this Manual, Volume 2, Part 6, Clause 6.12.

Part 6 – Section 5: Installation of Valves and fire Hydrants

6.5.1 Introduction

6.5.1.1 All water main pipe laying and associated fitting installation shall only be carried out by a qualified Water Service Person holding the qualification of National Certificate in Water Reticulation.

6.5.2 Scope

6.5.2.1 This specification covers the maintenance of valves and fire hydrants as well as the installation of valve and fire hydrant boxes within the Council water reticulation system.

6.5.3 Materials

6.5.3.1 Acceptable materials are listed in Section 1 of this Specification.

6.5.3.2 Materials to be used include Council's proprietary cast iron or aluminium and concrete components, as detailed on Figure 128: TS 607 Hydrant box, Figure 130: TS 609 Hydrant box lid, Figure 132: TS 611 Valve box to Figure 139: TS 618 Heavy duty concrete hydrant surround base inclusive.

6.5.3.3 Only cast iron boxes shall be used in carriageways.

6.5.4 Maintenance

6.5.4.1 Wherever possible, routine maintenance shall be carried out on the valve or hydrant at the time of rebuilding the surrounding box. Such work shall be approved by Council prior to commencement of the work.

6.5.4.2 Any defects or damage to the fitting shall be reported to Council immediately so that the necessary remedial action can be carried out while the Contractor is on site (wherever possible).

6.5.4.3 Maintenance that cannot be carried out immediately shall be referred to Council.

6.5.5 Installation of valves

6.5.5.1 Preferably, valves should be installed outside of the sealed carriageway in the grass berm. Valves shall be installed in the pipeline at the minimum cover depth of the pipeline.

Table 47: Installation of Valves

Location	Principal Water mains	Rider mains
Grass berms & footpaths	750mm depth to top of pipe	600mm
Under carriageways	900mm	900mm

6.5.5.2 Preferably, valves shall be installed next to other fittings such as tees or bends. Where the valve is fitted to the branch of a tee, it shall be flanged unless this results in the valve being in the carriageway, in which case, spigot ended valves connected to adjoining pipes with gibaults is the acceptable alternative. Spigot ended valves shall be secured to anchor blocks conservatively sized to resist any unequal hydraulic thrust forces arising from closing and opening the valve.

6.5.6 Installation of fire hydrants

6.5.6.1 The preferred location for hydrants is in the road berm rather than the carriageway.

6.5.6.2 Generally, they should be installed in the centre of the property to avoid driveways.

6.5.6.3 Hydrant risers shall be used or the water main laid deeper, where necessary, to ensure the top of the spindle is between 50 & 200mm below the fire hydrant lid.

6.5.7 Installation of valve & hydrant boxes

6.5.7.1 Berm areas (includes installations in the road berm):

(a) Installations in berm areas shall be in accordance with Figure 143: TS 623 Sluice valve installation carriageways and berm areas, Figure 144: TS 624 Fire hydrant installation carriageways and berm areas, and Section 2 of this Specification. At least one, but no more than three, cast iron packers shall be used in any one installation.

(b) Backfill and reinstatement shall be in accordance with Part 3 of this Volume.

6.5.8 Carriageway areas

6.5.8.1 Installations in carriageway areas shall include all streets and shall be in accordance with Figure 143 and Figure 144 and with the following:

(a) No more than three cast iron packers shall be used in any one installation;

(b) The base shall be well compacted and properly levelled prior to installation of the concrete surrounds;

(c) The edge of the excavation shall be saw cut to provide a neat, clean edge for reinstatement; and

(d) Backfill and reinstatement shall be in accordance with Part 3: Roading Projects Technical Specification, except that backfill shall be as per Figure 143: TS 623 Sluice valve installation carriageways and berm areas, Figure 144: TS 624 Fire hydrant installation carriageways and berm areas.

6.5.8.2 The valve or hydrant box must be installed parallel to the main.

6.5.8.3 The box and surrounds shall be installed so that no traffic load on the surface box can be reflected onto the pipe or fittings.

Part 6 – Section 6: Installation of Service Connections

6.6.1 Introduction

6.6.1.1 All water main pipe laying and associated fitting installation shall only be carried out by a qualified Water Service Person holding the qualification of National Certificate in Water Reticulation.

6.6.2 Scope

6.6.2.1 This specification covers the installation of all service and fire main connections for use within the Council water reticulation network and is to be read in conjunction with the following documents:

(a) Installations and figures pertaining to the work to be done (including service figures).

(b) Manufacturer's instructions for the handling, storage and laying of the pipe being used.

(c) Operative Waipa District Water Supply Bylaw.

6.6.3 Connections to Customers

6.6.3.1 ***General***

(a) Connections shall be made under pressure, wherever possible.

(b) All Domestic water supplies will not shall be metered. unless specified by Council.

6.6.3.2 ***Point of Supply to Consumer***

(a) Services shall be located at the centre of each front allotment or close to one side boundary of the access ways to rear allotments. See Figure 142: TS 622 Water main locations at intersections.

(b) The service connection shall have a meter, gate valves and a back flow preventer (if applicable), under a tall reverse taper polypropylene or polyethylene meter box located in the road reserve, 300mm from the boundary and be extend 300mm inside the boundary. Installation of the extension should be timed to avoid damage by other service trenches. See Figure 147: TS 627 Standard connection installation 20-50mm pipework and Figure 148: TS 627.1 20mm metered connections residential.

(c) Where this is not practical, the meter box may be located within 300mm inside the boundary. In this case, and where a kerb exists, a 'V' is to be chiseled into the top of the kerb directly opposite the toby valve, to indicate the valve location.

(d) In rural areas, where a restricted supply is provided, the installation shall be as per Figure 147: TS 627 Standard connection installation 20-50mm pipework, Figure 150: TS 630.1 Water meter and valve assembly type 1 and Figure 152: TS 630.3 Water meter and valving assembly type 3.

(e) A permanent notch or mark shall be inscribed on the concrete kerb (where applicable) to indicate the position of the toby box. In rural areas a marker shall be installed on the fence above the water meter Refer to Figure 127: TS 602 Water meter marker.

(f) Meters on supplies to commercial or industrial properties which are located in service areas or other areas which are subject to vehicular movement should be housed in a cast iron manifold box.

(g) Should back-flow prevention be necessary, refer to the operative Waipa District Water Supply Bylaw'.

(h) Service connection pipes shall have minimum cover of 350mm.

(i) Service isolation valves (manifold assembly) shall be installed in the service pipeline as indicated in Figure 147: TS 627 Standard connection installation 20-50mm pipework.

6.6.3.3 *Services up Access ways Lots or Right of Ways*

(a) Where there are 2 or more service lines in a common right of way, each meter manifold shall be permanently marked with the serviced lot number and arranged in a logical order. See Figure 149: TS 629 Multi-service connections for connection details suitable for up to 4 dwellings.

(b) Service pipes crossing the access to lots shall be minimum 25mm O.D. and shall be placed in 50mm I.D. ducts.

(c) Service connections, meters (where applicable), manifolds, backflow preventers (where applicable) and gate valves shall be laid and marked as shown in Figure 147: TS 627 Standard connection installation 20-50mm pipework and Figure 148: TS 627.1 20mm metered connections residential.

6.6.3.4 *Diameter of service connections*

(a) All service pipes, ferrules, meters, meter manifolds and gate valves shall be 20mm internal diameter unless otherwise specified (Refer also to Volume 2, Part 6).

6.6.3.5 *Tapping Bands, Ferrules and Service Pipes*

(a) Service connections to principal and rider mains shall be by means of a tapping band and a ferrule. Ferrules are to be left fully opened and gate valves fully closed.

(b) All service pipes shall be laid at right angles to the street. Refer to Figure 147: TS 627 Standard connection installation 20-50mm pipework.

(c) Tapping bands shall be in accordance with Section 1 of this Specification.

6.6.3.6 *Construction*

(a) Tapping bands and ferrules on the water main shall be fitted when the mains are first laid.

(b) In Industrial and Commercial Subdivisions, it is normal to omit tapping bands and service connections until the specific requirements of the consumer are known. Refer to the operative 'Waipa District Water Supply Bylaw' for matters relating to the customer's point of supply including backflow protection, flow meters and connections for fire protection systems.

(c) The service shall not be extended to the boundary until after any other reticulation between the water main and the boundary has been laid. Service connections shall normally be laid at right angles to the frontage.

6.6.3.7 ***Service Connection Materials***

(a) Refer to Section 1 of this Specification.

6.6.3.8 ***Meter Boxes***

(a) Meter boxes for domestic shall be installed in accordance with Figure 147: TS 627 Standard connection installation 20-50mm pipework.

(b) Metal meter boxes are to be used for commercial and industrial access ways or whenever the manifold assembly is located in a constant trafficable area.

6.6.4 Connections to Industrial/Commercial Users

6.6.4.1 Refer to the operative 'Waipa District Water Supply Bylaw' for matters relating to the customer's point of supply including backflow protection, flow meters and connections for fire protection systems.

6.6.5 Fire main Connections

6.6.5.1 Refer to the operative 'Waipa District Water Supply Bylaw' for matters relating to the customer's point of supply including, backflow protection, flow meters and connections for fire protection systems.

6.6.6 Installation

6.6.6.1 Refer to Section 2 of this Part.

6.6.7 Meter Installation

6.6.7.1 Refer to the operative 'Waipa District Water Supply Bylaw' for matters relating to the customer's point of supply including, backflow protection, flow meters and connections for fire protection systems.

6.6.7.2 Meters shall be installed on supplies to Industrial and Commercial premises as well as on domestic connections as specified in the operative Waipa District Water Supply Bylaw.

6.6.7.3 The following figures shall refer as necessary:

(a) Figure 147: Standard Meter Installation 20mm up to 50mm.

(b) Figure 148: Standard 20mm Domestic Meter Installation.

(c) Figure 150 to Figure 152: Standard meter installation : 20mm up to 80mm diameter.

(d) Figure 153: Standard meter and double non-return valve backflow preventer: 80mm up to 150mm diameter.

(e) Figure 153: Standard meter pit for 80mm to 150mm diameter connections.

(f) Figure 154: Standard meter arrangement for un-dedicated Fire Fighting Connections.

(g) Figure 155: Above ground meter and backflow device: 80mm up to 200mm diameter.

6.6.7.4 Care shall be taken during installation of the meter to ensure that no foreign matter enters the pipes or meter. All meters shall be checked by the Contractor after installation to ensure that the meter is recording the flow passing through it.

Part 6 – Section 7: Shutdown Procedures

6.7.1 Introduction

6.7.1.1 All water main pipe laying and associated fitting installation shall only be carried out by a qualified Water Service Person holding the qualification of National Certificate in Water Reticulation.

6.7.2 Scope

6.7.2.1 The procedures for Emergency and Planned Shutdowns are contained within the current Water Supply Bylaw.

6.7.2.2 Continuity of supply to customers shall have a very high priority.

6.7.2.3 Shutdowns of mains shall be minimised, wherever, possible by isolating at the ferrule during changeover of services/stoptaps.

6.7.2.4 To avoid unnecessary shutdowns, and unless specific dispensation is received from Council, live connections shall be made to pressured water mains, where practicable.

6.7.3 Emergency Shutdowns

6.7.3.1 Emergency work can be carried out without a notified shutdown. An emergency shutdown duration should be kept to a minimum and should not exceed the following time limits:

(a) 30 minutes for domestic water supply pipe lines.

(b) 4 hours for delivery water mains 50mm dia. or less.

(c) 6 hours for delivery water mains larger than 50mm dia.

6.7.3.2 Affected customers shall be notified of a shutdown and when normal service has been restored. In the event of damaged or a burst to large mains, critical services and major industry shall be notified of a shutdown and when normal service has been resumed.

6.7.3.3 Council's Customer Support frontline and other essential services shall be notified at the earliest opportunity for both commencement and conclusion of any emergency shutdown.

6.7.4 Planned Shutdowns

6.7.4.1 ***Application***

(a) Shutdown Procedure for contractors:

(i) Identify location of connections.

(ii) Contractor to liaise with Council's Water Services operations staff 5 working days prior to planned shutdown to confirm valve shut down sequence.

(iii) Council's Water Services operations staff to test valve operations and trial run through if required.

(iv) Council's Water Services operations staff to confirm results back to Contractor.

(v) Contractor to submit "water mains shutdown request form" to the designated Council Warrant Officer 72 hrs prior to proposed shutdown date.

(vi) The designated Council Warrant Officer will confirm acceptance/alterations of proposed shutdown within 24 hrs of receiving request form.

(vii) Contractor shall notify affected property owners, in writing, at least 48 hrs prior to mains shutdown.

(viii) Council's Water Services operations staff are to carry out mains shutdown unless otherwise agreed between the designated Council Warrant Officer and the Contractor.

6.7.4.2 ***Shutdown Planning***

(a) The Contractor shall contact Council's Water Services operations staff 5 working days prior to proposed shutdown date and arrange a site meeting to confirm connection location and valve sequence.

6.7.4.3 ***On Site Preparation and Investigation***

(a) Council's Water Services operations staff shall confirm that the required valves are accessible, operational and functional. A test shutdown shall be carried out and the designated Council Warrant Officer/Contractor informed of its outcome.

6.7.4.4 ***Shutdown Request to the Council***

(a) The Contractor shall complete the "water mains shutdown request form" 72 hrs prior to the proposed shut down date having already completed the above steps. It can be faxed or sent electronically direct to the designated Council Warrant Officer. Any shutdown request outside the time frames may result in the mains shut having to be rescheduled.

6.7.4.5 ***Confirmation from Council***

(a) The designated Council Warrant Officer will contact the Contractor within 24 hours upon receipt of the shutdown request form to confirm that the shutdown details are acceptable or discuss changes. Once shutdown details are agreed, the Contractor shall give 48 hrs notice to affected property owners of the planned shutdown. All documentation to be approved by the designated Council Warrant Officer prior to delivery.

6.7.4.6 ***Valve Operation***

(a) Council's Water Services operations staff shall perform the closing of valves to enable the water mains to be isolated and drained. Upon completion of the connection, the Contractor shall contact Council's Water Services operations staff to re-pressurize the water main, flush and check all valves are fully open. The Contractor is not permitted to operate any valves or hydrants without the expressed permission of Council's Water Services operations staff or designated Council Warrant Officer.

6.7.4.7 ***General Information***

(a) *Shutdown Duration*

(i) The scheduled shutdown shall not exceed 4 hours duration except in exceptional circumstances. The Contractor shall endeavour to complete all work in the 4-hour period. In exceptional circumstances where it is thought more time will be required, the Contractor shall apply for a longer duration when submitting the shutdown request.

Part 6 – Section 8: Disinfection and Flushing

6.8.1 General Procedure

6.8.1.1 Pipeline pressure testing and disinfection shall be witnessed by Council. The Contractor shall provide at least 1-day's advance notice for each of pressure testing and disinfecting a pipeline.

6.8.1.2 It is a requirement for the Contractor's site-supervisor for pressure testing and disinfection water mains to hold the NZQA qualification "National Certificate in Water Reticulation".

6.8.1.3 The process of commissioning a pipeline shall follow one of the general procedures outlined below.

6.8.1.4 The pipeline is thoroughly flushed, pressure tested, disinfected using dissolved HTH powder and then left in the 'in-service' and pressurised state.

6.8.1.5 The pipeline is disinfected using chlorine tablets glued to the inside of each pipe during construction, pressure tested, flushed and then left in the 'in-service' and pressurised state.

6.8.1.6 In the second of these options, if further work on the pipeline is required as a result of a failed pressure test then the disinfection step shall be repeated (using dissolved HTH powder).

6.8.2 Disinfection

6.8.2.1 Disinfection chemicals should be applied to achieve a free chlorine concentration of between 10mg/litre and 100mg/litre (the pH should not be higher than pH 9 – concrete lined pipes can cause the pH to be raised to the point where chlorine becomes ineffective).

6.8.2.2 The disinfectant requires time to be effective. The required contact time is a function of concentration. The product of free chlorine concentration (mg/litre) and contact duration (minutes) shall be not less than 7,200. E.g. a satisfactory treatment regime would involve a free chlorine concentration of 10mg/litre with a contact duration of 720 minutes.

6.8.2.3 At the end of the disinfection period, the free chlorine concentration shall be not less than 10mg/litre. If, at the end of the disinfection period, the free chlorine concentration is less than 10mg/litre then the pipeline shall be thoroughly flushed and the disinfection process repeated.

6.8.2.4 If the disinfection process is being applied to a pipeline with customer connections, each service pipeline shall be closed at the toby prior to the disinfectant being administered.

6.8.2.5 The quantity of available chlorine varies for each chemical so it is not appropriate to apply 'rules of thumb' as to how much is needed to achieve a particular concentration.

6.8.2.6 Generally the calculation takes the form:

$$\text{Target chlorine concentration (grams/ m}^3\text{)} = \frac{\text{Wt. of available chlorine (gms)}}{\text{Volume of pipeline (m}^3\text{)}}$$

Where:

- wt. of available chlorine = wt. of chlorine chemical (grams) x % of available chlorine.
- volume of the pipeline = length (m) x [diameter (m)]^2 x 0.785 (m^3).

and

- $$\text{diameter (m)} = \frac{\text{pipe diameter (mm)}}{1000}$$

Equation 10: Disinfection chlorine concentration

6.8.2.7 If chlorine tablets are used for disinfection, these shall be glued to the inside of the pipe using a small amount of food grade glue or sealant such as 'Silaflex RTV clear'. The tablets take some time to dissolve so timing of the chlorine contact period shall not begin until such time as the available chlorine level reaches the intended concentration.

6.8.3 Disinfectant

6.8.3.1 Common forms of disinfectant are:

(a) Sodium Hypochlorite (NaOCl) liquid sold in bulk which is typically 13 to 15% available chlorine.

(b) Chlorinated iso-cyanurate (swimming pool tablets) which is available as Di-chlor and Trichlor forms. The cyanuric acid content slows the rate of chlorine dissipation to the atmosphere. The amount of available chlorine varies between 58% and 90% depending on product.

(c) Calcium Hypochlorite (Ca (OCl) 2) also known as HTH (High Test Hypochlorite) which is a powder with typically 65 to 70% available chlorine by weight.

Warning: These chemicals are strong oxidants and can cause serious burns; they are explosive if allowed to come into contact with organic liquids such as petrol, diesel and oil. Using the chemicals should only be undertaken by personnel trained in this application of disinfecting water.

6.8.4 Removing the Disinfectant

6.8.4.1 Sometime after the minimum contact period for disinfection, the super chlorinated water is to be flushed from the pipeline. Flushing should continue for at least 10 minutes beyond the initial removal of the super chlorinated water. Projects involving pipelines of 250 NB and larger should be flushed until such time as the residual chlorine level matches that of the normal water supply in the area (i.e. upstream of the new pipe).

6.8.4.2 Individual customer connections shall be flushed by opening each toby valve installed on the pipeline. In the case of a pipeline repair where it is not practical to flush water at the toby, an outside hose tap should be used as the flushing point for each service connection. If the super chlorinated water cannot be discharged to a sewer, it shall be neutralised before discharge to the environment.

6.8.5 Bacteriological Test

6.8.5.1 In commissioning new pipelines, Council shall be given 24 hours' notice as to when sampling for bacteriological tests is to be carried out.

6.8.5.2 Water in the pipeline shall be sampled between 12 hours and 2 days after post-chlorination flushing and the samples tested for the presence of E.Coli by Ministry of Health Approved laboratory with IANZ accreditation for this type of test. The number of samples shall be at least one for projects involving less than 100m of pipe, two for projects up to 200m length, etc.

6.8.5.3 A satisfactory result is zero E.Coli per 100ml.

> Advice Note: There are high risks of test failure due to sample contamination so it is recommended that the testing laboratory be also involved in collecting the sample.

6.8.5.4 If E.Coli is detected the pipeline shall be swabbed, flushed, disinfected, flushed again and then the bacteriological tests repeated. The process shall be repeated until such time as a clear test is recorded.

Part 6 – Section 9: Miscellaneous and Testing

6.9.1 Introduction

6.9.1.1 All water main pipe laying and associated fitting installation shall only be carried out by a qualified Water Service Person holding the qualification of National Certificate in Water Reticulation.

6.9.2 Application

6.9.2.1 This part applies to steel, ductile iron, PVC and MDPE pipes.

6.9.3 Backfill, Compaction and Reinstatement

6.9.3.1 Refer to Section 2 of this Specification.

6.9.3.2 Compaction test results (or substituted scala penetrometer tests) shall be submitted to Council for approval by appending test results to the QA form Checklist 6.2, Volume 4, Part 6 of this Manual.

6.9.4 Testing

6.9.4.1 ***General***

(a) All pipelines shall be tested to the satisfaction of the Engineer or Council in accordance with the relevant Clauses 6.9.4.2 or 6.9.4.3 below after backfilling. The Contractor may carry out tests before backfilling if he wishes but the final test, known as the acceptance test, shall be carried out after all specials, fittings, permanent supports and anchors have been constructed, cured and backfilling has been completed. Each section of the reticulation shall be tested in the presence of the Engineer or Council.

6.9.4.2 ***Steel, Ductile Iron and PVC Pipes***

(a) *General*

(i) The test shall be carried out, and all necessary apparatus supplied, by the developer.

(b) *Test Procedure*

(i) The reticulation shall withstand a pressure of 1400 kPa measured at the lowest point of the section under test, or 1.5 times the working pressure at any point in the system, whichever is the greater, at which time the pump shall be disconnected and allowed to stand without makeup pressure for a period of one hour. The pipeline will pass the pressure test if the rate of pressure does not fall below 90% of the test pressure test. Joints between adjacent test sections shall be tested by re-pressurising the pipeline up to the test pressure and observing the joint for 15 minutes. If visual inspection of the joint shows no evidence of leaks, the joint will be accepted.

6.9.4.3 *MDPE Pipes*

(a) *General*

(i) This pressure test uses the visco-elastic creep characteristic of Polyethylene pipe material. A pressure transducer and data logger is the preferred means for monitoring the pressure during this test method, however, manual reading of a pressure gauge will be acceptable. Pressurising of the pipeline to 1200 kPa measured at the lowest point of the section under test, or 1.5 times the working pressure at any point in the system, whichever is the greater (STP), shall not begin until the Engineer or Council is on site to witness the test, unless the Engineer has given prior approval.

(b) *Test Rig*

(i) The pressure test-monitoring rig shall preferably consist of a recently calibrated pressure transducer, data logger and check gauge that has a dial of at least 100mm diameter and a pressure range that places the STP within the range 35% - 70% of the gauge's full scale. The transducer and check gauge shall read within +/-5% of each other. If they do not agree within this tolerance, re-calibration or replacement is necessary.

(ii) Where manual reading of a suitable pressure gauge is used, the main "test" gauge shall have:

- An accuracy of +/-5% of full scale.
- Minimum 100mm dial diameter.
- Readability of 5 kPa or better.
- A pressure range so that the STP falls within 50 – 90% of the dial range.
- Calibrated within the last 6 months.

(iii) A check gauge shall be used to confirm the calibration of the main gauge. The check gauge shall have:

- An accuracy of +/-1% of full scale.
- Minimum 100mm dial diameter.
- Readability of 10 kPa.
- A pressure range so that STP falls 50 – 90% of the dial range.
- Calibrated within the last 6 months.

(iv) A digital pressure gauge with similar or better readability and accuracy is acceptable.

(c) *Preliminary Phase*

(i) The preliminary phase is necessary before proceeding to the main test phase. It is intended to set up the prerequisites for volume alterations that are dependent on pressure, time and pressure. Proceed as follows:

- After flushing/swabbing and thoroughly venting the pipeline, depressurize to just above atmospheric at the highest point of the line and allow a relaxation period of at least 60 minutes to release pressure related stress. Ensure that no air enters the line.

- After the relaxation period, raise the pressure smoothly to the STP in less than 5 minutes. Maintain the STP for a period of 30 minutes by pumping continuously or at short intervals. Take care not to exceed the STP. During this time, carry out an inspection to identify any obvious leaks.
- Stop pumping and allow the pressure to decay by visco-elastic creep for 1 hour.
- Measure the remaining pressure at the end of the hour.
- If the pressure has dropped to 70% or less of the STP, the pipeline will not pass the test and the case should located and rectified. If the pressure at the end of the hour >70% of the STP, continue with the main test.

(d) *Main Test Phase (Pressure Drop)*

(i) This main test phase requires that the pipeline has been adequately vented.

(ii) The pressure drop test is carried out immediately after the completion of a successful preliminary phase.

(iii) Reduce the pressure remaining in the pipeline rapidly at the end of the preliminary phase by opening a "bleed" connection to produce a pressure drop of 10 – 15% of the STP or to 800 kPa, which ever produces the lowest pressure. The bleed time should be kept to a minimum, preferably less than 2 minutes.

(iv) The visco-elastic creep due to the STP is interrupted by the rapid pressure drop described above. The rapid drop in pressure leads to a temporary contraction of the pipeline. Observe and record the increase in pressure that results from the contraction of the pipeline for a period of 30 or 90 minutes. Note that there is usually an initial rapid rise in pressure.

(e) *Acceptance Criteria*

(i) The pressure test shall be satisfactory if:

- There is no failure of any thrust block, pipe, fitting or other pipeline component.
- There is no visible leakage.
- The pressure shows a rising tendency within the 30 minute period.
- If the pressure rises initially and then drops within the first 30 minute period, it is likely that there is a leak.

(ii) If doubt exists with the pressure recovery, the monitoring period may be increased to 90 minutes and any pressure drop that does occur shall not exceed 20 kPa over the full 90 minute period.

(f) *Failure of Test*

(i) If the pressure drops by more than 20 kPa during the 90 minute extended period, the test fails.

(ii) Should the test fail, the cause shall be located, rectified and the section re-tested until satisfactory results are obtained.

(iii) Repetition of the main test phase may only be done by carrying out the whole test procedure including the relaxation period of 60 minutes described in Clause 6.9.4.3(c) of this section.

(g) *Reporting*

(i) On satisfactory completion of the test, the test report shall be prepared by the Contractor and signed off by the Contractor, Engineer and Designer witnessing the test.

(ii) The test report shall include the following:

- Full details of the pipeline section tested (including details of pipe materials, diameter and pressure class, pressure rating, pipe manufacturers identification details, jointing system, pipeline profile showing any changes in elevation, pipe materials or diameter, as well as the location of valves and fittings and the location of the test section).
- Date and Time of testing (both start and finish).
- Failure of any thrust blocks, pipe, fittings or other components and its location.
- Any visible leakage detected and repaired.
- A detailed record of the pressure in the pipeline at appropriate time interval, preferably a data logger output graph or chart with logging intervals of 1 minute or less.
- Whether the pipeline passed or failed the test criteria.
- Names of key personnel and observers.

6.9.5 Water mains to be kept charged

6.9.5.1 After any water main has been laid, tested and disinfected, it shall be kept continually charged with water, and under pressure. If the permanent connection to the existing reticulation is delayed, a temporary small diameter connection shall be made from the existing reticulation. The pressure must be maintained while other underground services are being laid in the vicinity of the main.

6.9.6 Connection to Existing Water Reticulation

6.9.6.1 The physical connection to the existing water reticulation can only be carried out by Council staff or the Contractor, under supervision of Council's water services team, once the pressure and bacteriological test results have been submitted to, and approved by Council. The connection procedure shall be carried out in accordance with Section 6 of this Specification.

6.9.7 Abandoned Water main

6.9.7.1 *Recovery of Abandoned Assets*

(a) In the event that a water main is decommissioned, all removable valves, hydrants, fittings and surface boxes shall be recovered by the Contractor. The items shall be recycled by delivery to Waipa District Council Depot (Cambridge or Te Awamutu) for reuse.

6.9.7.2 *Inspection of Abandoned Assets*

(a) The Contractor shall provide Council with an opportunity to inspect the removed items and direct which recycling option is to be taken. The Contractor shall deliver the items for recycling as directed by Council.

6.9.7.3 *Recording Decommissioned Assets*

(a) In preparing as-built plans for the project, the Contractor shall include detail as to:

(i) Which valves and hydrants were removed.

(ii) Which sections of water main were decommissioned.

Part 6 – Section 10: Works Completion and Clearance

6.10.1 As-built Plans

6.10.1.1 Upon completion of construction work, copies of "As-Built" plans and data recording information about the completed works, as listed in Table 48: Asset Specific Data shall be provided to Council. Separate plans are required for wastewater, stormwater and water supply.

6.10.1.2 Responsibility for providing the plans and associated data shall lie with:

(a) The Developer, in the case of land development (urban and industrial sub-division);

(b) The Contractor, in the case of works constructed for Council under contract to Council.

6.10.1.3 Plans presented in fulfilment of this requirement shall be shown as "As-Built" in the amendments part of the figure title block and signed-off as 'approved for issue' by a person having responsibility for the quality assurance aspect of the as-built information.

6.10.1.4 As-built plans and associated data shall be sent to:

(a) In the case of subdivisions:

The Manager
Development Engineering
Private Bag 2402
Te Awamutu 3840

(b) E-mail electronic files to: as-builts@wdc.govt.nz and include in the subject heading: the Council's Subdivision Consent Number, subdivision name and stage number.

(c) In the case of Council contracts, send to the Engineer for forwarding to the appropriate Council asset manager.

6.10.2 Data Presentation Formats

6.10.2.1 For larger developments, the as-built data is required in three formats (Refer Threshold Matrix in Clause 6.10.6 of this Part).

6.10.2.2 Two copies of hard copy plans using line formats as indicated in Volume 1, Part 2, figure sheet size A3 and plan scale 1:500 preferred.

6.10.2.3 Electronic Microsoft Excel spread sheets listing various attributes of the assets constructed - refer blank template files accessed from the Table of Contents page of this Part.

6.10.2.4 Where as-built plans are prepared using computer aided design software, DXF format export files of the hard copy plans are required. The specification for the format is laid out in Volume 4, Appendix 7.

6.10.2.5 Hard copy plans are used in updating Council's records. The DXF format files facilitate data upload to the GIS.

6.10.2.6 The spread sheet lists of asset data facilitate data upload to the asset information database. As well as recording dimension and materials information, this database is used to manage asset condition information.

6.10.3 Asset Values

6.10.3.1 This requirement has been suspended pending review. Refer to Volume 4, Part 9, Appendix 8.

6.10.4 Datum's and Units of Measurement

6.10.4.1 Only metric units are to be used in as-built data. Principally these are millimetres *(mm)*, meters *(m)*, litres/sec *(L/s)*, cubic meters /day *(m3/day)*. All levels are to be in terms of Moturiki Datum and to two decimal places.

6.10.4.2 Geographic coordinates shall be:

(a) New Zealand Geodetic Datum 2000 (NZGD2000).

(b) Projection: Mount Eden Circuit 2000.

6.10.4.3 Coordinates should be presented in standard 6-digit format (east coordinate followed by north coordinate) to two decimal places. e.g. 305718.97, 643728.35.

6.10.5 Asset Component Types and As-Built Data Requirements

6.10.5.1 As-built data shall be accompanied by the following list of project specific data:

(a) Works construction contractor.

(b) Project name or subdivision name (including subdivision stage number).

(c) The Council contract number (Council projects).

(d) The Council project ledger code (Council projects).

(e) Name of person responsible for preparing the as-built data.

(f) Date of preparing the as-built data.

(g) Date of Construction.

6.10.5.2 The following list of asset specific data shall be supplied and shown on the figures.

> Advice Note: Occasionally privately owned assets need to be shown on as-built plans; such assets shall be clearly labelled 'Private & … *'name and details of asset'*.

Table 48: Asset Specific Data

Asset Component Type	Asset Attribute Required	Shown on plans	Comment
Water Pipelines	Plan ID	Yes	Plan number used to identify as-built plan
	Pipe ID	Yes	Use a pipe numbering system to link individual pipes and related information such as length, diameter, material, coordinates, etc. Pipe ends occur at pipe intersections and when pipe diameter changes
	Pipe Diameter	Yes	Nominal bore in millimetres
	Pipe Length	Yes	Show pipeline location on the plan. Show dimensions to adjacent boundaries
	Laying Depth	Yes	Average depth below ground level to top of pipe
	Pipe Material	Yes	Material and strength classification
	Joint Type	Yes	RRJ, gibault, welded, etc.
	Construction Date	No	Construction/Installation Date
	Service Status	Yes	Abandoned and decommissioned pipelines are required to be identified on as-built records. Show “A” for abandoned pipes, “D” for deleted/decommissioned assets
	Asset Value		Refer Clause 6.10.3 of this section – pipe, pipe bends, and tees and associated fittings; show valves and hydrants separately
	Comments		Any pertinent comments (particularly water table depth and soil conditions)
Water Connections	Plan ID	Yes	Plan number used to identify as-built plan
	Pipe ID	Yes	Use a pipe numbering system to identify individual pipes if Property ID or Street numbering is not adequate
	Property ID	Yes	Either property number or legal description
	Street Name	Yes	If street name is not applicable use a property deposited plan (DP) number
	Street Type	Yes	Qualifier to street name e.g. Crescent, Road, Lane, etc.
	Service Pipe Diameter	Yes	Nominal bore in millimetres
	Service Pipe Length	Yes	Show pipeline location on the plan
	Service Pipe Material	Yes	Material and strength classification
	Eastern coordinate		Coordinate at customer end of service pipeline i.e. at the service valve or toby
	Northern coordinate		Coordinate at customer end of service pipeline i.e. at the service valve or toby
	Toby Lid Level		On middle of Toby Lid
	Distance from left (LB) or	Yes	Distance to customer connection point relative to

Asset Component Type	Asset Attribute Required	Shown on plans	Comment
	right (RB) boundary		left-hand or right-hand boundary facing the property from the street
	Meter Installed	Yes	Yes/no response (if yes complete a Council 'Water Meter' form for each installation)
	Asset Value		Refer Clause 6.10.3 of this section – include all components from tapping band to toby
	Comments		Any pertinent comments
Water Valves	Plan ID	Yes	Plan number used to identify as-built plan
	Pipe ID	Yes	Use a pipe numbering system to identify individual pipes if Property ID or Street numbering is not adequate
	Property ID	Yes	Either property number or legal description
	Street Name	Yes	If street name is not applicable, use a property deposited plan (DP) number
	Street Type	Yes	Qualifier to street name e.g. Crescent, Road, Lane, etc.
	Valve Size		Nominal bore in millimetres
	Valve Manufacturer		
	Location	Yes	Roadway, berm
	Eastern coordinates	Yes	Coordinate of valve
	Northern coordinate	Yes	Coordinate of valve
	Valve Level		From middle of Hydrant Lid
	Asset Value		Refer Clause 6.10.3 of this section – include all fittings such as gibaults, flanged spigots, surface box, marker post, etc.
	Comments		Any pertinent comments such as 'attached to anchor block'
Hydrants	Plan ID	Yes	Plan number used to identify as-built plan
	Asset ID	Yes	Use an asset numbering system to identify individual pipes if Property ID or Street numbering is not adequate
	Property ID	Yes	Either property number or legal description
	Street Name	Yes	If street name is not applicable, use a property deposited plan (DP) number
	Street Type	Yes	Qualifier to street name e.g. Crescent, Road, Lane, etc.
	Hydrant Size		Nominal bore in millimetres
	Hydrant Manufacturer		
	Location	Yes	Roadway, berm
	Eastern coordinate		Coordinate of hydrant
	Northern coordinate		Coordinate of hydrant

Asset Component Type	Asset Attribute Required	Shown on plans	Comment
	Hydrant Level		From middle of Hydrant Lid
	Asset Value		Refer Clause 6.10.3 of this section – include all fittings such as gibaults, flanged spigots, surface box, marker post, etc.
	Comments		Any pertinent comments

6.10.6 Threshold matrix for as-built data

6.10.6.1 For small developments, the provision of separate as-built plans for each service, separate data sheets and DXF data is not justified. Therefore, the following matrix has been developed to guide when each type of data presentation is required. If the data presented is not clear, Council may request additional information.

Table 49: Threshold Matrix for As-built Data

	Small Development (2 – 5 lots)	Medium development (5 - 10 lots)	Large development (10+ lots)	Contract
Separate plans for each service	No	Not required if adequate clarity is possible on same plan	Yes	As per large development or contract documents
DXF data	No	Please supply if available	Yes	As above
Separate data spread sheets	No, include information on	WW or SW if >2 manholes or 10 lots. Water if more than 5 hydrants or valves.	Yes	As above
GST invoice on vesting	Yes	Yes	Yes	As above
Plan size	A3	A3	A3	As above

6.10.6.2 As-built figures must be scalable. Refer to Volume 1, Part 2, Clause 2.4.3.

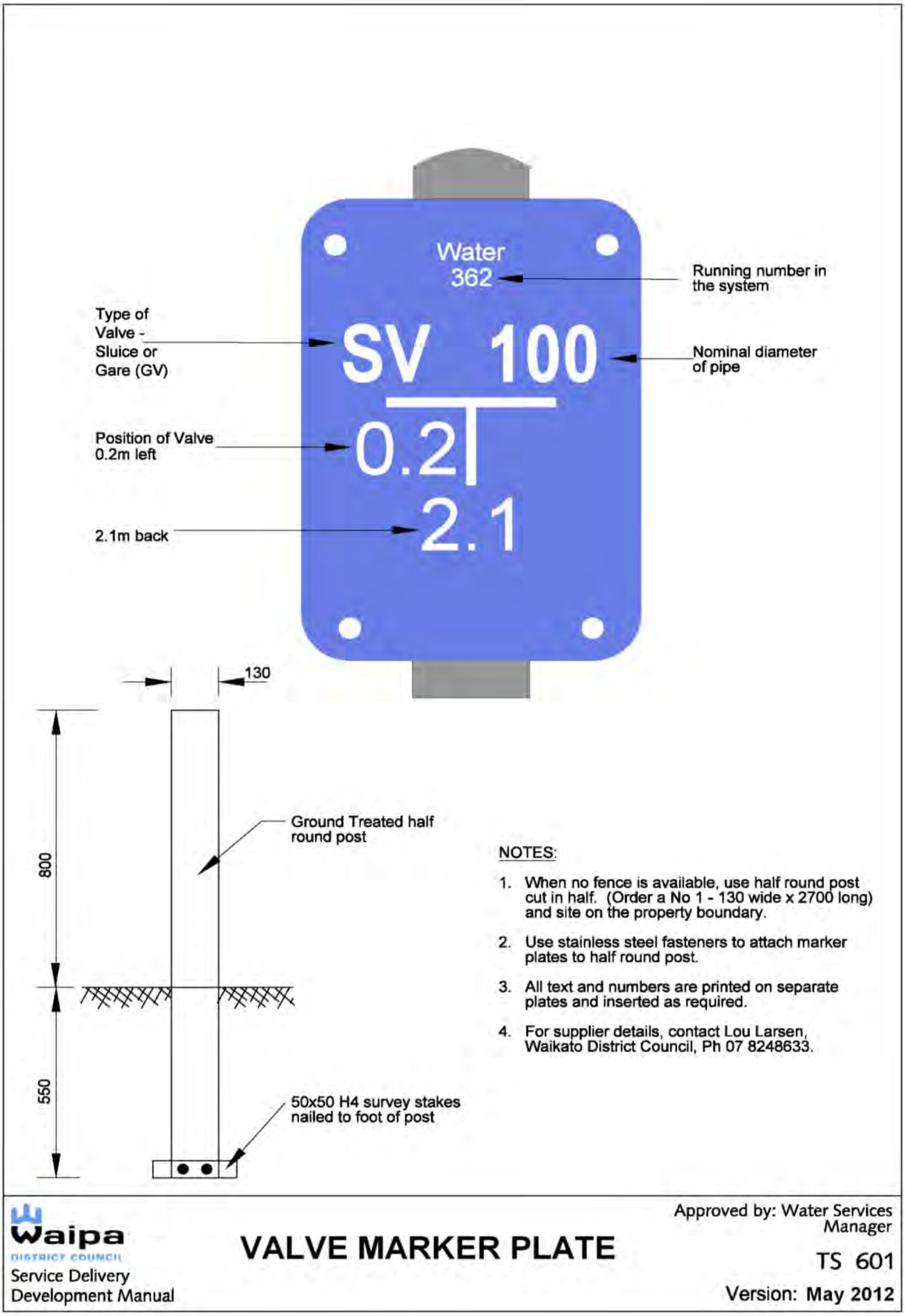


Figure 126: TS 601 Valve marker plate

NOTES

1. White plastic - 3mm thick
2. To be installed on fence above the water meter
3. Available from:-
   TECH PRINT LTD
   87 Cambridge Road
   Hamilton
   Ph (07) 856 5409

Waipa District Council Service Delivery Development Manual	**WATER METER MARKER**	Approved by: Water Services Manager TS 602 Version: May 2012

Figure 127: TS 602 Water meter marker

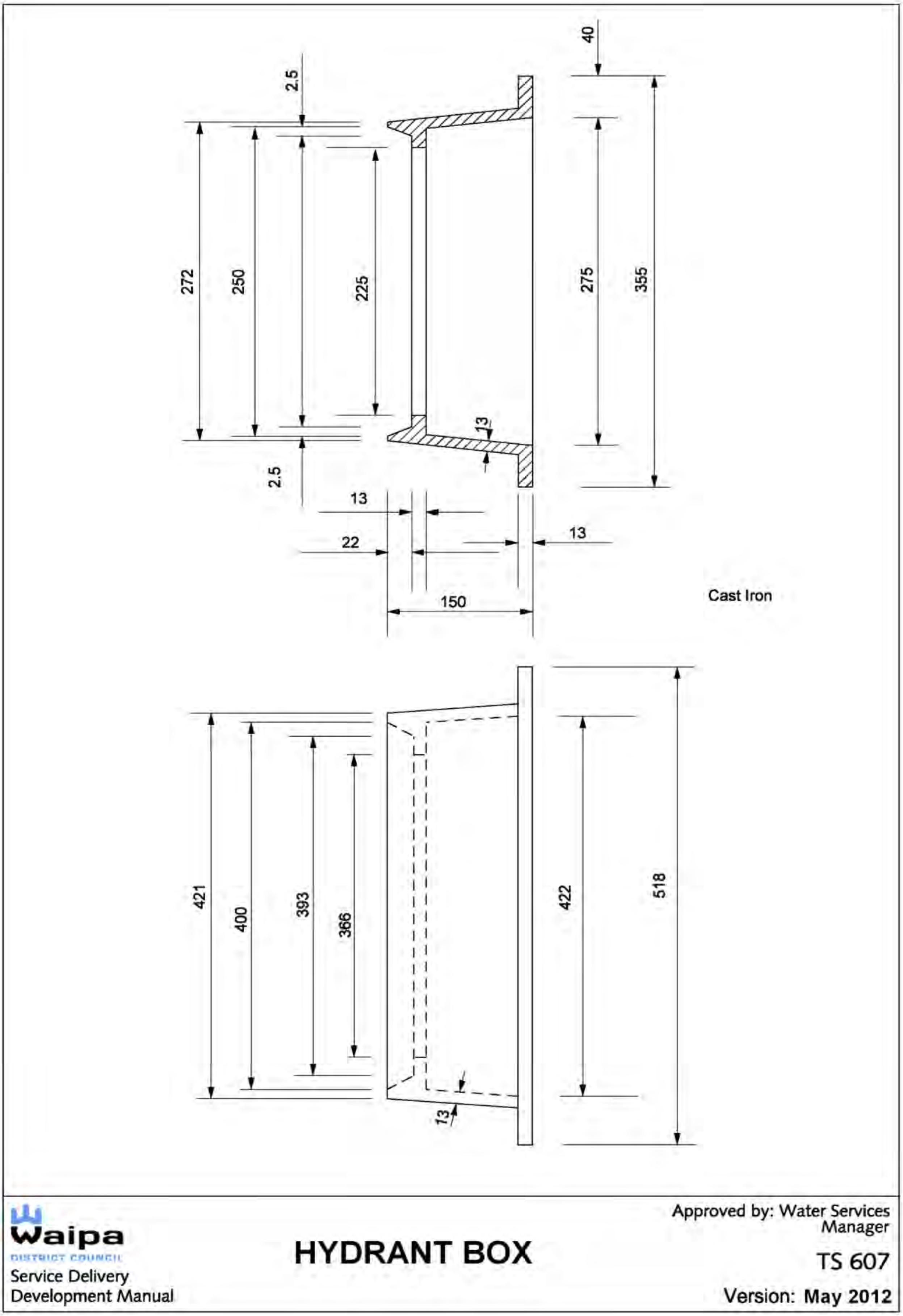


Figure 128: TS 607 Hydrant box

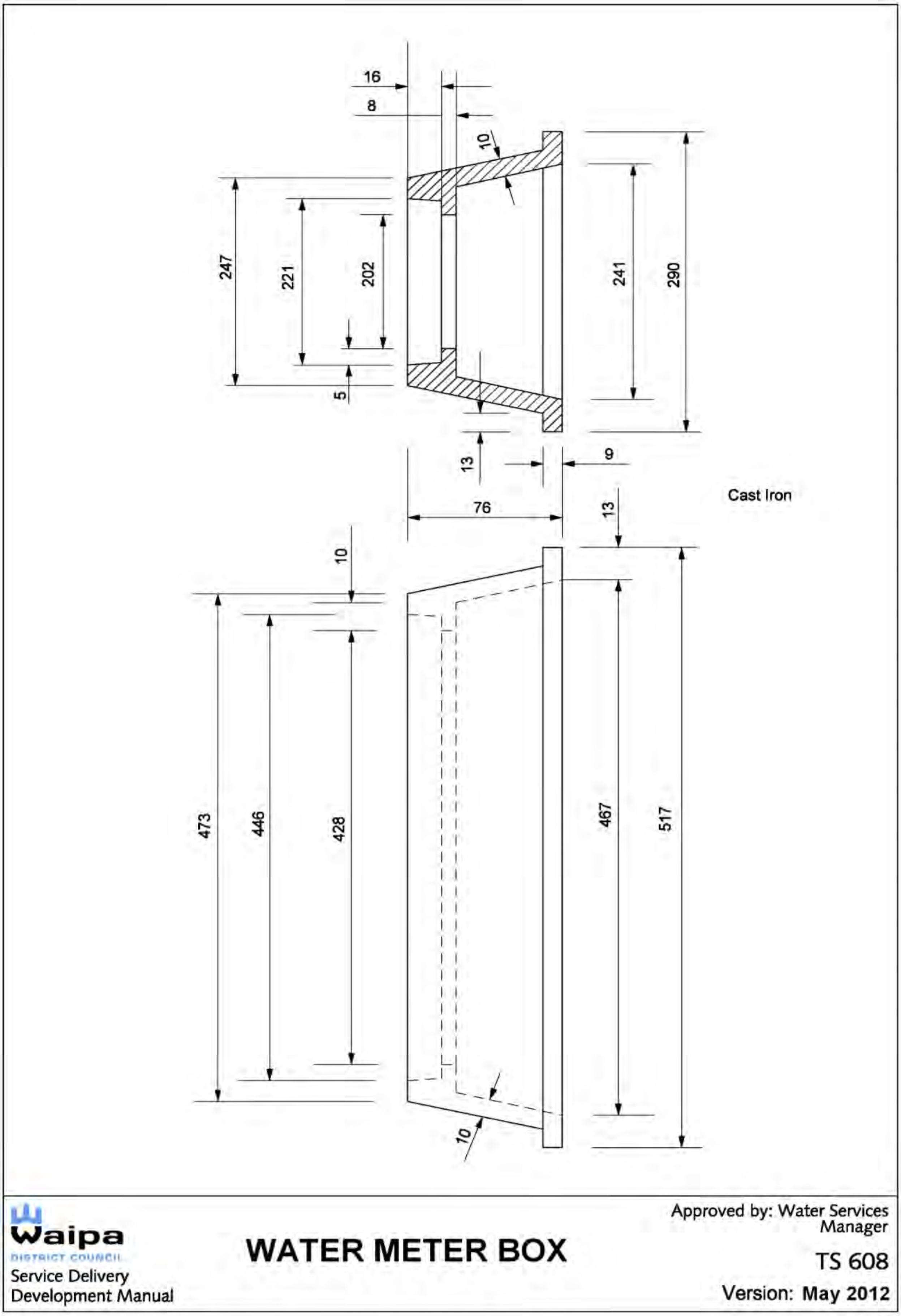


Figure 129: TS 608 Water meter box

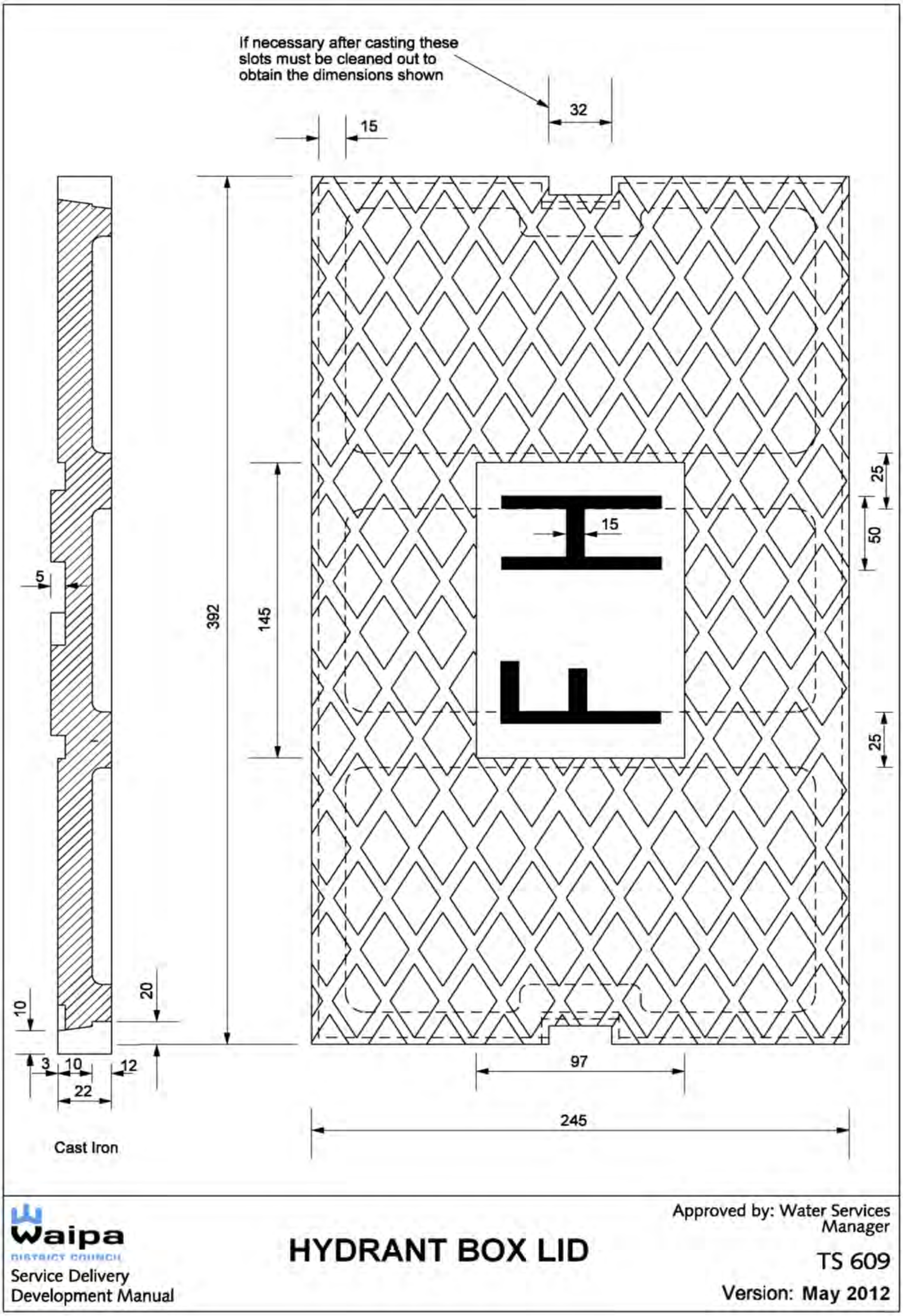
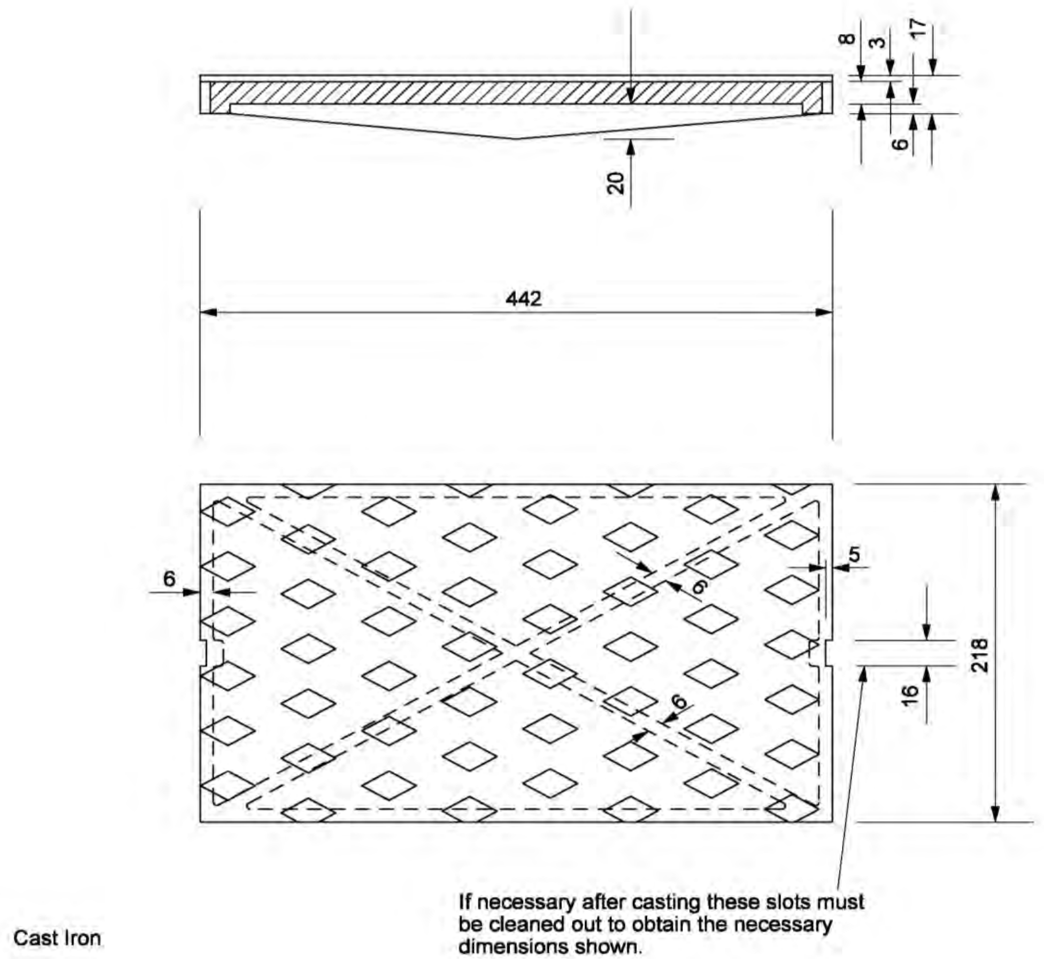


Figure 130: TS 609 Hydrant box lid



Waipa District Council
Service Delivery Development Manual

METER BOX LID (STANDARD PATTERN)

Approved by: Water Services Manager

TS 610

Version: May 2012

Figure 131: TS 610 Meter box lid (standard pattern)

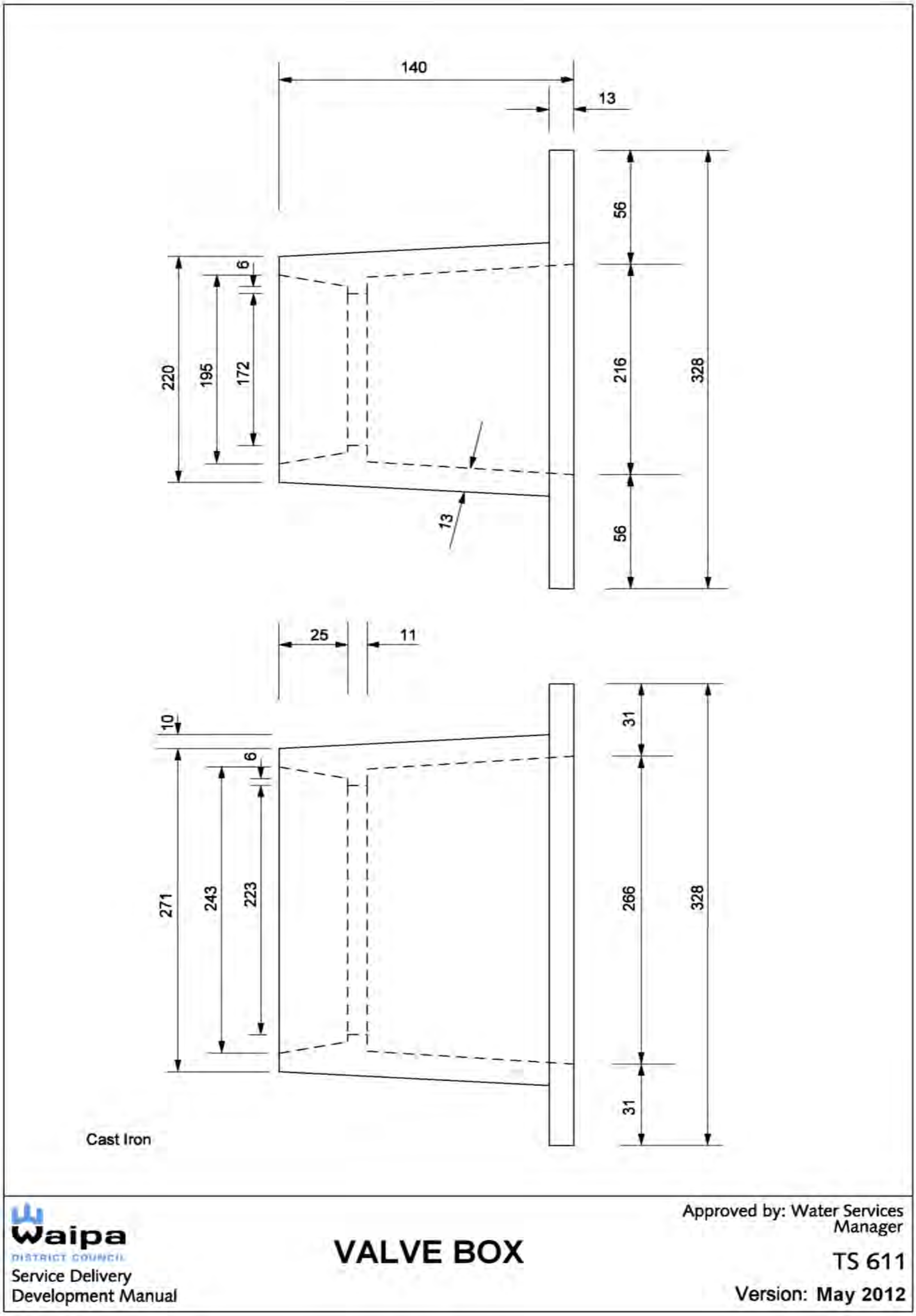


Figure 132: TS 611 Valve box

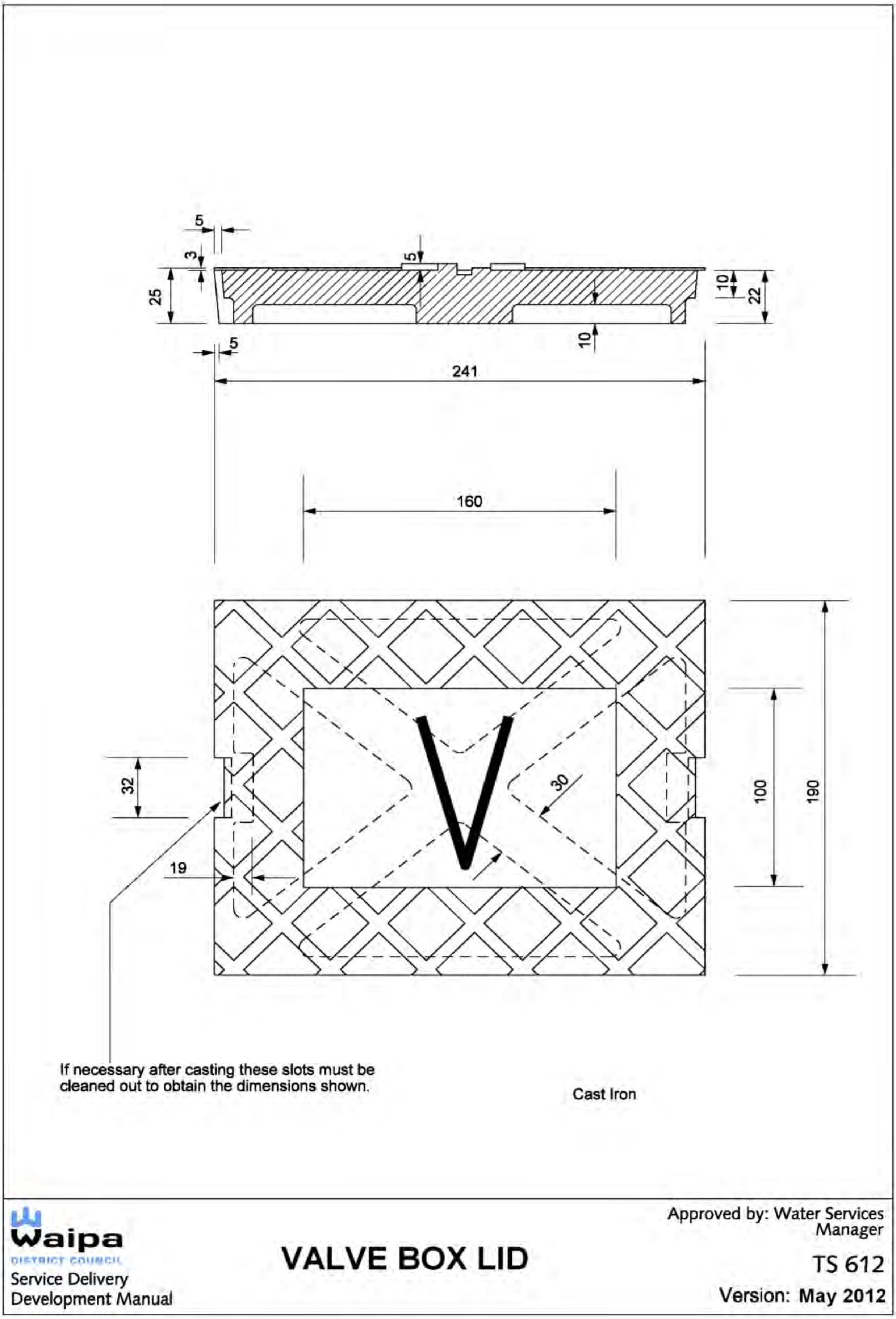


Figure 133: TS 612 Valve box lid

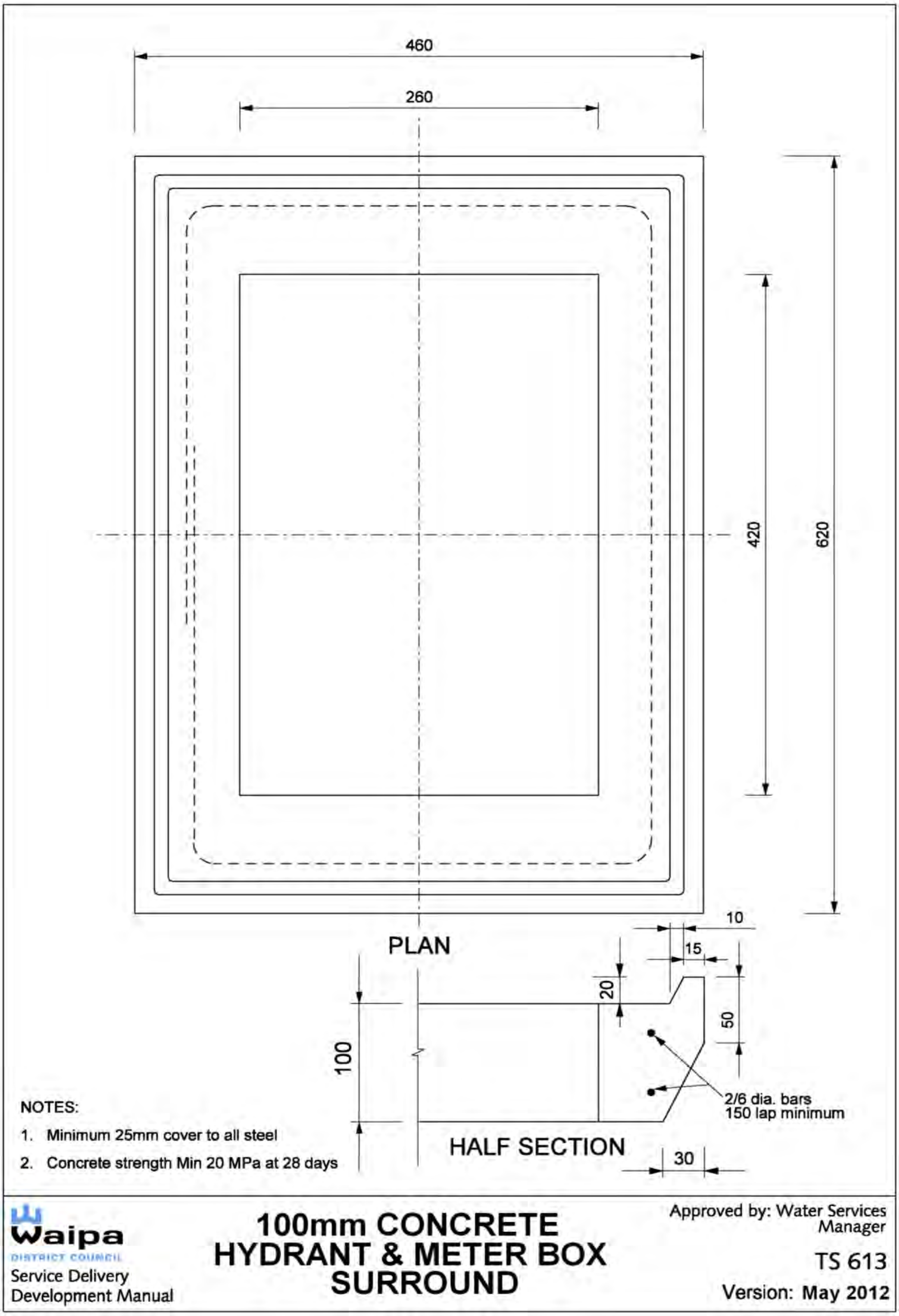


Figure 134: TS 613 100mm concrete hydrant and meter box surround

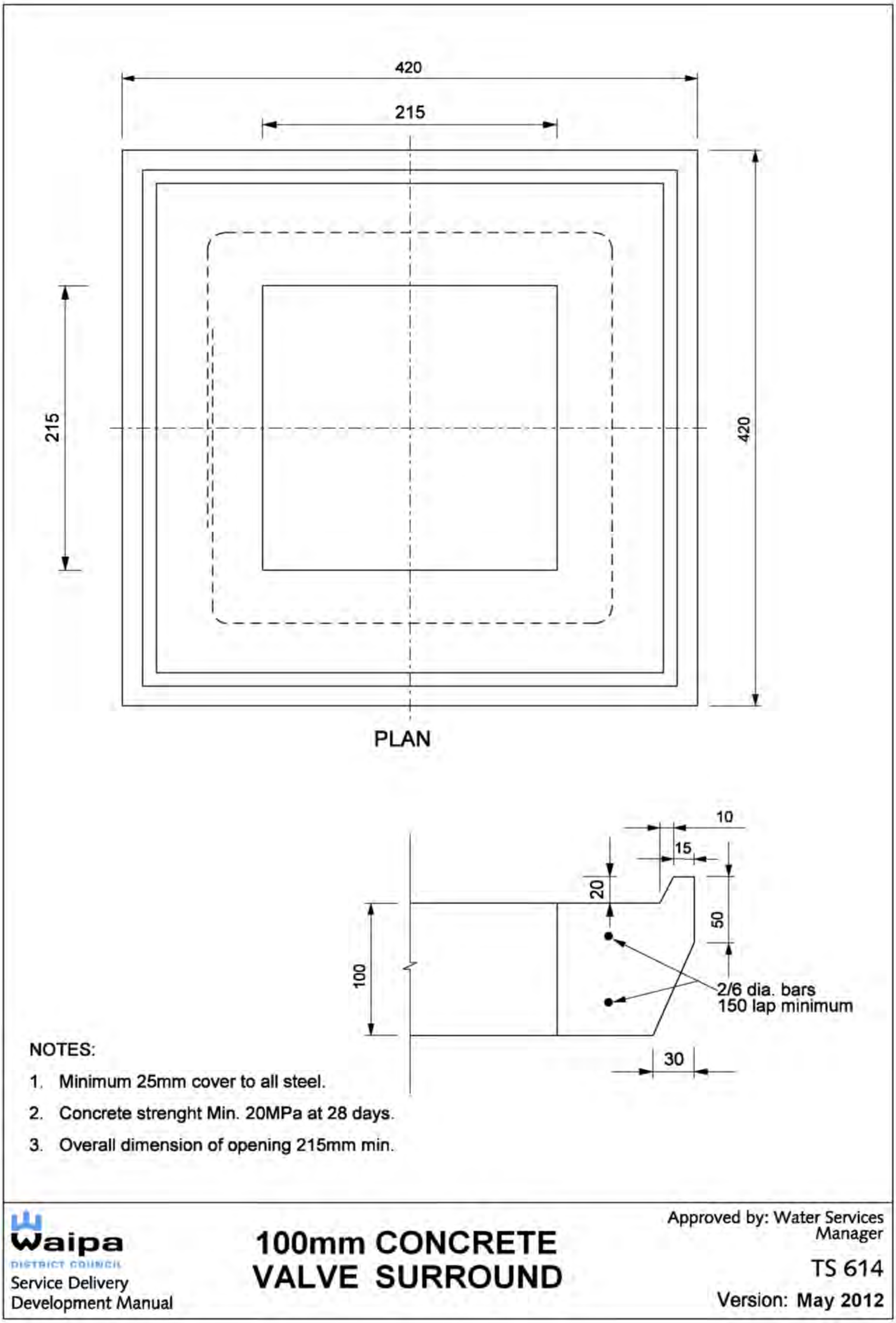
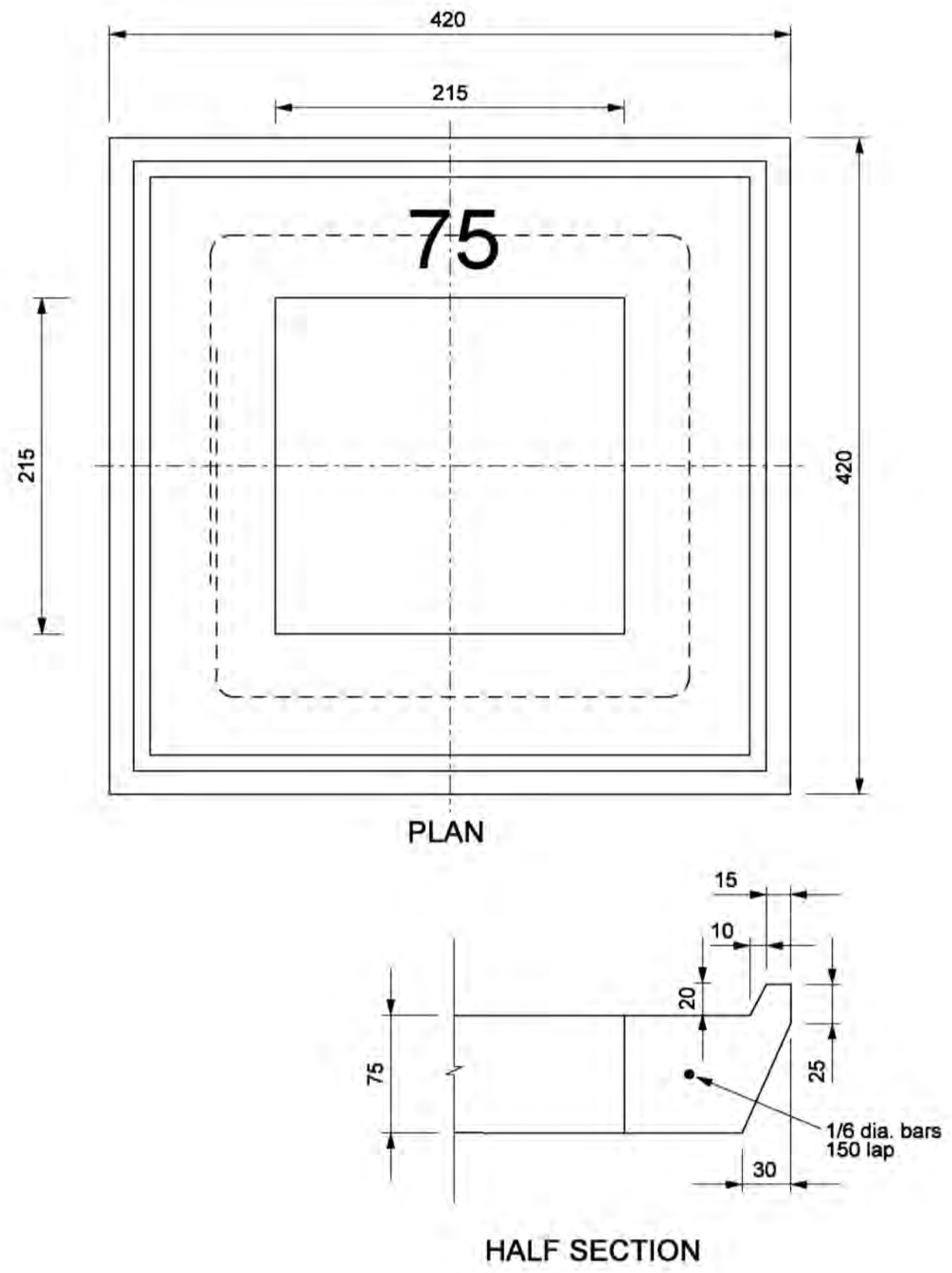


Figure 135: TS 614 100mm concrete value surround



NOTES:

1. Minimum 25mm cover to all steel
2. Concrete strength min. 20MPa at 28 days
3. Overall dimension of opening 215mm min.
4. The numbers "75" to be imprinted in the top face in letters at least 40mm high

Waipa DISTRICT COUNCIL Service Delivery Development Manual	**75mm CONCRETE VALVE SURROUND**	Approved by: Water Services Manager TS 615 Version: May 2012

Figure 136: TS 615 75mm concrete valve surround

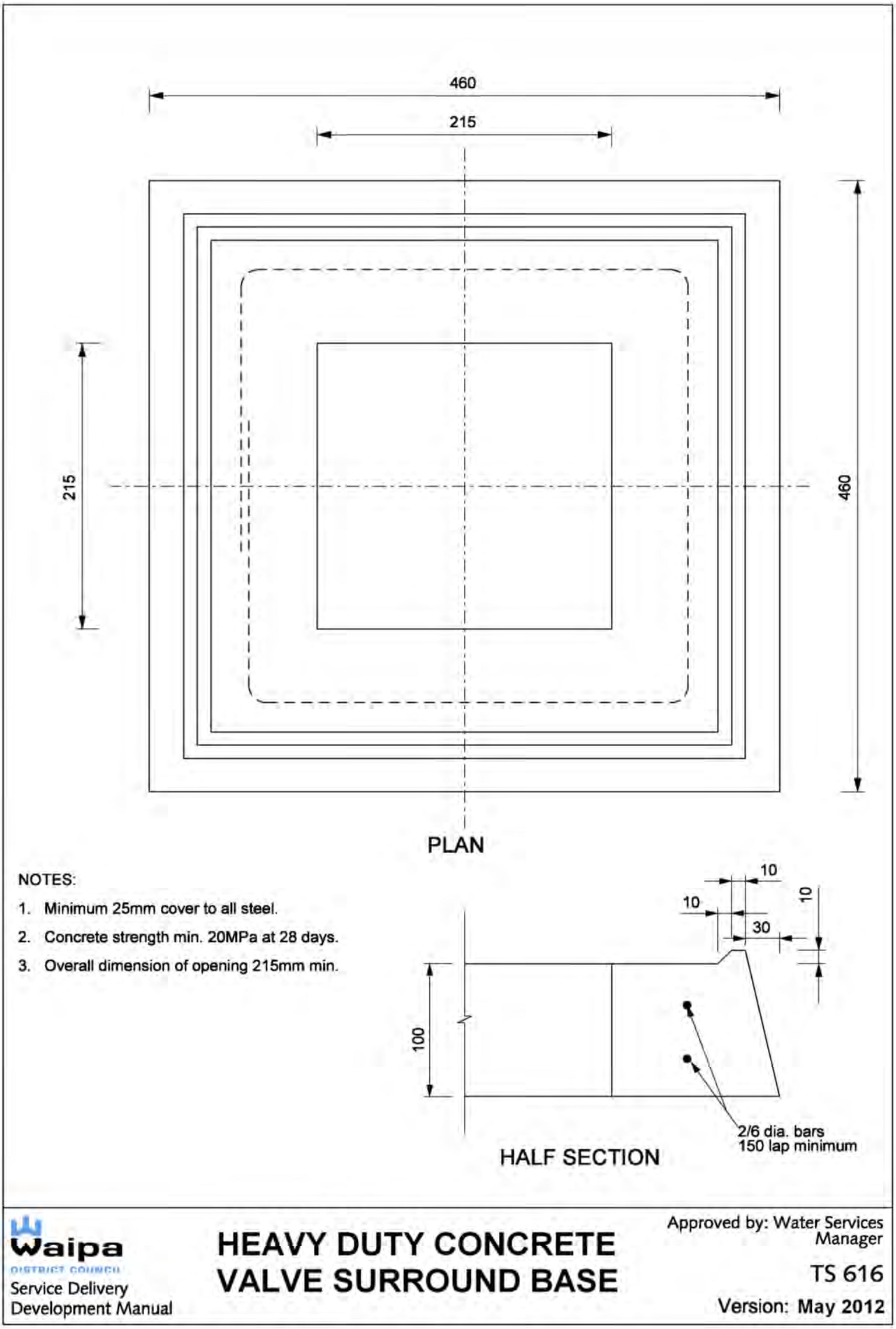


Figure 137: TS 616 Heavy duty concrete valve surround base

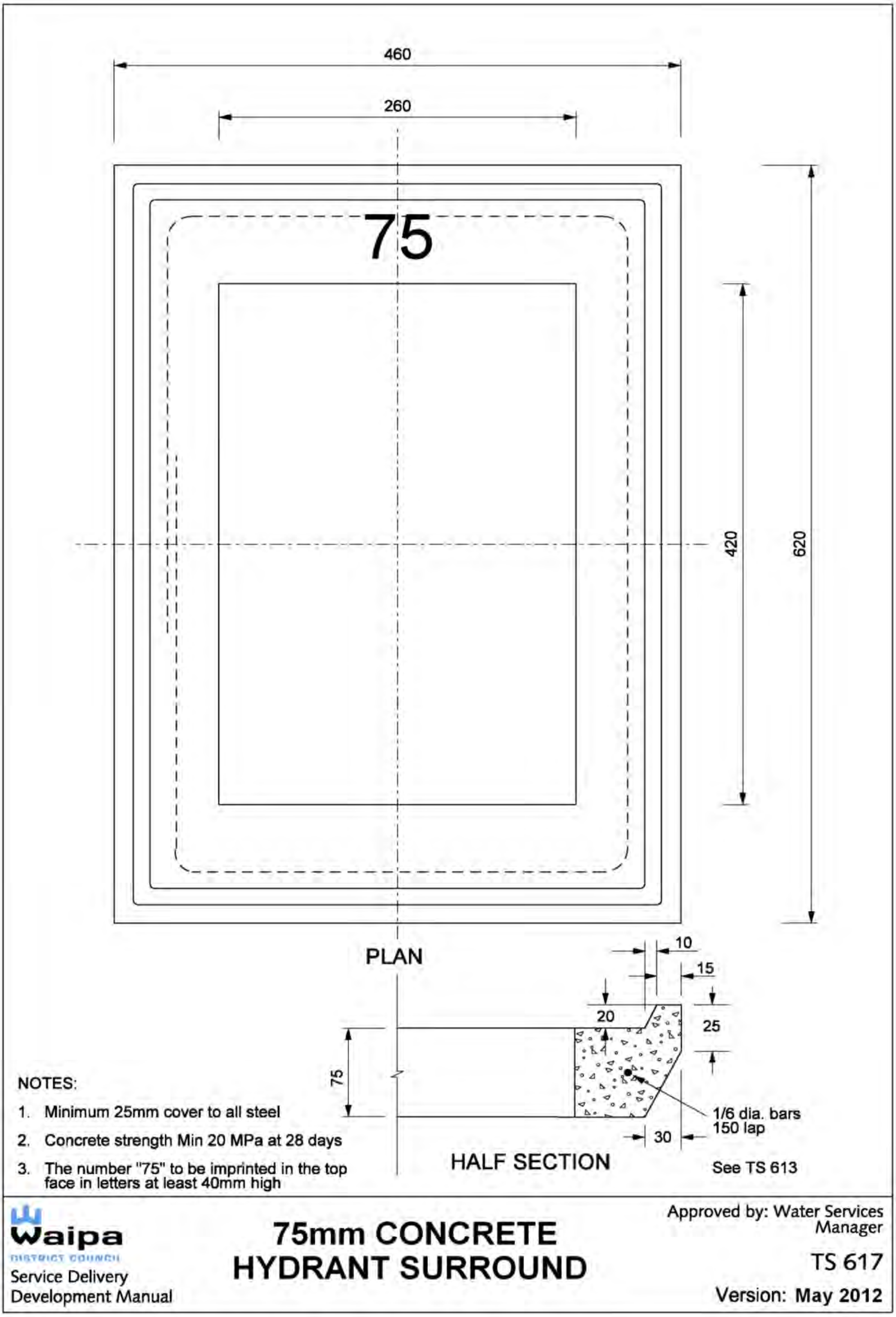


Figure 138: TS 617 75mm concrete hydrant surround

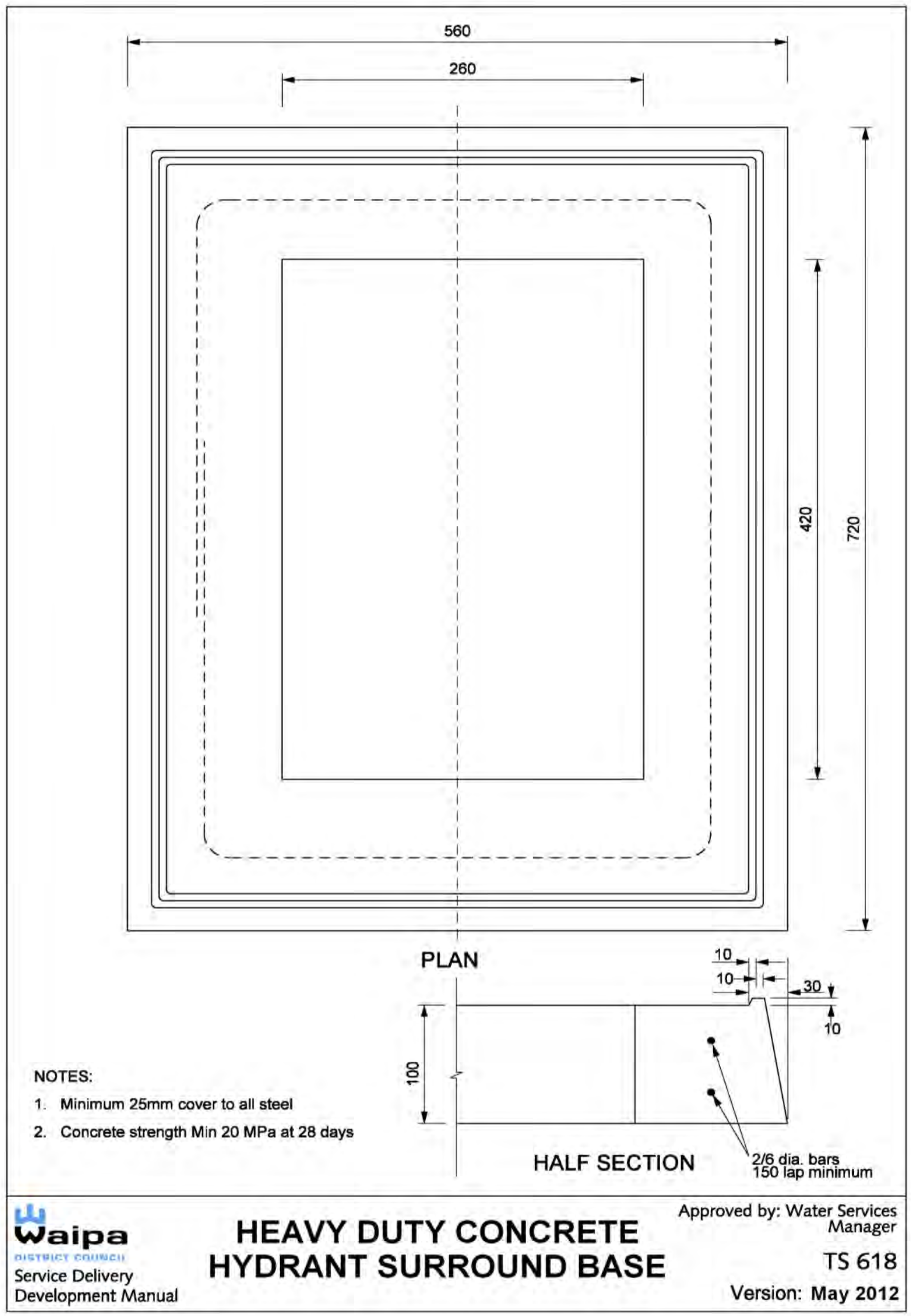


Figure 139: TS 618 Heavy duty concrete hydrant surround base

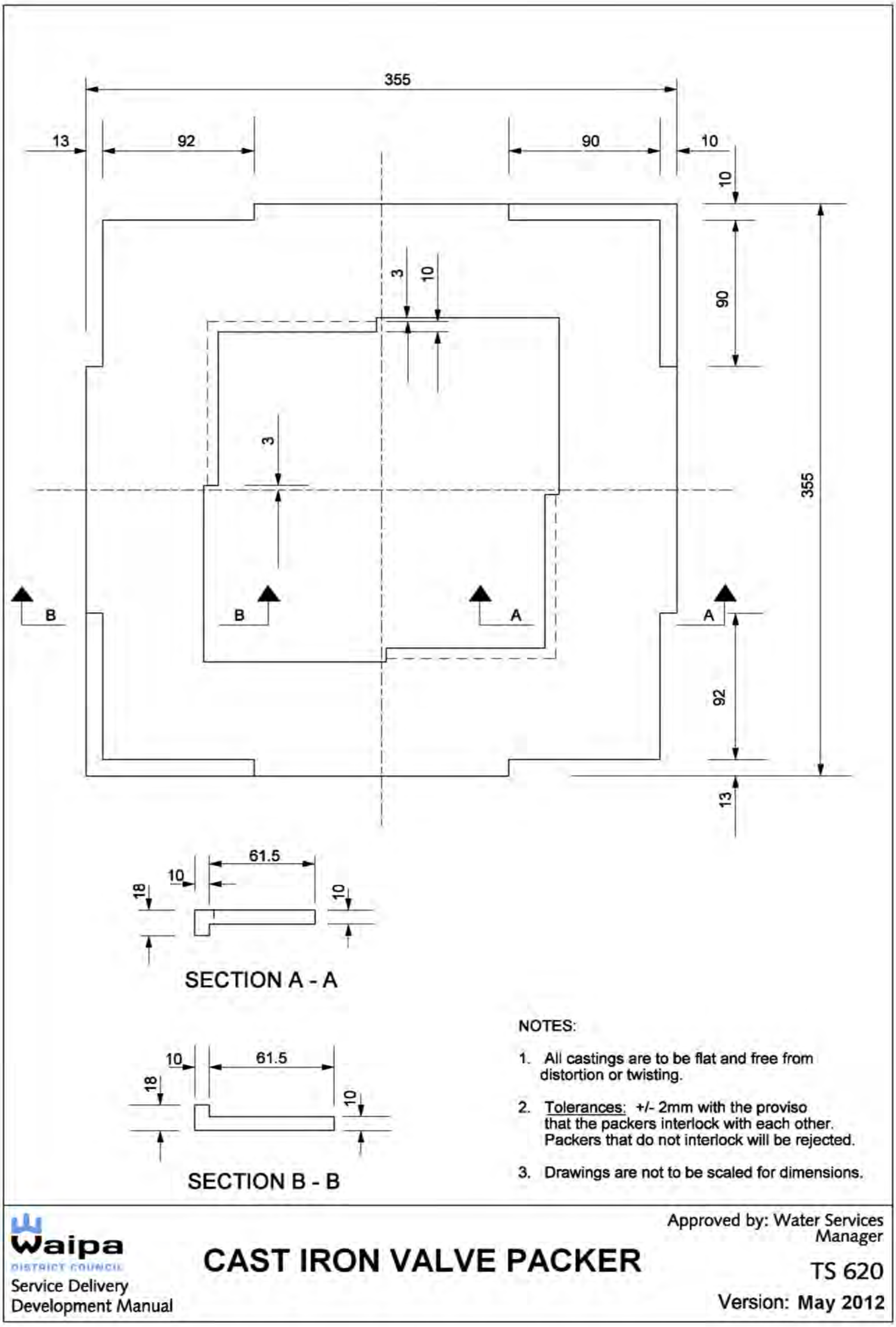


Figure 140: TS 620 Cast iron valve packer

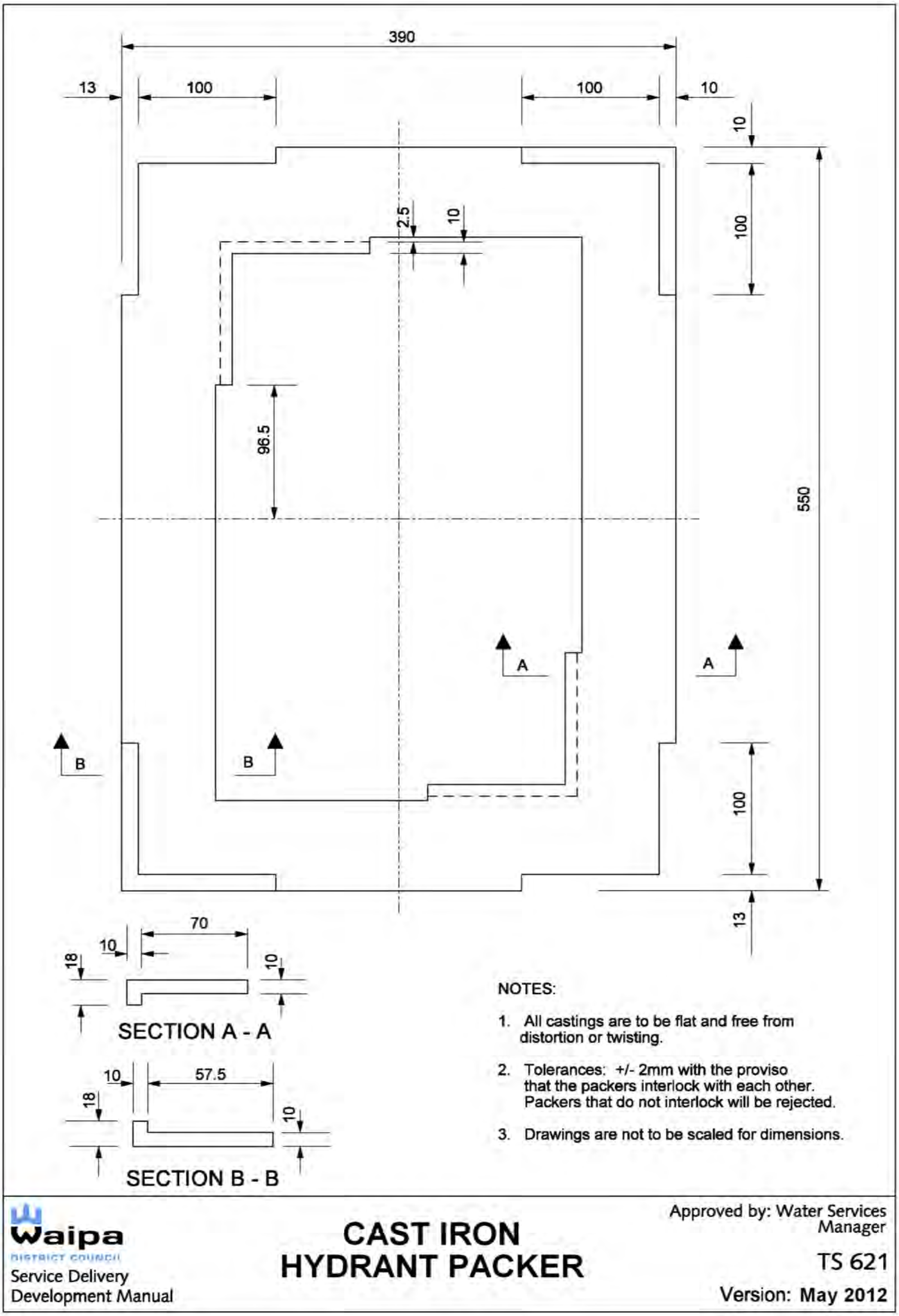


Figure 141: TS 621 Cast iron hydrant packer

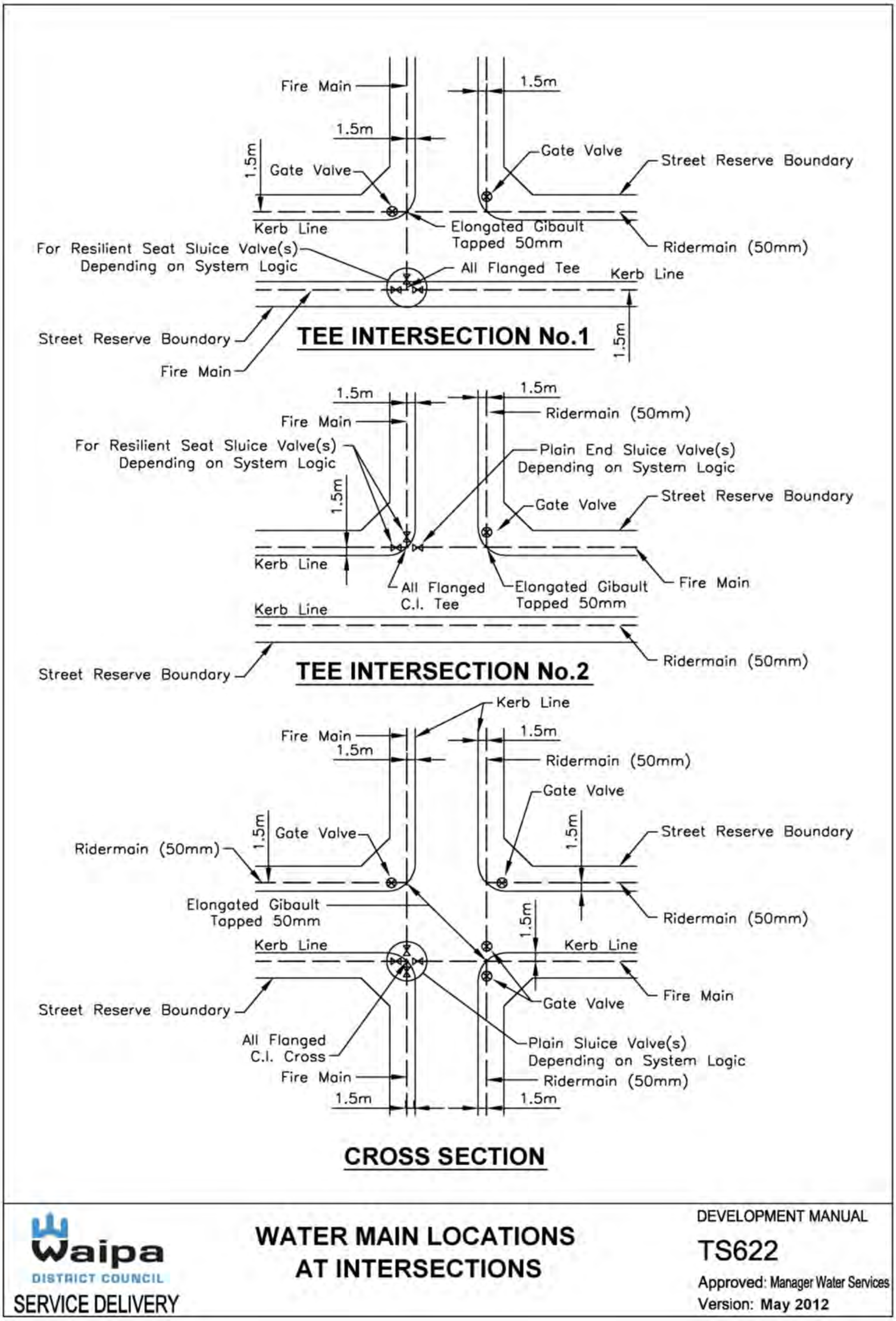
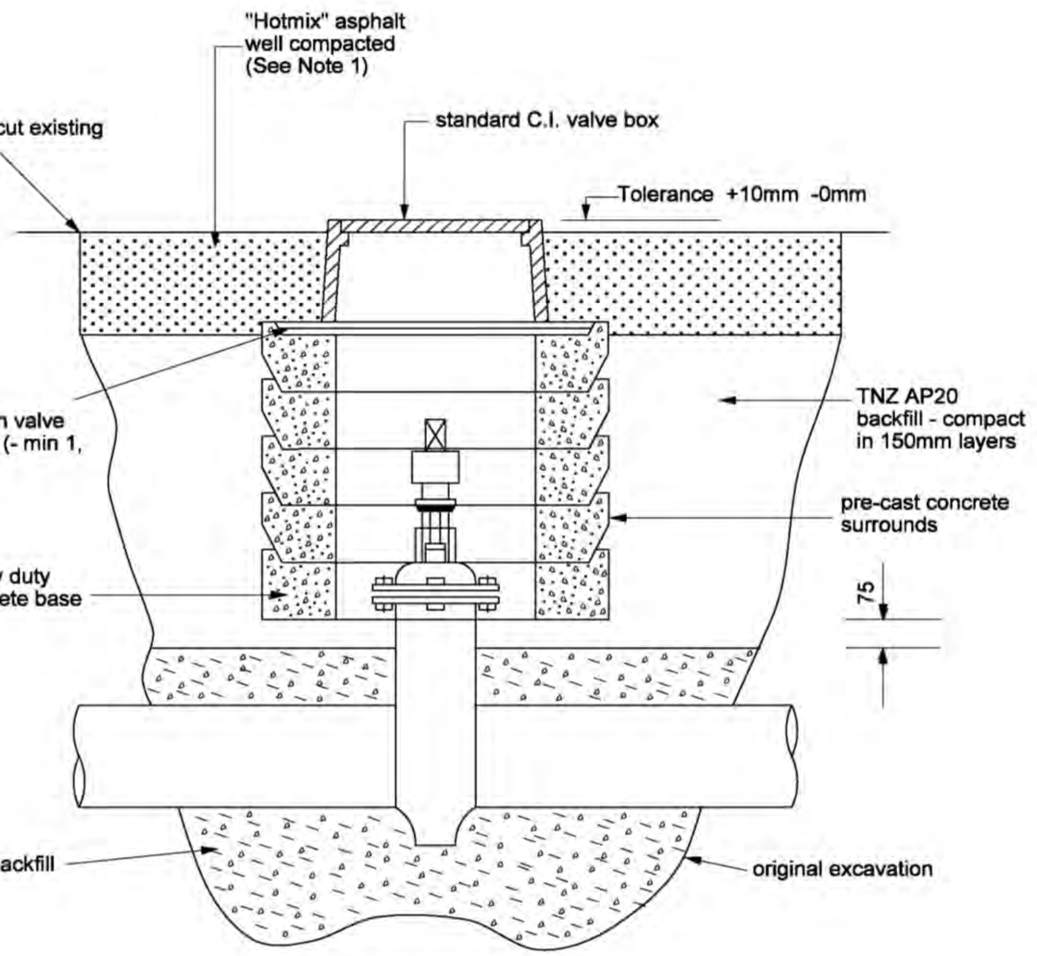


Figure 142: TS 622 Water main locations at intersections



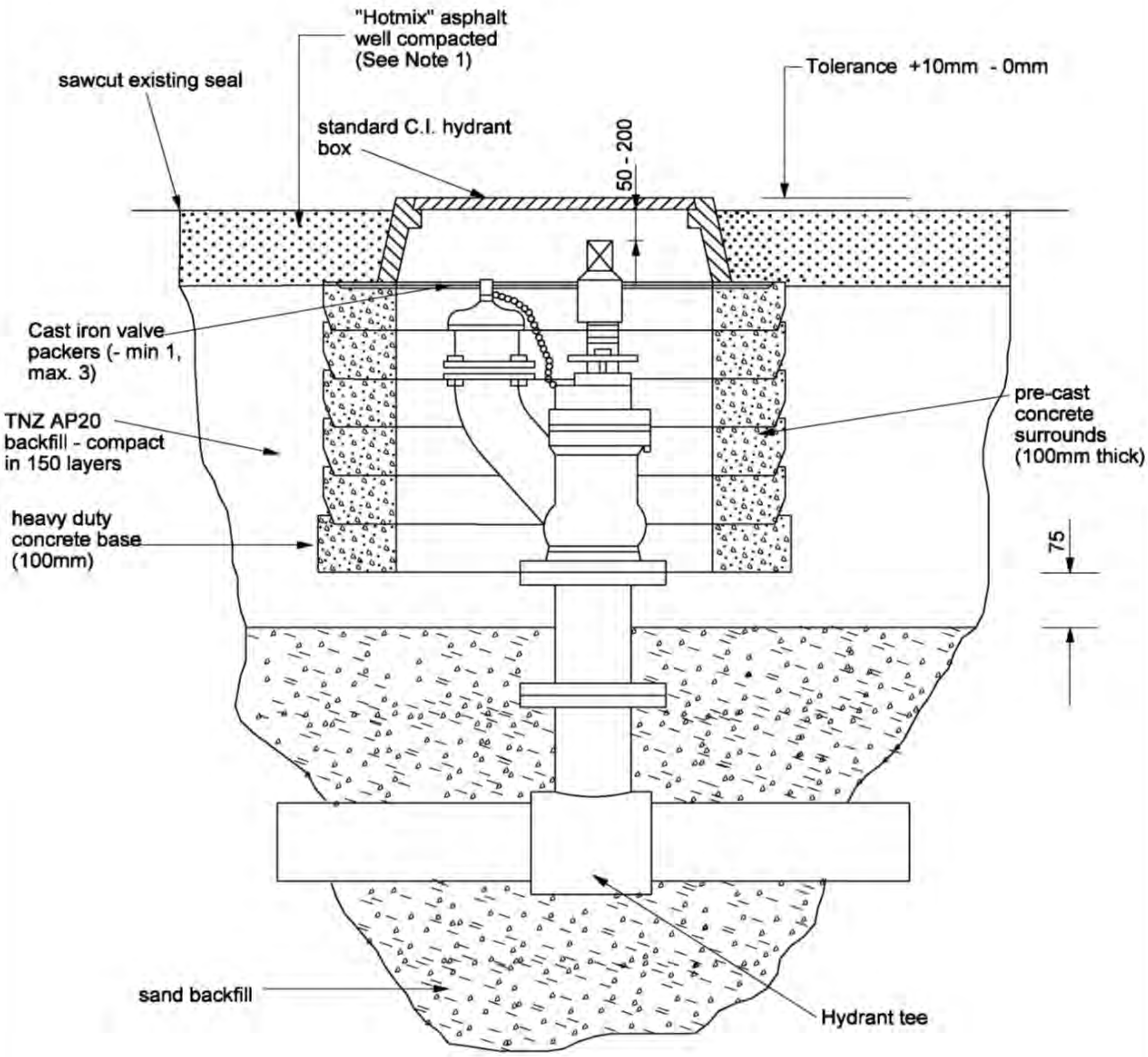
NOTES:

1. In Berm Areas

   a) the TNZ backfill can be replaced with pitsand
   b) the finished surface shall match the surrounding

Waipa District Council Service Delivery Development Manual	**SLUICE VALVE INSTALLATION CARRIAGEWAYS & BERM AREAS**	Approved by: Water Services Manager TS 623 Version: **May 2012**

Figure 143: TS 623 Sluice valve installation carriageways and berm areas



NOTES:

1. In Berm Areas
   a) the TNZ backfill can be replaced with pitsand
   b) the finished surface shall match the surrounding
2. See TS 634 for roadmarking

Waipa District Council
Service Delivery
Development Manual

FIRE HYDRANT INSTALLATION
CARRIAGEWAYS AND BERM AREAS

Approved by: Water Services Manager

TS 624

Version: **May 2012**

Figure 144: TS 624 Fire hydrant installation carriageways and berm areas

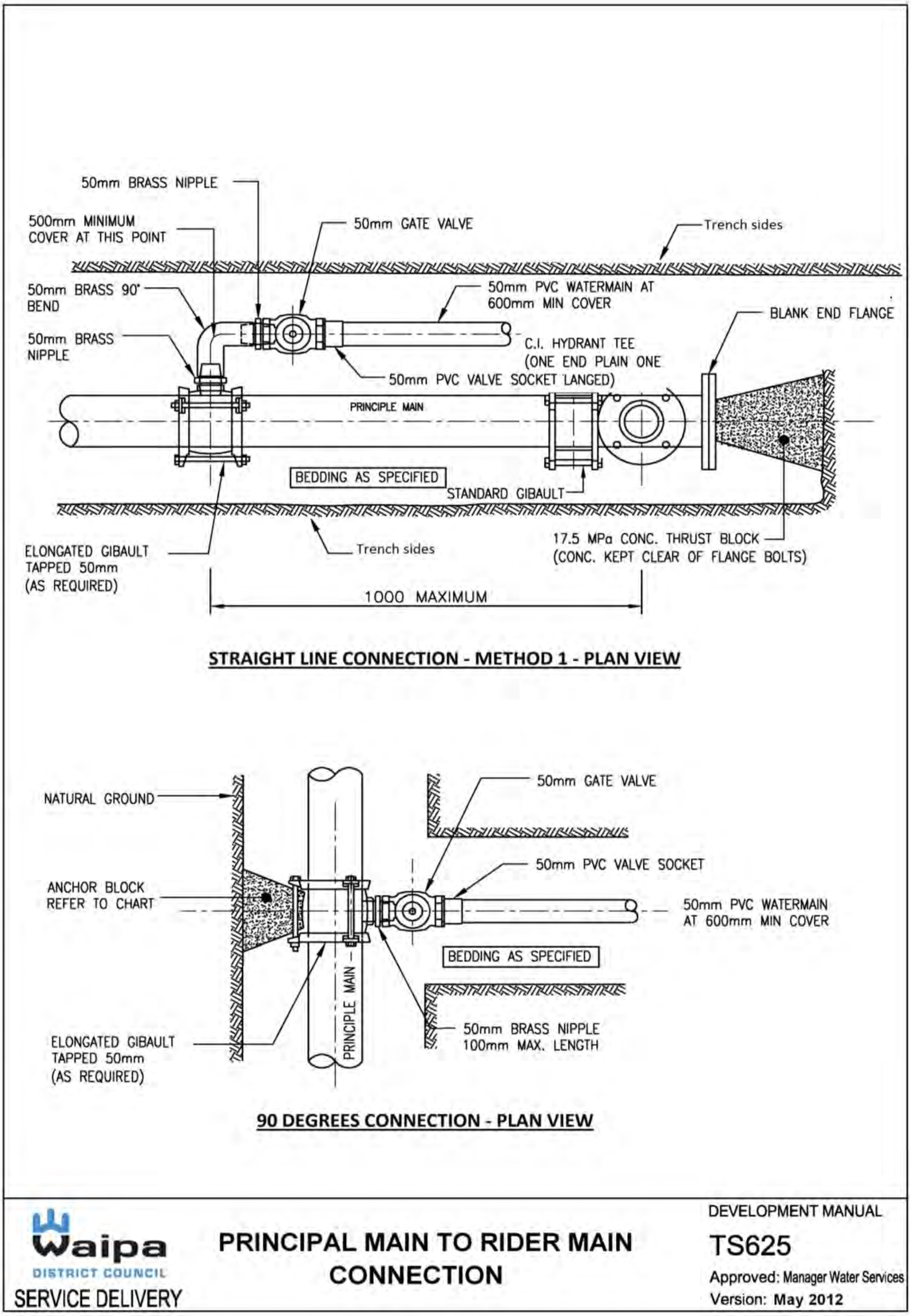
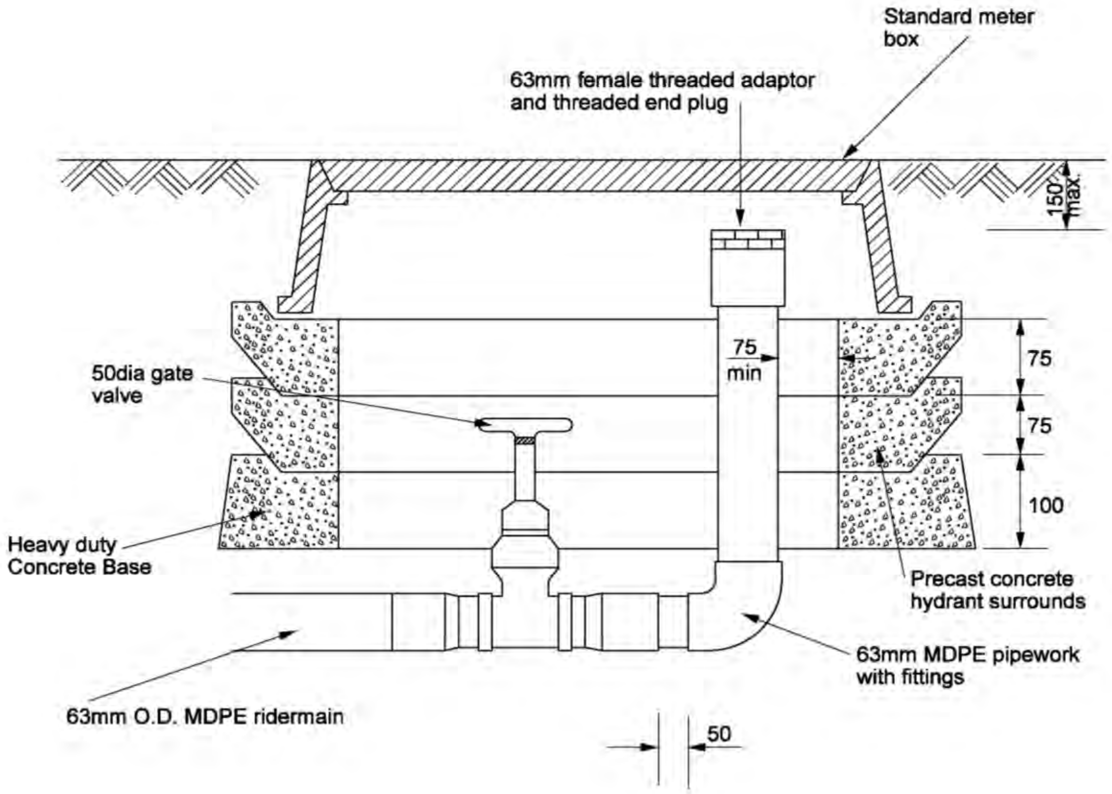


Figure 145: TS 625 Principal main to rider main connection



Waipa District Council
Service Delivery Development Manual

FLUSHOUT AT END OF RIDERMAIN

Approved by: Water Services Manager

TS 626

Version: May 2012

Figure 146: TS 626 Flushout at end of ridermain

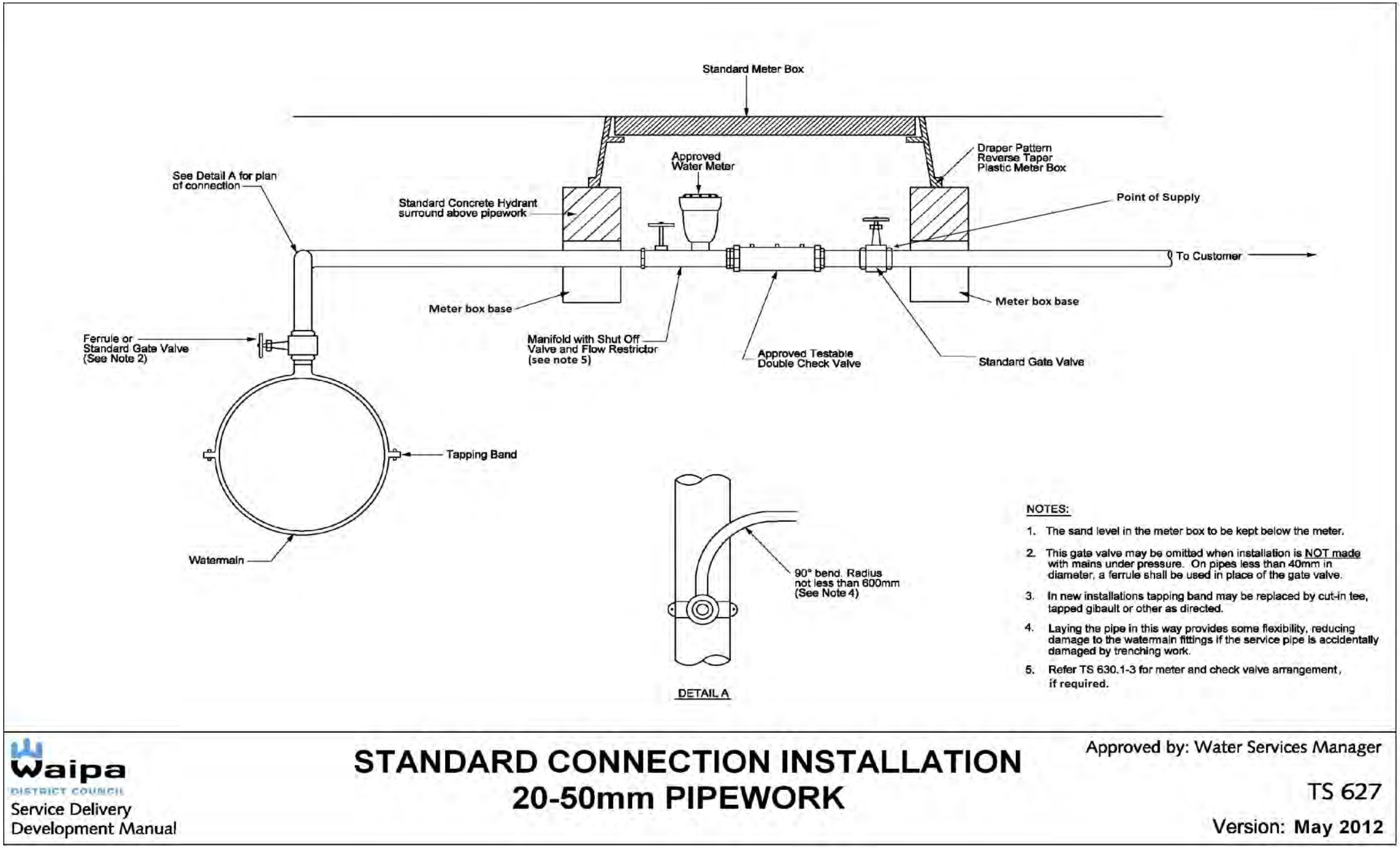
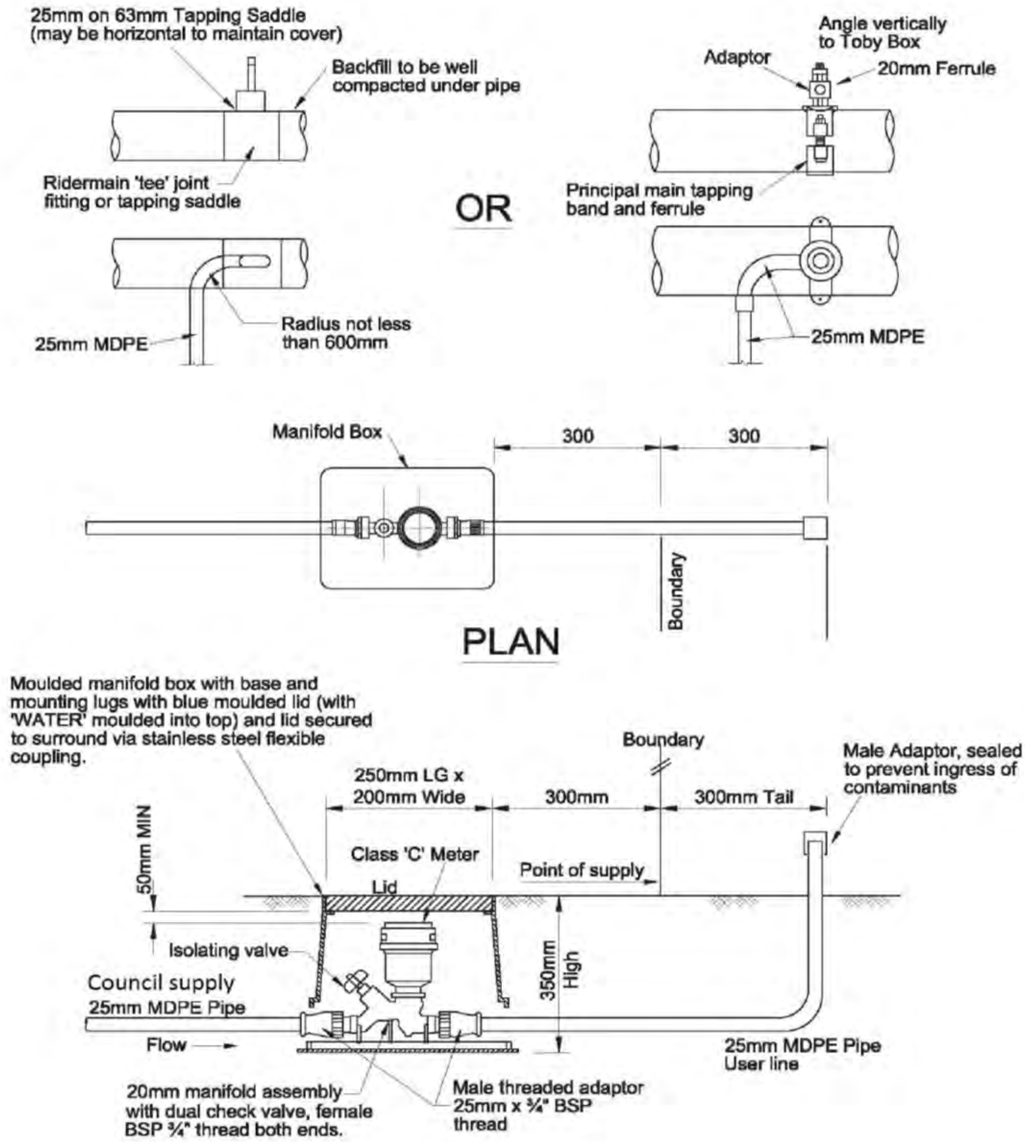


Figure 147: TS 627 Standard connection installation 20-50mm pipework



NOTE:

1. When a connection is made to an existing watermain, a gunmetal self-tapping ferrule shall be installed directly on the tapping saddle prior to the installation of other fittings.

Waipa District Council
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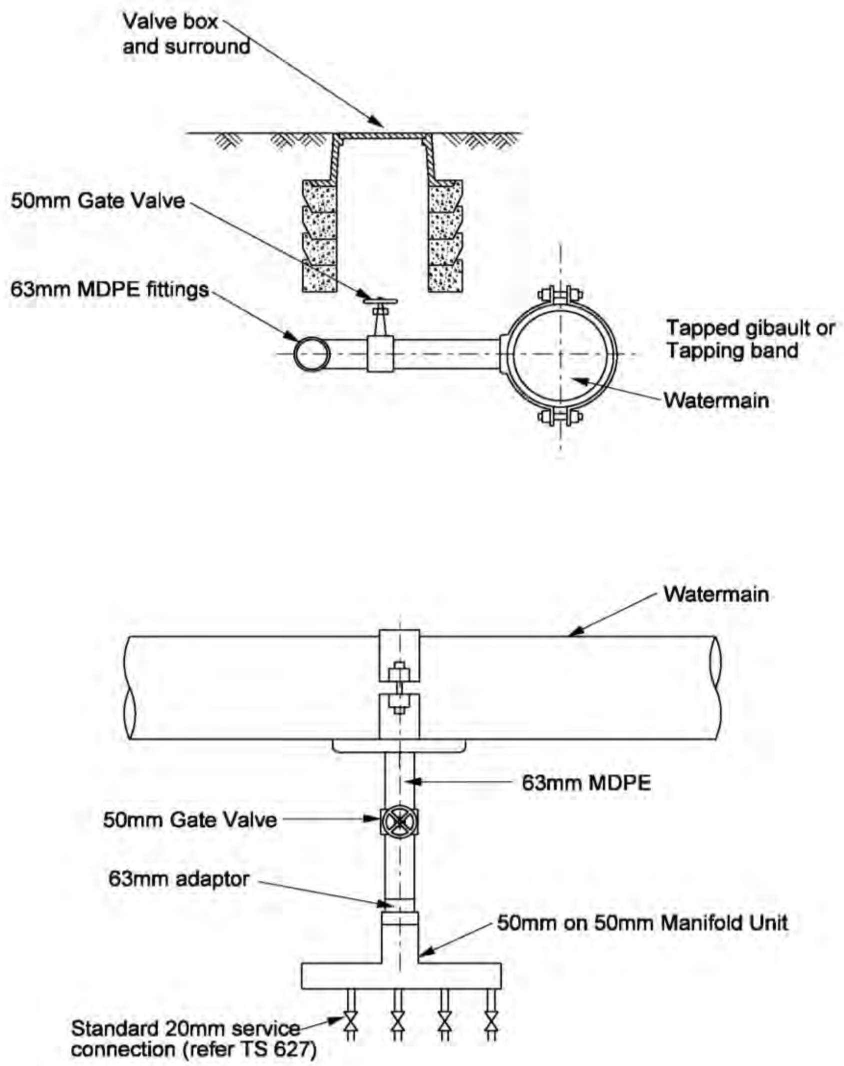
20mm METERED CONNECTIONS RESIDENTIAL

TS 627.1

Version: October 2014

Figure 148: TS 627.1 20mm metered connections residential



NOTES:

1. To be situated in a meter box.
2. Connections from ridermains to be made using 63 x 63 mdPE tee in place of a tapping band or tapped gibault. Tee to be placed horizontally to maintain standard cover.
3. This arrangement of manifold and separate supply pipes is suitable for up to 4 dwellings. For 5 or more dwellings a ridermain configuration shall be used.

Waipa District Council
Service Delivery
Development Manual

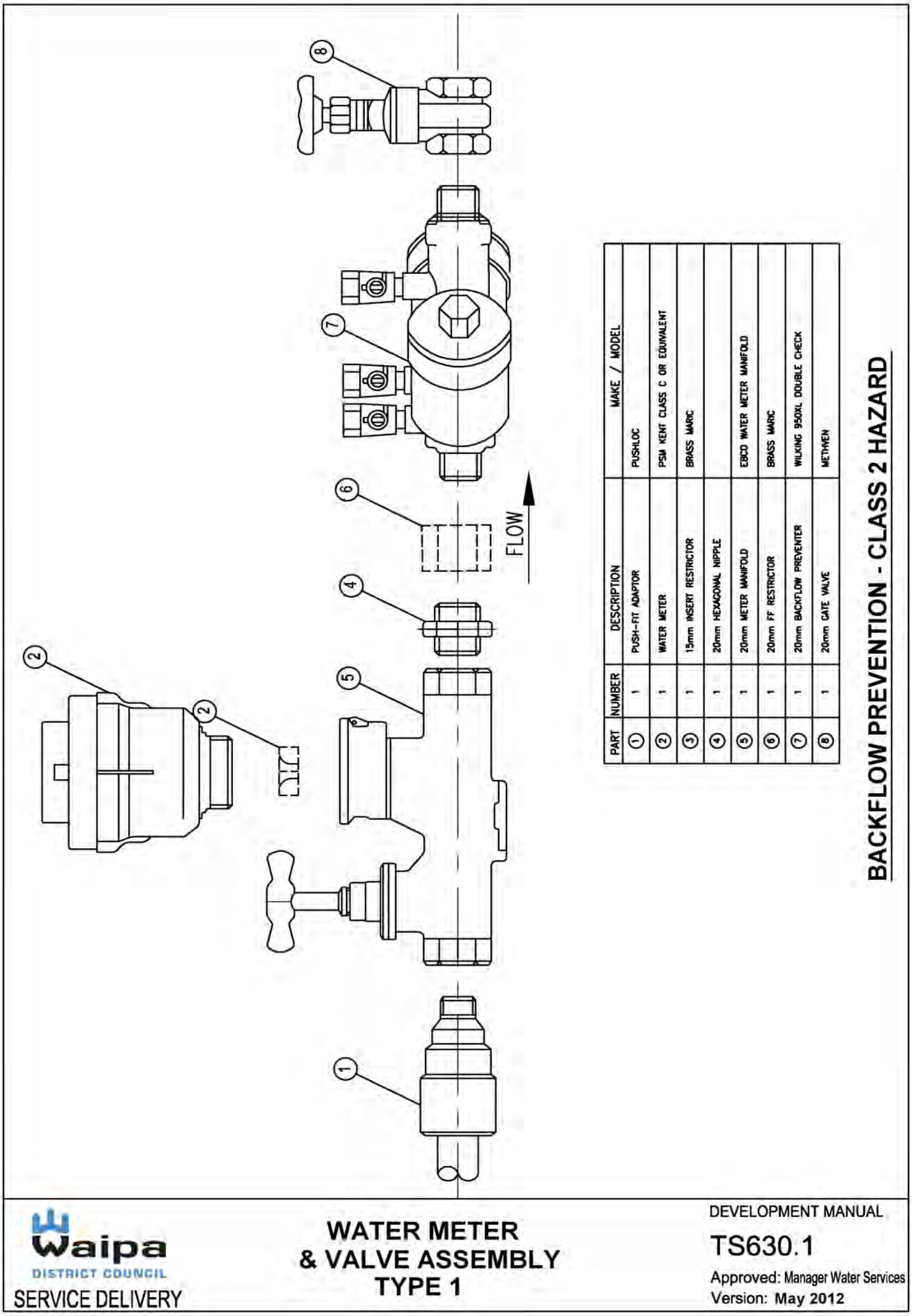
MULTI-SERVICE CONNECTIONS

Approved by: Water Services Manager

TS 629

Version: **May 2012**

Figure 149: TS 629 Multi-service connections



PART	NUMBER	DESCRIPTION	MAKE / MODEL
1	1	PUSH-FIT ADAPTOR	PUSHLOC
2	1	WATER METER	PSM KENT CLASS C OR EQUIVALENT
3	1	15mm INSERT RESTRICTOR	BRASS MARIC
4	1	20mm HEXAGONAL NIPPLE	
5	1	20mm METER MANIFOLD	EBCO WATER METER MANIFOLD
6	1	20mm FF RESTRICTOR	BRASS MARIC
7	1	20mm BACKFLOW PREVENTER	WILKING 950XL DOUBLE CHECK
8	1	20mm GATE VALVE	METHVEN

Figure 150: TS 630.1 Water meter and valve assembly type 1

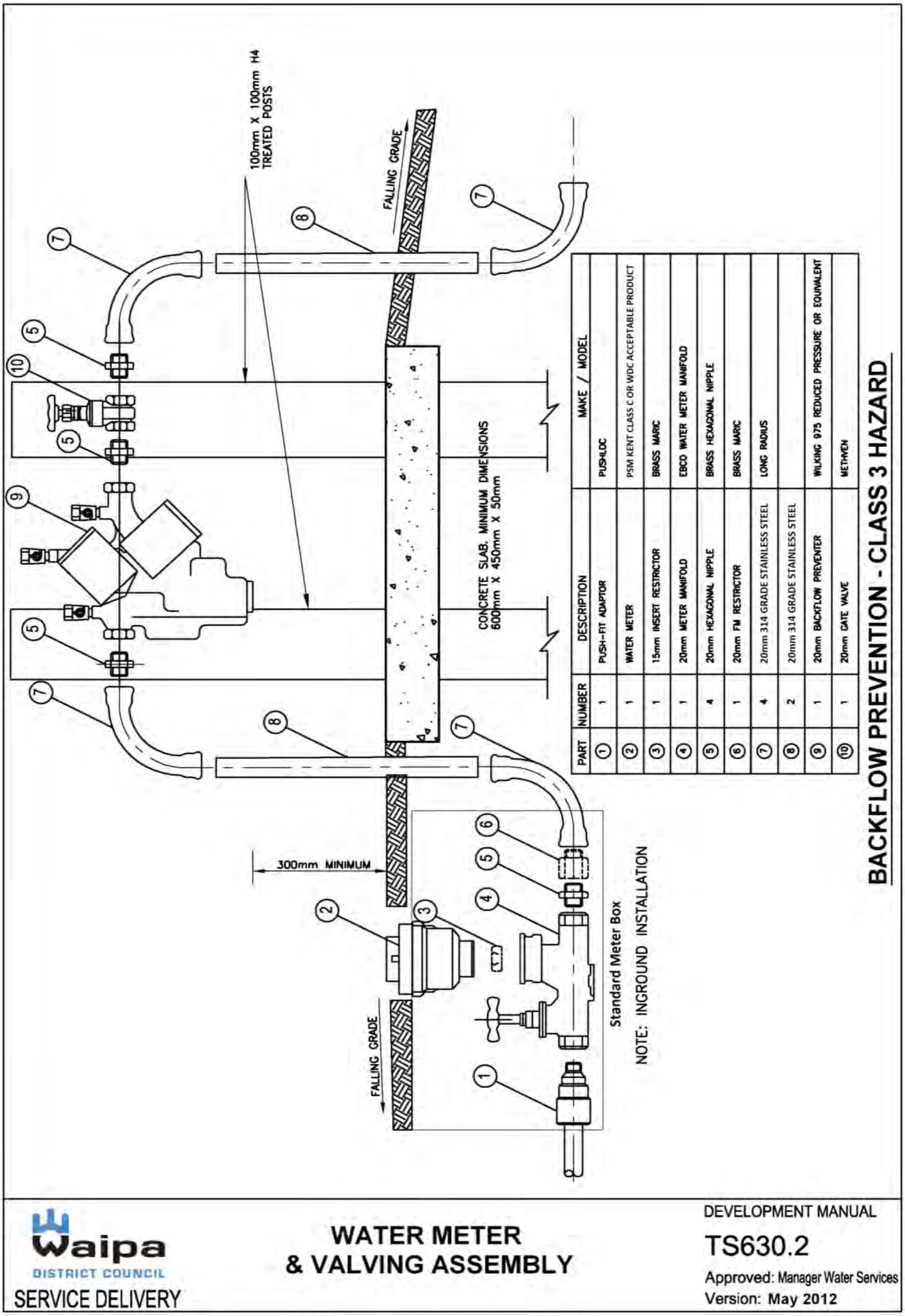
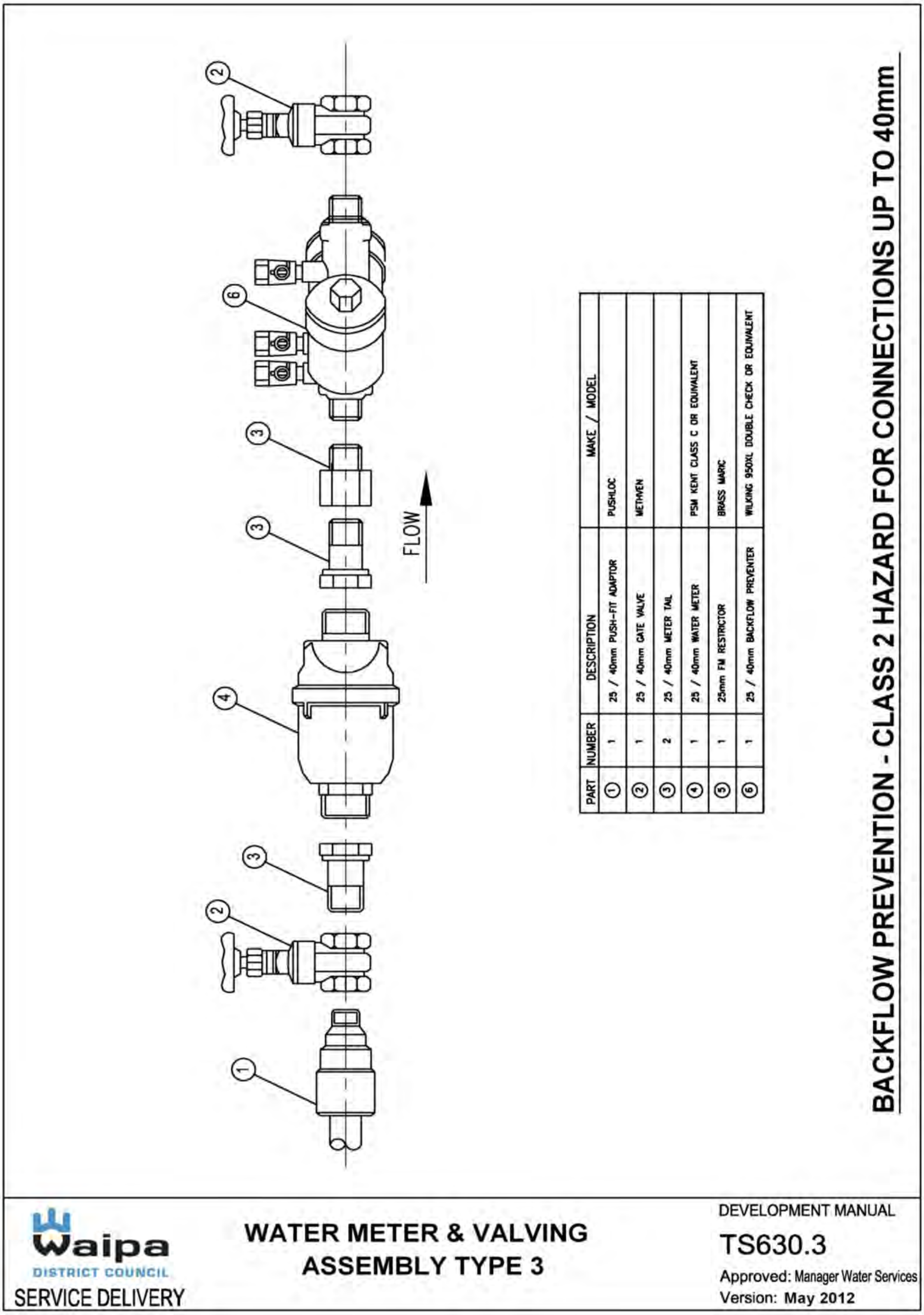


Figure 151: TS 630.2 Water meter and valving assembly



PART	NUMBER	DESCRIPTION	MAKE / MODEL
1	1	25 / 40mm PUSH-FIT ADAPTOR	PUSHLOC
2	1	25 / 40mm GATE VALVE	METHVEN
3	2	25 / 40mm METER TAIL	
4	1	25 / 40mm WATER METER	PSM KENT CLASS C OR EQUIVALENT
5	1	25mm FM RESTRICTOR	BRASS MARC
6	1	25 / 40mm BACKFLOW PREVENTER	WILKINS 950XL DOUBLE CHECK OR EQUIVALENT

Figure 152: TS 630.3 Water meter and valving assembly type 3

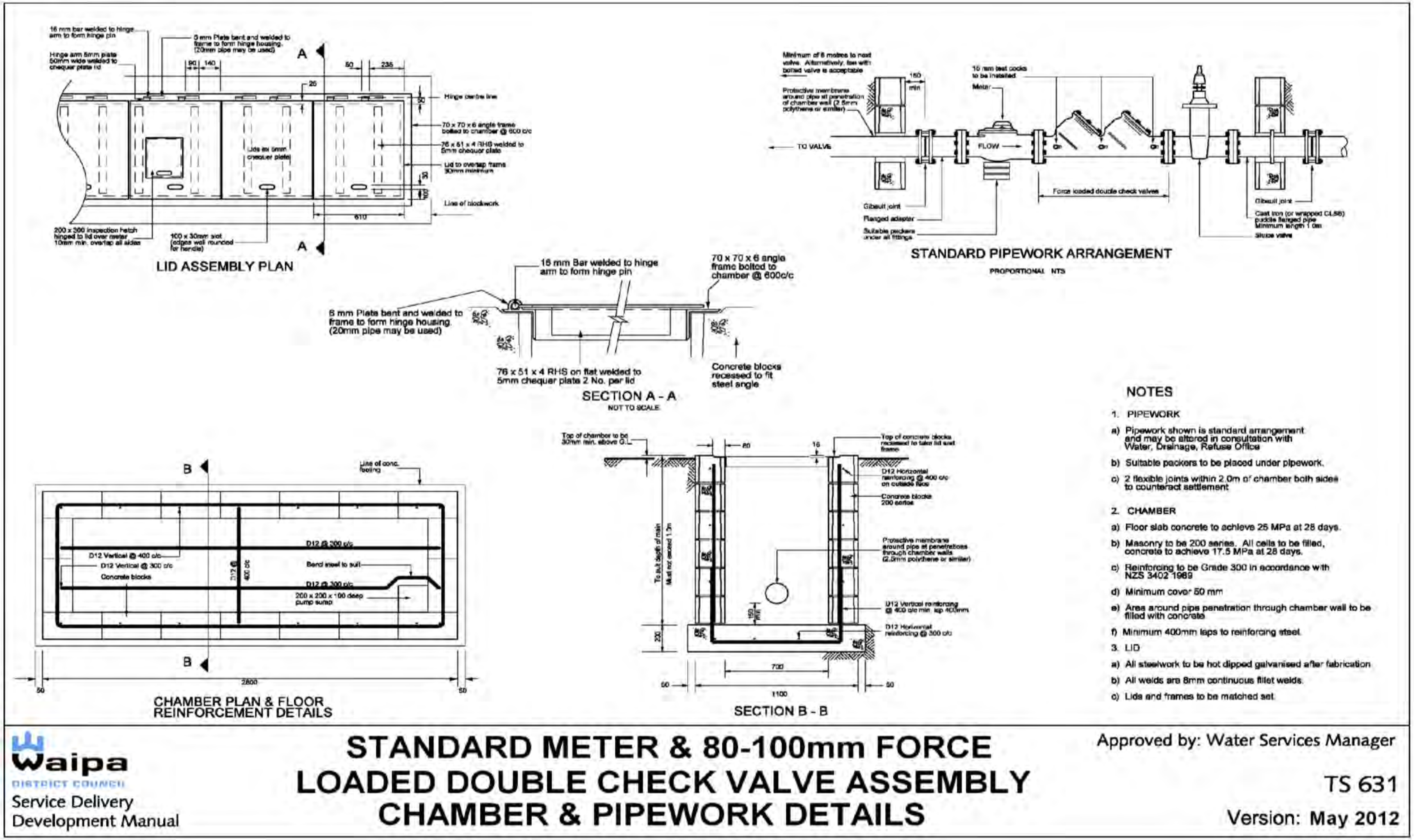


Figure 153: TS 631 Standard meter and 80-100mm force loaded double check valve assembly chamber and pipework details

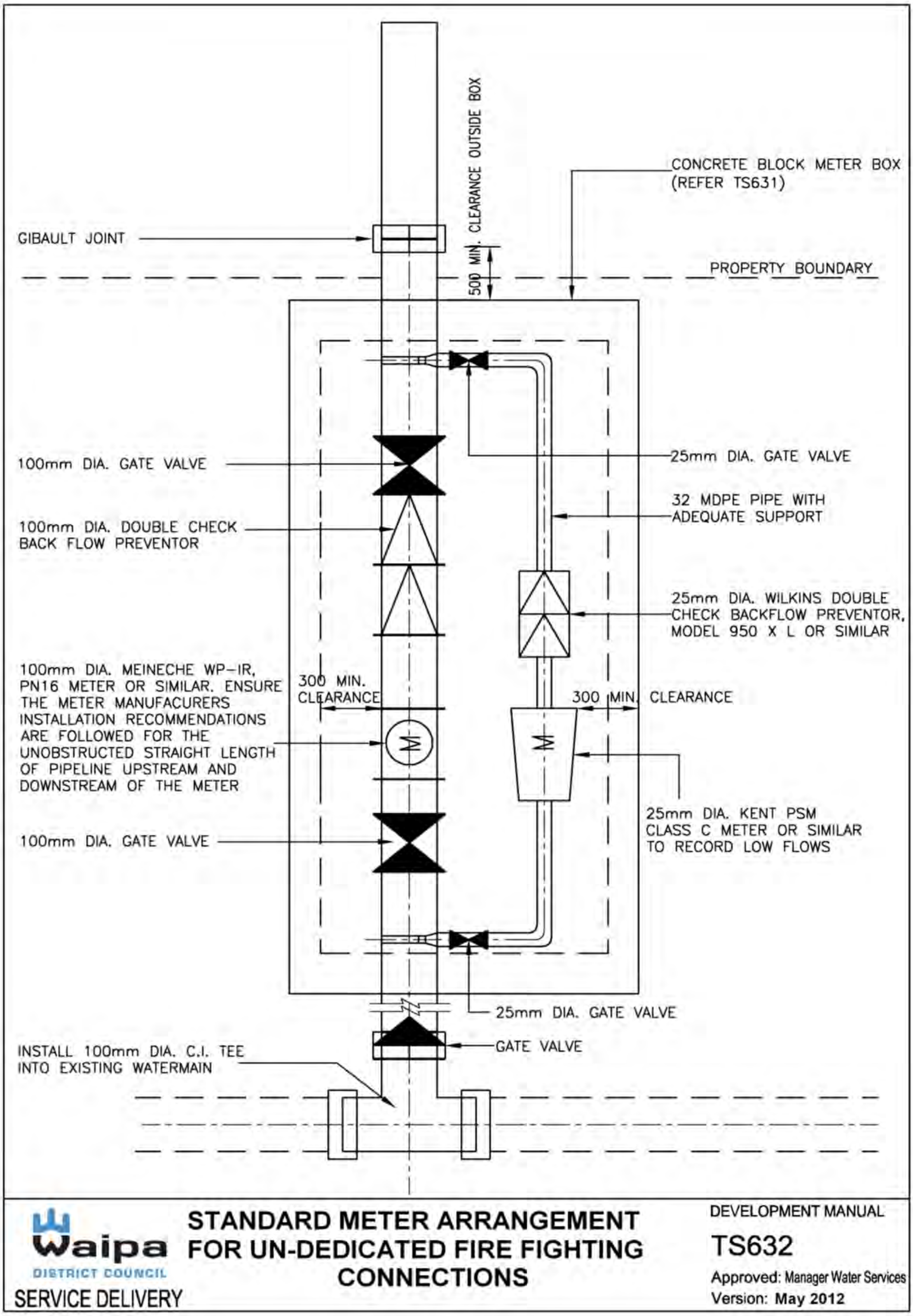


Figure 154: TS 632 Standard meter arrangement for un-dedicated fire fighting connections

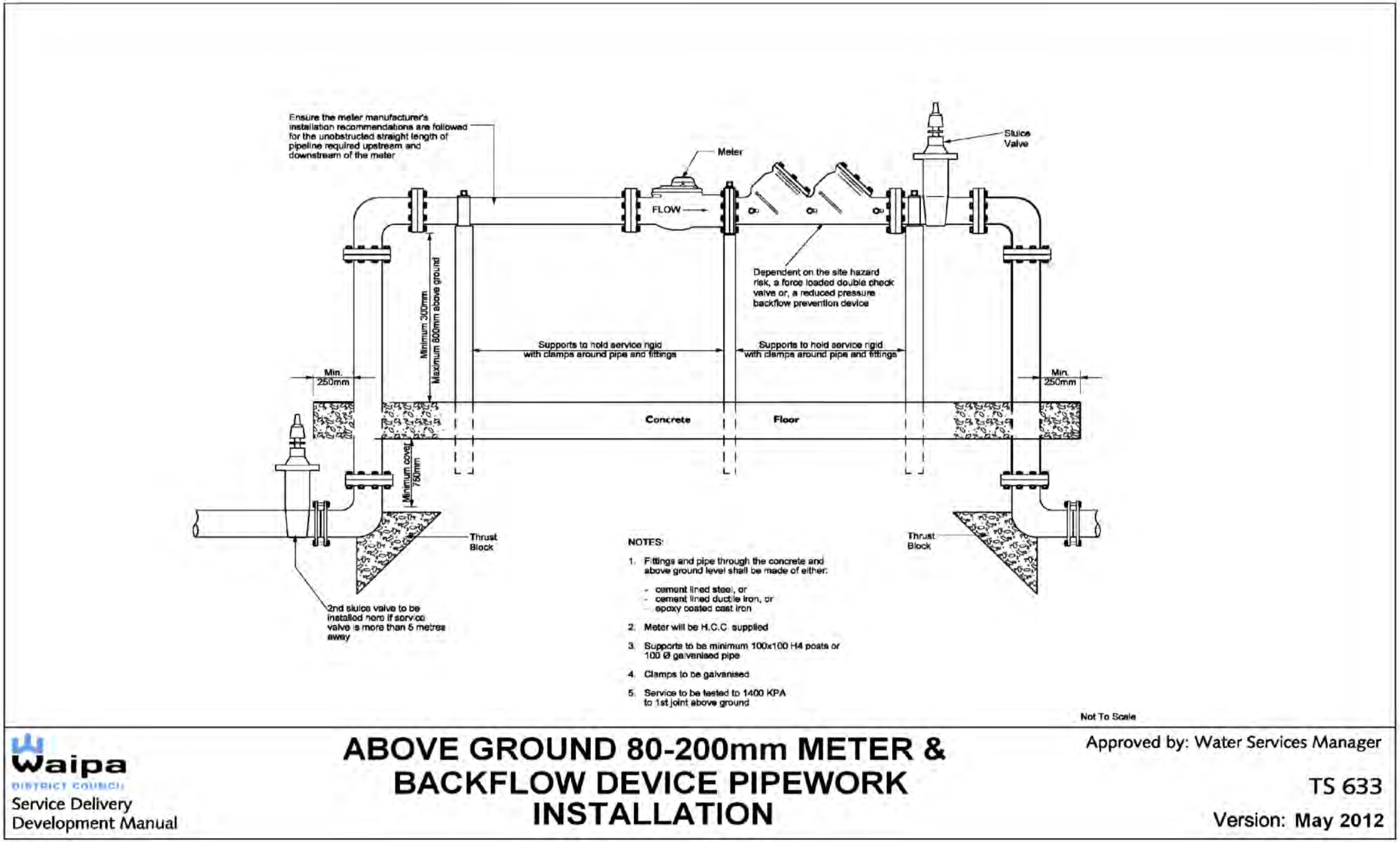


Figure 155: TS 633 Above ground 80-200mm meter and backflow device pipework installation

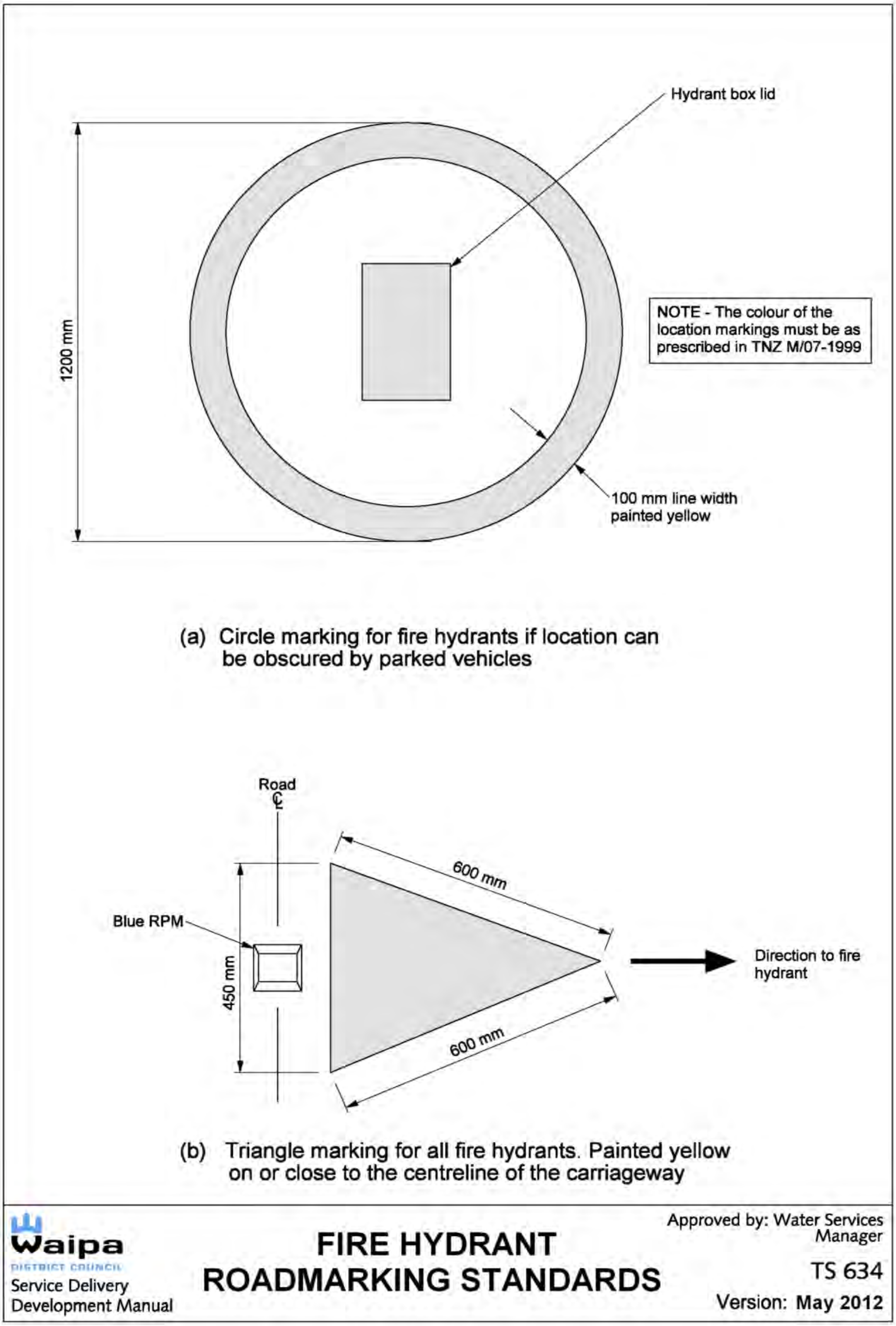


Figure 156: TS 634 Fire hydrant roadmarking standards

Part 7: Landscape Works

Table of Contents

Part 7 – Section 1: Planting

7.1.1 General

7.1.1.1 This section describes the work to be carried out to prepare planting sites and complete planting of trees, shrubs and groundcovers. It is to be read in conjunction with Planting Plans supplied and is supplementary to them. The figures show the nature and extent of the work in sufficient detail to enable the works to be carried out.

7.1.1.2 All landscape planting within the road reserve shall be designated and implemented according to Volume 2, Part 7: Street Landscaping.

7.1.2 Site Preparation

7.1.2.1 All irrigation and drainage works, utilities installation, signs or landscape structures shall be completely installed prior to planting.

7.1.2.2 Saw cutting of existing seal where required shall be undertaken between 250mm and 300mm from the back of the kerb. The cut line shall be parallel to the kerb lines wherever possible. Small radius curves shall be cut, as best as possible, using a serious of short incisions to approximate the curve arc.

7.1.3 Excavation of planting areas

7.1.3.1 Excavation shall be carried out, where necessary, to achieve either of the following required soil profiles where depths indicate are post consolidation:

(a) Landscape Bedding (refer to Figure 155: TS 633 Above ground 80-200mm meter and backflow device pipework installation):

(i) 150mm of base soil.

(ii) 150mm composite topsoil, being 70% topsoil and 30% manure or compost incorporated (refer below).

(iii) 75mm of bark or 10mm biodegradable fabric mulch (refer to Clause 7.1.10) (to be maximum of 25mm below top of kerb).

(iv) Total depth of excavation 400mm below top of kerb.

(b) Annual bedding (refer to Figure 155: TS 633 Above ground 80-200mm meter and backflow device pipework installation):

(i) As per the Landscape Bedding profile.

(ii) Total depth of excavation 325mm below top of kerb.

(iii) All waste material shall be removed from site.

(iv) Exposed subgrade shall be trimmed and levelled so that no part of the subgrade shall be above the required depth of cut.

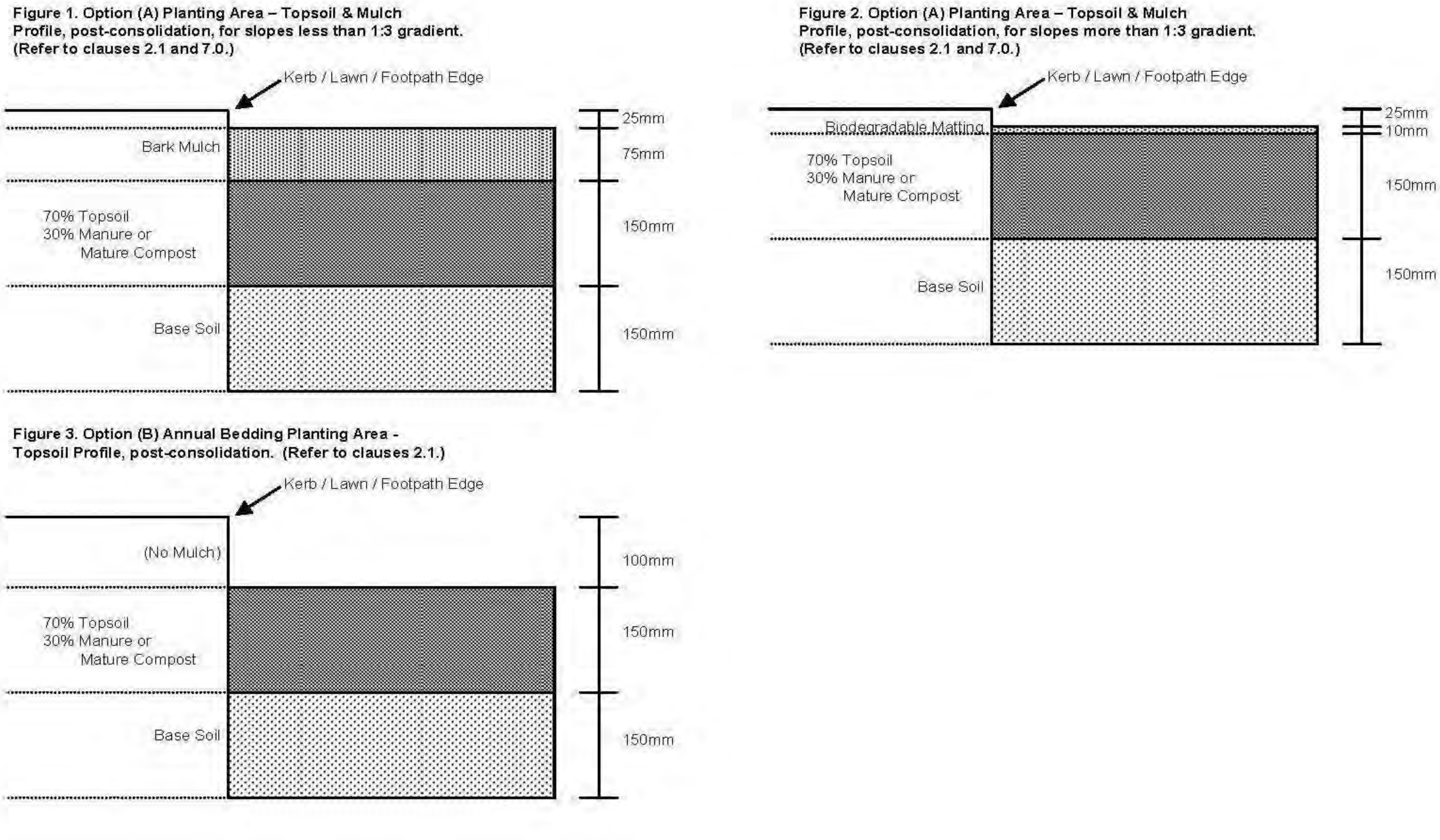


Figure 157: Excavation of planting areas

7.1.3.2 The subgrade of the proposed planting area shall be firm but free draining. If required by the Engineer, the subgrade strata shall be made permeable by the insertion of vertical holes to permeable layers, by scarifying the surface to ensure free draining through the underlying material or by undercutting the existing subgrade to a greater depth than specified. In this case, the unsuitable material shall be removed and replaced by imported pit sand to top of subgrade level.

7.1.3.3 In areas of new planting, base soil (either 2nd grade topsoil or pit sand) shall be placed evenly over the prepared subgrade and consolidated to a depth of 150mm. The sand/soil shall be placed without the Engineer's prior consent.

7.1.3.4 In all sites, except natural gully systems, where the slope gradient is steeper than 1:3, it is preferable that the embankment is either scarified or grooved on an angle to a depth of 200mm, from the top of the bank to the base. This assists topsoil adhesion and prevents separation of top 1500mm topsoil from the base material due to gravity and/or glazed/planning of base material.

7.1.3.5 Should site conditions such as gradient or compaction prevent scarifying, the embankment sub-base shall be benched to develop an adequate top soil profile. The horizontal benching depth is dependent on the slope gradient.

7.1.4 Soil for Planting Areas

7.1.4.1 Topsoil, both imported and existing on site, shall be a loam soil of good quality, free draining, free of perennial weeds and debris and capable of sustaining the required plant growth. All topsoil shall be inspected at its source and shall not be placed without the Engineer's consent.

7.1.4.2 Stockpiles of imported or site topsoil to be used in planting areas shall be left to grow vegetation and sprayed by the contractor to eliminate perennial weeds prior to their seeding and prior to the soil's use. A knockdown system herbicide without long-term residues shall be used (see Clause 7.1.14). Treated soil shall not be placed without the Engineer's consent. If, after placing the topsoil and prior to any final cultivation, there is evidence of vegetation growth, the surface shall again be sprayed by the Contractor with a knockdown systemic herbicide. Areas so treated shall not be planted for at least two weeks.

7.1.4.3 All new planting areas on insitu topsoil shall be deep ripped to 300mm prior to planting. Heavily compacted soils shall be deep ripped to 600mm. If, in the Engineer's opinion, the soil has consolidated to a density unsuitable for planting out at the time of planting, re-cultivation of soil to a depth of 150mm shall be undertaken by the Contractor.

7.1.4.4 All new planting areas shall be filled with topsoil or excavated (as appropriate), to be 100mm below adjacent paving, kerbs or lawns after cultivation and reasonable consolidation.

7.1.4.5 Prior to planting, all planting areas shall be cleaned of rubbish, stones, unwanted vegetation and other debris.

7.1.4.6 At planting, all planting areas shall have minimum uniform soil moisture level or greater than 50% to 200mm depth.

7.1.5 Soil Laboratory Testing

7.1.5.1 At Council's discretion, When 2,500 or more shrubs and/or trees are to be planted, the topsoil shall require nutrient laboratory testing. The minimum number of sample sited depends on the following criteria:

(a) If the topsoil has already been installed on site or existing insitu top soil is being used for planting, a minimum of 10 soil samples shall be taken throughout the site.

(b) If the topsoil has yet to be installed, then a minimum of three soil samples shall be taken at its source, ensuring that the same topsoil tested in stalled on the site after Council has approved its use.

7.1.5.2 Soil samples shall be taken as per sampling instructions provided by the soil-testing laboratory.

7.1.5.3 The laboratory results and a plan indicating sample site locations shall be provided to Council prior to planting. Planting shall not proceed without Council's soil test approval. Council reserves the right to undertake further topsoil sample testing prior to soil test approval, should it be seemed necessary.

7.1.5.4 Where sample results are beyond acceptable parameters, the topsoil shall be modified to ensure that it aligns within these parameters or another conforming topsoil source shall be identified to be used for planting. Soils with a high pH level may require Extractable Aluminium testing at Council's discretion.

7.1.5.5 The following soil testing is required per sample:

Table 50: Sample Soil Testing

Soil Component	Acceptable Parameter
pH	5.8 - 6.3 (dependant on plant species requirements)
Phosphorus	30 - 80 ug/mL
Potassium	0.5 - 1.0 me/100g
Calcium	6 - 12 me/100g
Magnesium	1 - 3 me/100g
Sodium	0 - 0.5 me/100g
CEC	12 - 25 me/100g
Base Saturation	50 - 85%
Volume Weight	0.60 - 1.00 g/mL
Available Nitrogen (15 cm Depth)	150 - 250 kg/ha
Organic Matter	7- 17%
Total Nitrogen	0.2 - 05%

7.1.5.6 When less than 2,500 shrubs and/or trees are to installed, the topsoil may require laboratory testing, as per above, at Council's discretion.

7.1.6 Plant materials

7.1.6.1 All plants shall be supplied true to the species and grades specified on the approved landscape plans. All street trees, unless specified otherwise, shall be a minimum grade of 2m with a 30mm calliper. Other tree grades shall be supplied as follows:

(a) 1.5m – 2.5m specimens shall have a calliper of 30 – 50mm.

(b) 2.5m – 3.5m specimens shall have a calliper of 50 – 70mm.

(c) 3.5m – 5m specimens shall have a calliper of 70 – 100mm.

7.1.6.2 All other stock shall be a minimum pb3 grade for groundcover and pb5 grade for shrubs.

7.1.6.3 All plants to be advanced specimens for their grade and to be well furnished and rooted relative to container size.

7.1.6.4 No substitution of species or grade shall be made without the written approval of the Engineer. If species or grades specified are unobtainable, the Engineer may approve alternatives. Smaller grades may require an increased planting density and numbers, which shall be at the Contractor's expense.

7.1.6.5 All plant material supplied shall be clearly labelled stating the plant's Latin name and the supplier's name, (one label per plant ground planted). These labels shall be removed on completion of planting.

7.1.6.6 The contractor shall give the Engineer not less than five days' notice of dates upon which plants are to be delivered on site, so that arrangements can be made for quality inspection and confirmation of identification of plant material.

7.1.6.7 Plants shall be well branched, symmetrical and of typical habit for the species. All plants shall be nursery stock of good form, healthy, vigorous with strong fibrous root systems and free of all pests and diseases.

7.1.6.8 All trees shall be supplied with the central leader intact – no pruning of the central leader shall have taken place. All torn or damaged roots shall be pruned before dispatch. All stock shall be well rooted but not root bound. Open ground stock shall be well wrenched. All root balls and containers shall be free of all weeds. Plants shall be well 'hardened – off' prior to supply.

7.1.6.9 The Contractor shall ensure that all plants and their roots shall be maintained in a moist environment, protected from adverse conditions such as drying winds, frost or water logging. All roots much be covered during transit and storage to prevent desiccation or damage.

7.1.7 Installation of plants

7.1.7.1 All of the planting shall normally be undertaken between April 1 and October 1. Planting for deciduous stock shall take place between 1 June and 15 September. Planting not undertaken in this period is subject to additional maintenance requirements.

7.1.7.2 All plants shall be planted on the day of delivery to the site. Plants shall be planted in the locations shown on the plans and in accordance with good horticultural practices. Unless otherwise indicated on the plans, all plants shall be planted in a random pattern at the densities specified.

7.1.7.3 Planting holes shall be excavated a minimum of 150mm wider and 150mm deeper than the root ball. For large trees the planting hole minimum dimensions shall be:

(a) 1.5m – 2.5m trees: 300 x 300 x 300mm.

(b) 2.5m – 3.5m trees: 750 x 750 x 500mm.

(c) 3.5m – 5.0m trees: 1000 x 1000 x 500mm.

7.1.7.4 The base of the planting hole shall be forked to a minimum depth of 100mm and any stones over 50mm diameter or poor quality soil shall be removed from the hole. The sides of the planting hole shall also be loosened and the surrounding ground to two times the root ball diameter to be 'forked' over to reduce compaction.

7.1.7.5 Where topsoil is unsuitable for backfilling, the Contractor shall use imported or modified topsoil for backfilling. The imported topsoil shall be a free drainage loam of a quality complying with that specified in Clause 7.1.4 and subject to inspection prior to placement.

7.1.7.6 Modified backfill soil shall consist of a homogenous mixture of the following:

(a) Seven parts by volume of good quality, friable topsoil from the site or imported.

(b) Parts by volume of approved compost e.g. that produced from the Hamilton Organic Recycling Centre.

(c) Parts by volume of coarse river sand.

(d) Appropriate levels of fertiliser where specified in Clause 7.1.9.

7.1.7.7 The contractor shall not plant into waterlogged soil or holes that are full or part full with water. If the water table is high and the Contractor cannot disperse the water from the hole, the Contractor shall consult the Engineer as to whether planting can continue.

7.1.7.8 All plant containers or wrapping and, if necessary, any root bound roots shall be removed prior to planting. Leaves and branches shall be pruned to assist plant establishment, if necessary. Generally, the nursery soil level is clearly identifiable on the main stem of the plant and replanting should not exceed this level.

7.1.7.9 The hole shall first be backfilled with 150mm of consolidated soil or soil mix, mounding the soil centre to aid even spread of the roots.

7.1.7.10 The plants shall be placed in the hole ensuring that the final soil level is equal to or not exceeding 10mm above the nursery soil level and at an appropriate depth to ensure sustained growth. Roots shall be spread evenly to their natural extent without touching the sides of the hole or being distorted in any way. Bare rooted material shall be shaken to ensure even root spread.

7.1.7.11 For trees, the hole shall be backfilled with topsoil or soil mix in 150mm layers, firming each layer. For container plants and shrubs, the hole shall be filled to half its depth, firmed, then completely filled and firmed again. Upon completion of backfilling, the plants shall be well watered in.

7.1.7.12 All road reserve planting installation is to comply with Volume 2, Part 7: Street Landscaping, especially in respect to traffic islands, berms and roundabouts.

7.1.8 Irrigation

7.1.8.1 During installation and establishment, the contractor shall ensure that soil in all planting areas is moist enough to maintain active plant growth throughout the growing season (September – May). Irrigation systems may be required to achieve a high level of site presentation or in areas of annual bedding display planting.

7.1.8.2 Where an irrigation system is required to be installed, 'Toro' brand or a similar approved brand shall be used. The system shall be capable of providing a minimum soil moisture level of 50% to 200mm depth throughout the planted areas or within the drip line of trees specified. It shall be capable of fully re-wetting the root zone to 200mm depth when the irrigation is applied and shall be fully automated to operate between 1am and 6am when moisture levels drop below 50%.

7.1.9 Fertiliser

7.1.9.1 Generally, some form of fertiliser shall be applied to planting. For shrubs and trees, all fertiliser shall be well mixed with a backfilled soil. For bedding or groundcover, all fertiliser shall be well mixed with the site topsoil prior to planting. Fertilisers shall be either an approved pelletised natural or organic fertiliser or an approved synthetic fertiliser.

7.1.9.2 The following synthetic fertilisers are acceptable unless alternatives have been approved:

(a) For bedding or perennial (groundcover) planting – 'Nitrophoska Blue' at 100g/m^2.

(b) For shrub planting – 'Mag Amp' at 40g/shrub.

(c) For tree planting – 'Mag Amp' at 80g/tree.

7.1.9.3 An exception to these is for Proteaceous species and ferns which should, on no account, be fertilised with Phosphate (P) containing fertilisers.

7.1.10 Mulch

7.1.10.1 Where indicated in the schedule and on the plans, the Contractor shall provide mulching to newly planted areas. In addition, all individual trees including street trees shall be mulched to a radius of 500mm.

7.1.11 Flat site mulch

7.1.11.1 On sites flatter than 1:3, bark mulch shall be spread evenly to minimum depth of 75mm and maximum of 100mm except that around tree trunks and a slight hollow shall be left. The mulch shall be either coarse or fine, untreated, shredded pine bark as scheduled and shall be approved by the Engineer prior to spreading. The bark mulch shall be clean and free of soil or sawdust. Coarse bark should have an average diameter of 50mm and with no pieces longer than 100mm. Fine bark should have no pieces longer than 40mm and be evenly graded. Coarse bark is appropriate for most locations. Fine bark may be specified by Council in Commercial zones or for other specified locations.

7.1.11.2 All care shall be taken in placing the bark mulch so as to protect the plants and any irrigation system. All damage to the plants or irrigation system shall be rectified at the Contractor's expense.

(a) *Steep Site Mulch*

(i) On slopes steeper than 1:3, mulching for weed control shall consist of a Council approved matting with the following criteria:

- The matting consists of biodegradable mulching fabric or material without synthetic geonet or synthetic geotextile content.
- It shall be installed according to manufacturer's instructions prior to planting, ensuring that the mulch will not uplift due to inundation or wildlife exposure (for example, from Pukeko birds).
- The mulching fabric shall have a minimum 24 month life expectancy and be fully biodegradable into soil within 6 years.

(ii) At Engineers discretion, mat rounds may be used instead of matting. These shall be a minimum 500mm diameter and have the same characteristics as the matting.

(iii) On steep slopes with erosion issues that are receiving planting, a biodegradable netting with no geotextile or geonet content shall be used, at the Engineers discretion. The netting will have an expected lifespan of at least 36 months. This may be placed on top of the mulch matting and shall be installed according to manufacturer's instructions. The netting is not intended to suppress weeds and should be used in conjunction with mulch matting or rounds.

7.1.12 Staking and protection

7.1.12.1 Newly planted trees shall be firmly staked and tied as follows:

(a) 1.5m – 2.5m trees shall be staked with two 50 x 50 x 1.8m stakes with at least 1m exposed.

(b) 2.5m – 5m trees shall be staked with two 75 x 75 x 2.4m stakes with at least 1.5m exposed or with a system of ground anchors approved by the Engineer and specified in the landscape plans.

7.1.12.2 All street trees shall be staked with two 50 x 50 x 1.8m stakes.

7.1.12.3 All stakes shall be rough sawn Pinus H5 treated. Stakes shall be placed with at least one third of their length in the ground.

7.1.12.4 Two flexible ties per stake shall be attached. Ties shall be tensioned to avoid chafing of the tree against the stakes. All ties shall be fixed to the stakes. Ties shall be of a type approved by the Engineer prior to tying.

7.1.12.5 Newly planted areas shall be protected from any possible construction or other damage. To ensure protection for the duration of the site works, the Contractor shall, if necessary, provide and maintain a 1m minimum height barrier around the plants.

7.1.12.6 Similarly, during planting, existing structures, turn, other planting, or irrigation system shall be protected by appropriate means from possible damage.

7.1.13 Pruning

7.1.13.1 On-going pruning during the maintenance period shall concentrate on producing good plant form, ground coverage, removal of spent flowers, healthy growth, preventing plants smothering other planting, keeping access ways clear of growth and maintaining visibility.

7.1.13.2 Trees shall be pruned up to provide good visibility for vehicles and pedestrians at all times. (Long term, trees should have a clear stem to 2.4m). Pruning should be carried out in accordance with acceptable modern arboriculture practices.

7.1.13.3 Shrubs shall be pruned down to 450mm height maximum, for good visibility at intersection and other visibility splays.

7.1.13.4 Pruning of shrubs and groundcovers shall use techniques which maintain the natural form and habit of the plants. Pruning shall avoid “hedging” techniques which create strong visual lines and detract from the natural texture and form of the plants. Groundcover plants shall be pruned by undercutting at the edges.

7.1.13.5 Planting designed as hedges shall be clipped only after spring or autumn growth flushes. Hedges grown for flowers shall be clipped only after completion of flowering. Hedge trimming shall be carried out in a way that will promote even growth to the specified height and width.

7.1.13.6 All pruning’s shall be removed from the planted areas and the site to maintain these in a clean and tidy condition.

7.1.14 Chemical applications (weed & pest control)

7.1.14.1 All chemical application on planted areas shall be carried out by qualified, trained personnel and according to the Growsafe Code of Practice for Use Pesticides and Herbicides; NZS 8409 ‘The Agrichemical Users Code of Practice’ and any manufacturers’ directions.

7.1.14.2 All spraying operations shall be carried out in windless, dry conditions, when rain is not imminent for at least 12 hours and at times which minimise possible hazards or disruption to the public, animals or other beneficial fauna. Care shall be taken to prevent spray drifting onto non-target areas or plants and comply with notification requirements as required by the proposed Waikato Regional Plan.

7.1.14.3 Herbicides may be used to control weeds or excess grass growth over structures, surfaces or planting areas. Approved herbicides are:

(a) Glyphosate with Codacide oil and Pulse Penetrant for general use.

(b) Glyphosate + "Versatil" for persistent perennial weeds.

(c) Tordon Bushkiller or Escort for spot spraying of woody weeds only.

7.1.14.4 All use of any other herbicides shall be first approved by the Engineer.

7.1.14.5 All trees in grassed areas shall have a weed release spot spray applied between 4 and 6 months after planting. General weed control shall be carried out, whenever necessary, to maintain the planting weed-free.

7.1.14.6 Chemical weed control in planting areas shall be kept within the edge of the planting beds, within a maximum of 500mm of tree trunks, within 50mm of the edge of any undefined mulch surface and within 50mm of any posts or the base of any landscape structures.

7.1.14.7 Pesticide use shall be effected to the minimum level required for healthy plant growth to be maintained. All pesticides shall be approved for use by the Engineer. Pesticides used shall be selected for the lowest oral and epidermal toxicity range possible and shall be types which pose a minimum risk to bees or other beneficial insects.

7.1.15 Maintenance requirements

7.1.15.1 The Contractor (or Developer) shall be responsible for the routine maintenance of the landscape planting works including weeding, mulching, replacements of plants and watering during the defects liability period.

7.1.16 Defects liability period

7.1.16.1 The planting defects liability period shall be 6 months from completion and acceptance of the landscape planting works or upon release of any implementation bond held for uncompleted landscaping, except that id planting is carried out between October 1 and April 1 when the defects liability period shall be extended for an additional 6 months.

7.1.16.2 During and at the end of the defect liability period, the following minimum standards are required:

(a) All top soiled areas prior to planting and mulching shall be weed-free.

(b) All planted areas shall be kept weed-free.

(c) All planted areas including street trees shall be mulched with clean fabric, fibre or loose fill mulch.

(d) All trees and other planting shall be vigorous and healthy, free of disease and free of dead growth or dead flowers.

(e) All planted areas shall be moist to at least 200mm depth.

(f) Planting is becoming well established. Any plants failing during this period be replaced to the specification, to ensure adequate establishment of the planting.

(g) Plant growth shall be trimmed to the extent and height required for any visibility splays.

(h) All tree stakes and ties shall be intact and correctly installed.

7.1.17 Weed free requirement

7.1.17.1 At the end of the defects liability period, no individual weed must be larger than 30mm x 30mm x 30mm high. Furthermore, no weeds that are at least 10mm x 10mm x 10mm in size shall exceed no more than 5m². Furthermore, no perennial grass weeds will be accepted.

7.1.18 As-built plans

7.1.18.1 The Contractor shall supply one copy of the as-built plans recording any variation from the approved landscape plans and this specification. Refer Volume 1 of this Manual.

7.1.19 Defects liability period inspection

7.1.19.1 The Contractor, after completing all proposed works, shall advise the Parks and Reserve Team Leader, Council, at least 7 working days prior to the proposed commencement of the defects liability period and shall be available for a joint pre-defects liability period inspection.

7.1.20 Defects liability period – final inspection

7.1.20.1 The Contractor, at the end of the required defects liability period, shall advise the Parks and Reserve Team Leader, Council, at least 7 working days prior to the proposed commencement of Council’s acceptance of the asset and its on-going maintenance.

Part 7 – Section 2: Grassing and Turfing

7.2.1 General

7.2.1.1 This section covers the preparation and sowing of any new-grassed areas or those requiring reinstatement or turfing of such areas. It includes berms, lawns and banks.

7.2.2 Preparation for sowing or turfing

7.2.2.1 Grassing and fertilising shall be carried out over all existing grassed areas disturbed by contract activity and other specified areas that may require reinstatement. In existing grassed areas, excessive compaction of the subsoil shall be relieved by subsoiling or similar, as required, to achieve satisfactory long-term growing conditions.

7.2.2.2 All topsoil removed to permit contract works to be carried out shall be stockpiled for reuse.

7.2.2.3 All new grass areas shall be built on subgrades prepared to a CBR of not less than five and no greater than seven. A minimum 75mm layer of clean, friable peat loam or sandy loam topsoil, free from perennial weeds, stones, and rubbish shall be placed on the subgrade. If the subgrade has been backfilled with sand or if the existing subgrade material is of a sandy nature then the 75mm topsoil shall be a heavier silt loam.

7.2.2.4 The topsoil shall be lightly compacted or consolidated and may be laid proud of adjoining features (such as kerb and channel, path, crossings, etc.) by not more than 25mm to allow for settlement, provided that it does not cause water to pond on any footpath or vehicle crossing area. All finish levels shall be those specified on the plans or to a 2-2.5% slope. New areas shall be neatly contoured to adjoining grassed areas. The top 25mm of topsoil shall have a loose tilth. No soil shall be cultivated or handled when the moisture content is at a level where soil structure damage will result.

7.2.2.5 Perennial weeds shall be sprayed with Glyphosate plus "Versatil", if clover, thistles, etc. are a problem, according to manufacturer's instructions and at least 14 days before cultivation. All stones, rubbish and other foreign materials shall be removed from the areas to be grassed and the whole area rotary hoed to a depth of 150mm or such lesser depth of topsoil as may be approved by the Engineer.

7.2.3 Fertilisers

7.2.3.1 All fertilisers shall be delivered to the site immediately before they are required for spreading and shall be thoroughly mixed on the site. The Engineer may prohibit the use of any fertilisers that have deteriorated because of interaction, wetting, etc. Fertilisers shall be lightly harrowed into the topsoil, 2-3 days prior to seed sowing, at the following rates:

(a)	30% Potassic Superphosphate	150 kg/ha (15g/m^2)
(b)	Sulphate of Ammonia	50 kg/ha (5g/ m^2)
		200 kg/ha

7.2.3.2 This shall be followed one month after sowing, with an application of the following:

(a) Di-ammonium Phosphate (DAP) 100 kg/ha

7.2.4 Sowing

7.2.4.1 With the exception of the New Zealand Browntop component, all seed shall be certified and less than 12 months old at the time of sowing. Ryegrass component to be certified as having greater than 80% live endophyte content. The Engineer may prohibit the use of seed that has deteriorated because of wetting, fertiliser burning, etc.

7.2.4.2 Seed mixture to be:

(a) NZ Browntop 50kg/ha

(b) High endophyte Turf Rye 200kg/ha

7.2.4.3 On large areas, the seed shall be 'check' sown in at least two directions to ensure an even spread and covered by brush harrowing. The surface shall then be rolled with a suitable flat roller.

7.2.4.4 On small areas, grass seed shall be evenly applied to the prepared surface and raked thoroughly into the soil so that little seed remains exposed.

7.2.5 Establishment of sown areas

7.2.5.1 The Contractor shall ensure that the newly established grass is protected from damage by pedestrian and vehicular traffic until such time as the grass growth has reached a self-sustaining state.

7.2.5.2 The Contractor shall be responsible for watering the seeded areas to achieve an efficient germination of the seed and to maintain satisfactory growth throughout the Maintenance Period. Watering shall commence when root zone moisture is depleted to 50% and shall ensure full re-wetting of the root zone to 200mm depth.

7.2.5.3 During establishment, the Contractor shall maintain the newly grassed areas as follows:

(a) Upon the grass reaching 100mm in height, it shall be cut to 50mm high.

(b) For subsequent mowing's, the mowing frequency shall be governed by growth rate. Minimum grass height to be 40mm – Maximum grass height to be 50mm.

(c) The turf shall be maintained free of all broadleaf weeds.

(d) Areas where there has been a poor strike of grass shall be either re-cultivated and re-sown or under sown at the Contractors expense.

(e) Upon completion of mowing, all grass clippings shall be collected and removed from all sown grass areas except non kerb-and-channelled berms. All clippings shall be removed from adjacent hard surfaces.

(f) Edges of all sown grass adjoining cultivated gardens, borders, hand paving, sealed surfaces or landscaped structures shall be trimmed to the edge or controlled by herbicide to within 25mm of flat surfaces or 50mm of vertical structures. Grass shall not be allowed to encroach over flat, sealed or paved surfaces by more than 25mm.

7.2.6 Turfing

7.2.6.1 The turf shall be good quality, free of weeds and pests and with an even thickness of approximately 20mm x 450mm wide and of a consistent length. The constituent grasses of the turf should include Browntop and Fescue to provide grass of a close texture of even density and green colour, i.e. "Readylawn" or similar approved by the Engineer. The turf should be sufficiently fibrous for turves to hold together when handled, excess fibre or thatch is undesirable.

7.2.6.2 Turf should be packed to avoid drying out in transit. In hot weather, it shall be sprayed with water and covered with hessian as required. Turf shall be delivered to the site within 24 hours of lifting and shall be off-loaded by hand unless arranged on pallets for mechanical handling. Any turf permitted to dry out shall be rejected when, in the opinion of the Engineer, its survival after placement is doubtful. All turf should be laid immediately after delivery to site. Where this is not possible, the turves shall be unloaded and stacked on clear ground to maximum height of one metre and suitably protected.

7.2.6.3 No turf shall be laid in exceptionally hot dry weather or in exceptionally wet or frosty soil or weather conditions, nor shall any turf be laid until the top soiling has been satisfactorily completed by being brought to an even tilth and firmness.

7.2.6.4 Turf shall be handled carefully to ensure minimum breakage to prevent soil dropping from the roots. The turf shall be laid from planks working over turves previously laid.

7.2.6.5 The turves must be thoroughly watered until the turf mat and top 50mm of soil is wet. After allowing a "soaking in" period, the turves shall be lightly and evenly firmed with a wooden tamper so that the underside of the turf mat and the wet soil surface are thoroughly bonded.

7.2.6.6 The finished level of the turf shall conform to the levels indicated. Where the turf meets paths, mowing strips, etc., the finished level shall be 12mm above. Any inequalities in finished levels owing to variation in turf thickness or uneven consolidation of soil shall be adjusted by raking and/or packing fine soil under the turf, not by topdressing the lawn surface.

7.2.7 Establishment of turf

7.2.7.1 During the establishment, the Contractor shall maintain the turf as follows:

(a) Prevent any pedestrian traffic until grass is well established and uniformly covered with a strong sward of grass.

(b) Apply lawn fertiliser e.g. "Readylawn Food', at a rate according to manufacturer's instructions at monthly intervals during the growing season.

(c) Remove weeds, replace soil, if necessary.

(d) Water regularly: The turf shall not be allowed to dry out for at least three weeks after laying and then it shall be watered normally. 'Normal' watering shall commence when the root zone moisture is depleted to 50% and shall ensure full re-wetting of the root zone to 200mm depth. In summer, this will require watering at least daily. Watering shall normally be carried out prior to 7am and shall not be done in hot sunny conditions.

(e) Initial mowing shall be carried out when first growth is apparent, with blades set no lower than two-thirds of the height of the grass. Use roll-type mower for first cuts. Grass shall be in a reasonably dry condition. All clippings shall be collected and removed from site. All clippings shall also be removed from adjacent hard surfaces.

(f) Edges of all turf areas adjoining cultivated gardens, borders, hand paving, sealed surfaces or landscape structures shall be trimmed to the edge or controlled by herbicide to within 25mm of flat surfaces or 50mm of vertical structures. Grass shall not be allowed to encroach over flat or paved or sealed surfaces by more than 25mm.

7.2.7.2 Areas of turf where there has been a poor establishment shall be re-laid at the Contractor's expense.

7.2.8 Chemical applications (weed & pest control)

7.2.8.1 All chemical weed and pest control shall be in accordance with Section 1, Clause 7.1.14. Weed control, apart from edge maintenance, shall be by manual not chemical means.

7.2.9 Defects liability period

7.2.9.1 After initial establishment, during and at the end of the defect liability period, the following minimum standards shall be maintained:

(a) All kerb-and-channelled verges shall have grass growth no more than 50mm high, non-kerb-and-channelled verges shall have grass growth no more than 200mm high and banks shall have grass growth not more than 250mm high.

(b) The sward be maintained in a healthy, weed-and-disease free state without bare patches.

(c) Trees and other plantings shall be protected from damage by maintenance or mowing operations and, if damaged, shall be reinstated within one week of the damage occurring.

(d) Maintenance and mowing operations shall be carried out at times which minimise disruption to the public.

(e) Maintenance and mowing operations shall be carried out only in conditions with equipment that ensures maintenance of good soil structure, minimum deformation of ground surfaced and on-going establishment of the grass sward.

(f) Litter shall be removed prior to commencing maintenance or mowing operations. Highly visible shredded litter shall be removed following maintenance and mowing.

(g) Grass clippings, when not required to be collected during mowing, shall be spread evenly over the sward.

Part 7 – Section 3: Landscape Structures Installation

7.3.1 General

7.3.1.1 All landscape installations shall be constructed to the appropriate standards (including legal, national or Waipa District Council standards) and according to good practice within the relevant industry.

7.3.1.2 All installations shall use good quality, low maintenance materials.

7.3.1.3 At the completion of the work, the site must be clean and free of debris.

7.3.2 Fencing

7.3.2.1 Disturbance of or inconvenience to existing farming activities caused by contract works or traffic shall be minimised at all times. In some cases, this may require erection of suitable fencing. Gates, other fences, and water supplies shall be protected from damage by contract activity and reinstated immediately if damaged. Access of stock to water shall not be interrupted at any time.

7.3.2.2 The Contractor shall initiate discussion with the Engineer before commencing the fencing operation to clarify style, details, variations and the like.

7.3.3 Stock proof fence

7.3.3.1 The stock proof fence shall be a durable fence that achieves the required purpose of preventing access of all livestock to the contract works area.

7.3.3.2 At road frontages, the fence shall meet the following minimum standard:

(a)	Strainers	No. 1	2.4m long with stay.
(b)	Angles	No. 1	2.1m long with stays (if required) at fence line.
(c)	Stays	No. 2	2.4m long.
(d)	Posts	No. 2	1.8m long placed at 4.5m max centres.
(e)	Battens	50 x 40mm equidistant placing, 0.8m maximum spacing.	
(f)	Wire	High tensile wire. 8 wires.	

7.3.3.3 The wires shall be facing the roadside with posts and battens behind.

7.3.3.4 Strainers shall be set to lean away from the angle of the fence to some extent or at worst be vertical upon completion of the tensioned fence.

7.3.3.5 In poor soil conditions or variable topography, longer posts, longer strainers and more substantial footings and stays shall be used, where necessary, to achieve a stable fence.

7.3.3.6 Additional works/material due to poor soil conditions are a variation. Anchor or support posts required due to topography are not a variation.

7.3.3.7 All waste, particularly wire off-cuts, and the like shall be collected and removed from the site at completion of the fence.

7.3.4 Temporary stock proof fence

7.3.4.1 The temporary stock proof fence shall achieve the purpose of preventing access to all livestock as required by the adjacent land users for the duration of the required fence or the duration of the contract.

7.3.4.2 At road frontages, no hot wires shall be used unless they are attached 300m inside a physical barrier.

7.3.4.3 The consequences of stock escaping due to inadequate fencing shall be the Contractor's responsibility.

7.3.4.4 Temporary fences shall be removed from the site at the completion of the contract.

7.3.5 Defects liability period

7.3.5.1 During and at the end of the defects liability period, the following minimum standards shall be maintained:

(a) All permanent or temporary landscape structures shall be structurally sound, safe, functional or operational and in a presentable finished form.

(b) Paint works and other finishes shall be maintained in a clean and presentable finished form. Bolts and other fixtures shall be maintained sound and without loose parts or rough edges.

(c) All structures shall be free of litter, graffiti, grime, weeds and plant growth or any other foreign matter.

(d) Borders, footing edges or paving shall be maintained so that no more than 25mm of grass or other vegetation is allowed to encroach. Vertical elements without mowing edges shall have vegetation maintained clear of the structure by no less than 25mm and no more than 75mm.

Part 7 – Section 4: Planted Stormwater Devices

7.4.1 General

7.4.1.1 This section covers the preparation, installation and maintenance of all new and existing engineered stormwater devices that have a designed landscape component (PSD). This includes, but is not restricted to, stormwater ponds, rain gardens, vegetated filters and swales.

7.4.2 Standard landscape specifications

7.4.2.1 The specifications in this section are supplementary to and take precedence over Council's Standard Technical Specifications Part 7: Landscape Works, Sections 1 and 2. In all other instances, Council's Standard Technical Specifications Part 7: Landscape Works, Sections 1 and 2 are to be followed in the site preparation, establishment and maintenance of all PSDs. These specifications are to be implemented in conjunction with this Manual's Volume 2, Part 9: Planted Stormwater Devices.

7.4.3 Mulch

7.4.3.1 All PSDs shall be mulched except for areas that are grassed or turfed. All mulch is to be approved by the Engineer prior to spreading. Specific PSD mulch applications are as follows.

7.4.3.2 ***Amenity planting***

(a) Landscape planting between the drainage reserve boundary to the Upper Bank Zone shall only be mulched with bark or aged woodchip mulch where there is no possibility of surface ponding, flooding or mulch travel. Where surface ponding, flooding and mulch travel is possible within this area, biodegradable weed matting shall be used for all landscape planting.

7.4.3.3 ***Stormwater ponds***

(a) No synthetic geotextile weed matting is to be utilized in the installation of the landscaping portion of landscaping engineered stormwater devices. However, synthetic geotextiles and other materials may be used, as applicable, to meet functional engineering requirements. For example, for inlets, outlets and high velocity channels.

7.4.3.4 ***Mulching zones***

(a) *Upper bank and lower bank zone mulching*

(i) All plants shall be mulched with Council's approved 0.5m diameter biodegradable weed mat rounds that shall be secured around plants, allowing adequate room around the stem for future growth. Firmly secure fabric mulch with wooden or other biodegradable pegs as per the manufacturer's instructions so that the fabric mulch does not detach from the soil during inundation and high winds.

(b) *Marginal zone mulching*

(i) Council approved biodegradable weed mat is to be laid in a manner that the mulch will not uplift during inundation. Ensure that plants have adequate room around the stems for future growth.

(c) *Wet zone mulching*

(i) No mulching is required within the Wet Zone.

7.4.3.5 ***Rain gardens***

(a) Rain gardens shall be mulched with Council's approved biodegradable weed matting. River rocks (with a diameter of between 50mm and 150mm) in gabion mats (100mm to 300mm deep) may be permissible depending on stormwater engineering requirements and long-term maintenance requirements.

7.4.3.6 ***Swales***

(a) Roll-on turfed swales are not to be mulched.

(b) Non-turfed swales are to mulched according to the surface treatment and stormwater flow velocities, swale design, site location and long-term maintenance requirements. Mulching shall be installed as per manufacturer's instructions.

(c) Vegetated Swales planted with Carex sedges shall be mulched with biodegradable weed mat or secure biodegradable mat rounds.

(d) Swales mulched with river rocks shall either be constructed with:

(i) Loose 50-150mm diameter river rocks on biodegradable weed mat; or

(ii) River rocks of 50-150mm diameter encased in gabion matting.

7.4.4 Planting

7.4.4.1 All PSD landscaping shall be designed and installed according to this Manual, Volume 2, Part 7: Landscaping Engineered Stormwater Devices.

7.4.4.2 ***Grassing***

(a) All areas of engineered stormwater devices that are to be permanently grassed instead of vegetated with shrubs and/or trees shall be established according to this Manual, Volume 3 , Part 7, Section 2: Grassing and Turfing specifications. With the exception of Stormwater Ponds and turfed Swales, the grass seed mix shall be as specified in Section 2: Grassing and Turfing.

(b) During establishment and maintenance, ensure that no grass debris enters any water body or watercourse.

7.4.4.3 ***Stormwater pond planting***

(a) Permanent stormwater ponds shall be planted up as soon as possible after the completion of civil works construction. Where site conditions such as unstable soil structures require a more rapid groundcover than shrubs and trees provide, pond slopes shall be stabilised with grassing first and a Staged Pond Planting is permitted as detailed in this Section.

7.4.4.4 ***Staged pond planting***

(a) The staged pond planting shall be:

(i) *Stage 1: Grassing*

- Pond banks shall be prepared and sown with grass seed to establish rapid ground stabilization, according to this Manual, Volume 3 , Part 7, Section 2: Grassing and Turfing specifications.
- Where ponds are to be established in nitrogen-deficient soils and at the Engineers discretion, the seed mixture shall be:
  - Annual Rye Grass 150 kg/ha.
  - Sweet Clover 100 kg/ha.
- All seed shall be certified and less than 12 months old at the time of sowing. The Ryegrass component is to be certified as having greater than 80% live endophyte content. The Engineer may prohibit the use of seed that has deteriorated because of wetting, fertiliser burning, etc.
- Otherwise, the standard landscaping grass seed specifications shall apply as per Volume 3, Part 7, Section 2, Clause 7.2.4.
- The site shall be grassed for at least 3 months and meet establishment requirements for sown areas prior to landscaping. Marginal Zone planting and mulching shall be established at Stage 1.

(ii) *Stage 2: Landscape planting*

- Stage 2 Planting shall occur within Council's planting season (2 April to 30 September) once Stage 1 sown grass has established. Ensure that no weed species exist throughout the site. Where weed species need to be eradicated either carefully spot spray and/or hand-pull in such a manner that erosion is minimised and surrounding groundcover remains undamaged. The sown grass groundcover shall be spot sprayed to 0.50m diameter for each location where individual plants are to be planted 4 weeks prior to planting, ensuring that the established grass between spot sprays remains undamaged. Maintain sprayed areas so that no new weed growth exists at time of planting. Install and establish planting and mulching as per the Volume 3, Part 7, Sections 1, 2, 3 and 4.

7.4.4.5 ***Rain gardens***

(a) Rain gardens are to be planted according to this Manual, Volume 3 , Part 7, Sections 1 and 2.

7.4.4.6 ***Swales***

(a) Turfed swales shall be prepared, established and maintained as per this Manual, Volume 3, Part 7, Section 2: Grassing and Turfing. Both during and post-establishment, the height of the turf shall be consistently maintained at least fortnightly to designed stormwater engineering requirements. Turf shall be of a drought-resistant hardwearing rye-grass based variety with no weed species.

(b) Swales planted with Carex species shall be planted according to Volume 3, Part 7, Section 1.

7.4.4.7 ***Spraying and weed control***

(a) Ensure that no spray enters any water body or watercourse. In respect to Stormwater Ponds, where weed species exist both on and within 2.5m adjacent to the normal standard waterline, weeds shall be controlled by either hand-pulling or weed-eating in such a manner that no debris enters any water body or watercourse.

7.4.4.8 ***Tree staking and protection***

(a) Trees shall be tied to two stakes on opposite sides to the tree using biodegradable flexible ties made from either cloth or flax. The ties are to be positioned one third up the tree's main stem and with enough give to move in the wind to ensure adequate trunk development.

7.4.5 Defects liability

7.4.5.1 ***Defects liability period inspection***

(a) The Contractor, after completing all proposed works, shall advise Council at least seven working days prior to the proposed commencement of the defects liability period and shall be available for a joint pre-defects liability period inspection.

7.4.5.2 ***Defects maintenance requirements***

(a) The Contractor (or Developer) shall be responsible for the routine maintenance of the landscape planting works including weeding, mulching, replacement of plants and watering during the defects liability period.

(b) The minimum standards required during the Defects Liability Period shall be as per Table 1 – Defects Period PSD Maintenance Schedule.

(c) The Contractor at the end of the required defects liability period shall advise the Water Services, Waipa District Council, at least 7 working days prior to the proposed commencement of Council's acceptance of the asset and its on-going maintenance.

7.4.5.3 ***Defects liability periods***

(a) The following Defects Liability Periods apply to PSDs after obtaining the Engineers Approval as per Clause 7.4.5.1 of this Section.

(i) *Stormwater Ponds (& Wetlands)*

- Permanent grassing without planting.
- Where Stormwater Ponds are to be permanently grassed, the Defects Liability Period for the grassing is a minimum of 6 months if sown between April 2 and September 30. If sown between October 1 and April 1 the period is extended for a further 6 months.

(ii) *Staged Planting*

- Where a Stormwater Pond planting is implemented according to the Staged Pond Planting, (refer to Clause 7.4.4.3 of this Section).

(iii) *Stage 1: Temporary Grassing*

- The Stage 1 Grassing Defects Liability Period will extend for a minimum of six months or until such time as Stage 2 Planting is investigated.

(iv) *Stage 2: Landscape Planting*

- The Stormwater Pond Stage 2 Defects Liability Period shall be a minimum of 12 months except when planting is carried out between October 1 and April 1 the Defects Liability Period shall be extended for an additional 6 months.

(v) *Full Initial Planting*

- Where a Stormwater Pond is planted directly after completion of civil works construction, the planting Defects Liability Period shall be a minimum 12 month period, except when planting is carried out between October 1 and April 1 the Defects Liability shall be extended for an additional 12 months.

(vi) *Rain gardens*

- Rain gardens shall have a minimum 12 month Defects Liability Period, except when planting is carried out between October 1 and April 1 the Defects Liability shall be extended for an additional 6 months.

(vii) *Swales*

- The Defects Liability Period for grassed and planted swales shall be a minimum of 6 months except when the planting is carried out between October 1 and April 1 the Defects Liability Period shall be extended for an additional 6 months.

7.4.5.4 *Final defects inspection criteria*

(a) To achieve final Defects Liability approval, the PSD shall meet the following criteria, based on Volume 2, Part 9, Clause 9.5.4 – Planting Definitions and Approved PSD Species Plant Types. Percentages indicated are based on the total quantity of plants specified on the approved PSD Planting Plan Plant Schedule. Note: Any Defects Liability Period extensions shall apply to the whole PSD site.

7.4.5.5 *Planting Establishment*

Table 51: Planting establishment

Zone	Guidelines
Wet Zone	75% planting established, 25% establishing.
Marginal Zone	100% plants established.
Lower Bank Zone	▪ Groundcovers 75% established, 25% establishing. ▪ Shrubs 50% established, 50% establishing. ▪ All trees establishing.
Upper Bank Zone	▪ Groundcovers 75% established, 25% establishing. ▪ Shrubs 50% established, 50% establishing.

Zone	Guidelines
	▪ All trees establishing.
Plant Canopy	Lower & Upper Bank Zone groundcover canopy is providing 50% minimum cover over ground surface.
Planting Density	Installed plantings are at the approved consent planting plan centres.
PSD Maintenance **Loose Mulch (For example, bark)**	▪ 75mm minimum depth between plants and 25mm maximum depth around plant stems. ▪ No loose mulch is below the bottom edge of the Upper Bank Zone.
Permanent Grass	Permanent grass has established and is maintained according to this Manual, Volume 3, Part 7, Section 2.
Planted Areas Soil	All planted areas shall be moist to at least 200mm.
Replacements	All replacement plants that have been installed due to plant failure have been successfully establishing onsite for at least 3 months. The Engineer may request replacement records to verify installation dates; and ▪ No more than 25% replacements have been installed 3 months prior to the final defects inspection. ▪ More than 25% replacements shall incur a 12 month minimum defects extension. ▪ Should the final defects inspection find that areas of the PSD require replacement planting: - Less than 25% replacements shall incur an additional 3 months defects period after replacement planting has been completed to the Engineers approval, if the replacement planting occurs between 1 April and 1 October, otherwise the extended defects shall be 6 months minimum. - More than 25% replacements shall incur an additional 12 months defects period after replacement planting has been completed to the Engineers approval.
Rubbish	No rubbish, including domestic & building material is evident within the Drainage Reserve PSD, or where the PSD is located elsewhere, in and within 5 m of the PSD.
Spraying	There is no evidence of installed plants killed or severely damaged by weed spraying.
Stormwater Inlets & Outlets	No plants are evident within 1m of the inlet and outlet pipes.
Trees	▪ Where trees were installed with stakes, the trees are staked and tied as per this Manual. ▪ Trees are upright, healthy, free of disease & pests, without spray or weed-trimmer damage and of good conformation. ▪ No self-seeded trees are growing within the Wet or Marginal Zones.
Weed Cover	▪ The PSD has no noxious or Waikato Regional Council notifiable plants evident. ▪ There is no more than one 300mm maximum height weed

Zone	Guidelines
	per 1m² within the PSD. ▪ All plants are fully weed released. ▪ There is no evidence of vegetative waste within the Drainage Reserve PSD, or where the PSD is located elsewhere, in and within 10 m of the PSD.
Weed Matting	▪ Within 24 months of planting installation, biodegradable matting remains intact, has no non-plant stem holes or rips and has not become brittle enough for a hole to be created if stood on by an adult wearing safety boots. ▪ Where matting rounds have been used: - These are intact; - Are properly pegged to the ground around plants as per manufacturer's instructions; and - Have no weeds uplifting them from underneath the round.

Table 52: Defects Period PSD Maintenance Schedule

Maintenance Type	Sub Type	Regime	Frequency (Months)
Mulching	Bark	▪ Check and ensure that mulch has not deteriorated nor travelled below the Upper Bank Zone. ▪ Replace where quality and depth has diminished below specification requirements. ▪ Bark should only be topped up during winter or spring.	12
	Biodegradable Matting	▪ Check, repair or replace any matting that has rips and non-plant stem holes. Matting should remain intact for minimum 24 months post-planting installation.	6
	Biodegradable Rounds	▪ Check and ensure rounds are intact and remain properly pegged around plant stems for minimum 24 months post-planting installation. ▪ Remove any weeds that have uplifted rounds.	3
Permanent Grass		▪ Check and ensure that permanent grass is establishing and maintained to a minimum 100mm height and maximum 200mm height in accordance with this Manual Volume 3, Part 7, Section 2 Specifications.	3
Planting	Establishment	▪ Check and ensure all installed plants are healthy and free of pests, disease, spray and weed-trimmer damage, and are growing generally consistent with the species type shape and form. ▪ Where plants are not establishing, either	3

Maintenance Type	Sub Type	Regime	Frequency (Months)
		remediate or replace plants.	
	Installed Trees	▪ Check and ensure that trees remain staked as per specifications. ▪ Check and ensure that all trees are growing upright.	3
	Self-seeded Trees	▪ Remove all self-seeded trees from the Wet Zone and Marginal Zone without damaging embankment toe and installed plants.	3
	Replacements	▪ Keep a record of all replacement plants installed, including the plant species botanical name, plant grade, quantity and date(s) planted. ▪ Replacement installations should only occur between 1 April to 1 October each year in the Marginal, Lower Bank and Upper Bank Zones. ▪ Planting in the Wet Zone may occur in any season as long as the soil is moist to a depth of 300mm at the location of planting.	As required
Rubbish		▪ Check and remove any domestic rubbish or building material within the PSD site.	3
Soil Moisture		▪ Check and ensure that all areas with installed planting have soil that is moist to a 200mm depth. ▪ Irrigation may be required during summer if planting installation was late spring-early summer.	3
Stormwater Inlets & Outlets	Plant Cover	▪ Ensure that no plants are evident within 1m of the stormwater inlet and outlet pipes.	3
Swale Maintenance	Channel	▪ Check and remove weeds, dead plants, debris dams and pest damage. ▪ Remediate any channel surface scouring that has occurred. ▪ Ensure that Wet Zone plants are no higher than 0.5m high. ▪ Remove any non-installed plants from the swale channel.	6
Vegetative Waste		▪ Ensure that all vegetative waste is safely removed and disposed of offsite. ▪ Check and remove any vegetative debris that is blocking the PSD access track.	3
Weeds	Noxious Plants	▪ Check, remove and dispose of safely all noxious plants, including root systems from the PSD.	3
	Notifiable Plants	▪ Notify Waikato Regional Council should any Notifiable weeds be identified within the PSD.	3

Maintenance Type	Sub Type	Regime	Frequency (Months)
	Weed Cover	▪ Check and ensure that there is no more than one 300mm high weed per $1m^2$ throughout the PSD.	3
	Weed Control	▪ Check and ensure that all plants are fully weed-released. ▪ Weeds may be controlled by weed-trimming, chemical or steam spraying, hand or other manual releasing unless otherwise specified.	3
	Chemical Spraying	▪ Ensure that no chemical spraying occurs in the Wet Zone and Marginal Zone. All weeds growing in these Zones must be removed by other means.	As required

Part 7 – Section 5: Street Tree Planting

7.5.1 General

7.5.1.1 This section describes the work to be carried out to prepare planting sites and complete planting of both street and Parks/Reserve specimen trees. It is to be read in conjunction with Approved Planting Plans supplied and is supplementary to them. The plan figures shall show the nature and extent of the work in sufficient detail to enable the works to be carried out.

7.5.1.2 Specimen trees are those that are either of a larger grade than normally planted or have been specified as such by the Engineer.

7.5.1.3 In respect to the installation of specimen trees, this specification is supplementary to and takes precedence over the standard landscape technical specifications (Volume 3, Part 7, Section 1).

7.5.1.4 All other landscape planting within the road reserve shall be designed and implemented as per Volume 2, Part 7: Street Landscaping.

7.5.1.5 In respect to all street tree planting within Waipa District, the Parks and Reserves Contract Supervisor – Street Trees shall supervise all street tree planting. The Contract Supervisor – Street Trees or Parks and Gardens Unit Manager may also delegate the authority to supervise new street tree planting to a nominated Engineer. The term Engineer in these specifications therefore refers to either the Contract Supervisor – Street Trees or nominated Engineer.

7.5.2 Site preparation

7.5.2.1 Saw cutting of existing seal where required shall be undertaken between 250mm to 300mm from the back of the kerb. The design and measurements must be approved by the nominated Engineer in the Road Corridor Department prior to works commencing. The cut line shall be parallel to the kerb lines, wherever possible.

7.5.2.2 All cut-outs are to be square and be a minimum size of 1m x 1m.

7.5.3 Soil for planting pits

7.5.3.1 Topsoil, both imported and existing on site, shall be a loam soil of good quality, free draining, free of perennial weeds and debris and capable of sustaining the required plant growth.

7.5.3.2 All topsoil shall be inspected at its source and shall not be placed without the Engineer’s consent. Council reserves the right to request soil tests of the intended or existing topsoil as per Volume 3, Part 7, Section 1, Clause 7.1.4.

7.5.4 Plant materials

7.5.4.1 All street trees, unless specified otherwise, shall be of a minimum grade of PB 95 and be first grade nursery specimens. Grades shall be supplied as follows:

(a) 1.5m - 2.5m specimens shall have a minimum calliper of 30 – 50mm.

(b) 2.5m - 3.5m specimens shall have a minimum calliper of 50 – 70mm.

(c) 3.5m - 5m specimens shall have a minimum calliper of 70 – 100mm.

7.5.4.2 No substitution of species or grade shall be made without the written approval of the Engineer.

7.5.4.3 All plant material supplied shall be clearly labelled stating the plant's Latin name and the Supplier's name, (one label per plant group planted). These labels shall be removed on completion of planting.

7.5.4.4 The Contractor shall give the Engineer not less than five days' notice of dates upon which planting will commence.

7.5.4.5 Trees shall be well branched, symmetrical and of typical habit for the species. All plants shall be nursery stock of good form, healthy and vigorous with strong fibrous root systems and free of all pests and diseases.

7.5.4.6 All trees shall be supplied with the central leader intact, whereby no pruning of the central leader shall have taken place. All torn or damaged roots shall be pruned before dispatch. All stock shall be well rooted but not root bound. All root balls and containers shall be free of all weeds. Plants shall be well 'hardened–off' prior to supply.

7.5.4.7 The Contractor shall ensure that all plants and their roots shall be maintained in a moist environment, protected from adverse conditions such as drying winds, frost or water logging.

7.5.4.8 All roots must be covered during transit and stored to prevent desiccation or damage.

7.5.4.9 All trees shall be transported in covered trailers from the nursery to the planting site.

7.5.5 Installation of trees

7.5.5.1 All specimen tree planting shall be undertaken between May 1 and September 31, especially deciduous stock. Evergreen stock may be planted outside this period at the Engineer's discretion, but will be subject to additional maintenance requirements.

7.5.5.2 All plants shall be planted on the day of delivery to the site. Plants shall be planted in the locations shown on the planting plans and in accordance with these specifications.

7.5.5.3 Unless otherwise indicated on the planting plans all plants shall be planted centrally within the road berm.

7.5.5.4 Planting holes shall be excavated, according to the following specification:

(a) Street trees: Grade PB95: 1m x 1m x 600mm minimum depth

(b) Park/Reserve Trees: Grade PB95: 2m diameter x 600mm depth

(c) Grade PB150: 2.5m diameter x 600mm depth

7.5.5.5 The base of the planting hole shall be forked to a minimum depth of 200mm and any stones over 50mm diameter or poor quality subsoil shall be removed from the hole.

7.5.5.6 The sides of the planting hole shall also be loosened by forking to 150mm minimum, and the surrounding ground to two times the root ball diameter shall be 'forked' over to reduce compaction.

7.5.5.7 Where topsoil is unsuitable for backfilling, the Contractor shall use imported or modified top soil for backfilling. The imported topsoil shall be a free draining loam of quality and subject to inspection by the Engineer prior to placement.

7.5.5.8 Modified backfill soil shall consist of a homogenous mixture of the following:

(a) 7 parts by volume of good quality, friable topsoil from the site or imported;

(b) 3 parts by volume of approved compost e.g. that produced from the Hamilton Organic Recycling Centre; and

(c) 2 parts by volume of coarse river sand.

7.5.5.9 The Contractor shall not plant into waterlogged soil or holes that are full or part full with water. If the water table is high and the Contractor cannot disperse the water from the hole, the Contractor shall consult the Engineer as to whether planting can continue.

7.5.5.10 All plant containers or wrapping and, if necessary, any root bound roots shall be removed prior to planting.

7.5.5.11 Leaves and branches shall be pruned to assist plant establishment if necessary. Generally, the nursery soil level is clearly identifiable on the main stem of the plant and replanting shall be equal to or not exceed 10mm above this level.

7.5.5.12 The hole shall first be backfilled with consolidated soil or soil mix, mounding the soil in the centre to aid even spread of the roots in 150mm layers.

7.5.5.13 The plants shall be placed in the hole ensuring that the final soil level is equal to or not exceeding 10mm above the nursery soil level and at an appropriate depth to ensure sustained growth.

7.5.6 Planting location

7.5.6.1 Unless otherwise stated all Street Trees are to be centrally located within the dedicated service – free corridor.

7.5.6.2 All trees are to be planted a minimum of:

(a) 3m from any driveway;

(b) 8m from any light stand;

(c) 6m from any intersection; and

(d) 5m from any bus stop or school speed sign.

7.5.6.3 All reserve plantings shall be marked out by the Engineer prior to planting works commencing.

7.5.7 Irrigation

7.5.7.1 All trees are to be thoroughly watered prior to dispatch from the nursery and are to be thoroughly watered-in after planting.

7.5.8 Fertiliser

7.5.8.1 All specimen tree plantings shall have two year slow release fertiliser tablets installed at the time of planting. This shall be implemented using eight minimum 10g tablets inserted in the base of the planting pit, prior to planting, 100mm below the root ball to stimulate root growth.

7.5.8.2 All fertiliser tablets shall have a balanced NPK.

7.5.9 Mulch

7.5.9.1 Where indicated in the Schedule of Prices and on the planting plans, the Contractor shall provide mulching to newly planted Street and Reserve Trees.

7.5.9.2 All street trees must have a minimum 1m diameter mulching circle from the tree trunk.

7.5.9.3 Where required in small berms, the entire berm from footpath to curb line shall be mulched and squared off for easy maintenance. Park/Reserve Tree planting will require a minimum mulching circle of 2m in diameter from the tree trunk.

7.5.9.4 Mulch shall be well rotted organic tree mulch. Mulch shall be free of foreign debris such as rocks and plastic.

7.5.9.5 Mulch shall be applied to a depth of no more than 150mm after planting. The final settled depth shall be no more than 120mm and no less than 100mm. Ensure that mulch is welled to a depth of 25mm around the tree trunk.

7.5.10 Staking and protection

7.5.10.1 Newly planted specimen trees shall be staked with two 50 x 50 x 1.8m rough sawn Pine H5 treated stakes with at least one third of their length (600mm) in the ground and at least 1m exposed minimum or as specified on the plan with the approval of the Engineer.

7.5.10.2 Two flexible ties per stake shall be attached. Ties shall be tensioned to avoid chafing of the tree against the stakes but with enough play for the tree to move in the wind. All ties shall be fixed to the stakes.

7.5.10.3 Ties shall be of a type approved by the Engineer prior to tying. Ties are to be fixed to the outer stake face with a minimum of four staples in a square pattern.

7.5.10.4 At the Engineer's discretion, Park/Reserve trees may require 3-4 stakes depending on the size of tree and canopy size.

7.5.10.5 All staking shall be parallel with the road kerb.

7.5.10.6 All stakes shall be inserted to avoid hitting the root ball. Stakes shall be at least 400mm away from the tree trunk and no more than 500mm away.

7.5.11 Service locations

7.5.11.1 All service locations shown on the planting plans are to be used as an indicative guide only. It is the Contractor's responsibility to locate and protect all services. Any repairs to damage will be at the Contractor's expense.

7.5.12 Traffic control requirements

7.5.12.1 The Contractor, will at all times comply with Transit temporary traffic control requirements and HCC traffic management requirements.

7.5.13 Defects liability period

7.5.13.1 The Planting Defects Liability period shall be 12 months from Practical Completion and acceptance of the landscape planting works by the Engineer or upon release of any implementation bond held for uncompleted landscaping.

7.5.13.2 When planting is carried out between October 1 and April 31, the Defects Liability Period shall be extended for an additional 6 months.

7.5.13.3 During and at the end of the Defects Liability Period, the planting site shall be maintained according to Volume 3, Part 7, Section 1, Clauses 7.1.16 and 7.1.17 standards.

7.5.13.4 If planting is completed outside the stated planting timeframes, additional watering will be required at the Engineer's discretion.

7.5.14 As-built plans

7.5.14.1 The Contractor shall supply one copy of the as-built plans recording any variation from the approved landscape planting plans and this specification to the Parks and Reserves Team Leader for Council's records.

7.5.15 Defects liability period - inspections

7.5.15.1 The Contractor, after completing all proposed works, shall advise Council at least 7 working days prior to the proposed commencement of the Defects Liability Period and shall be available for a joint pre-defects Liability period inspection.

7.5.16 Defects liability period - final

7.5.16.1 The Contractor at the end of the required Defects Liability Period shall advise Council at least 7 working days prior to the proposed commencement of Council's acceptance of the asset and its on-going maintenance.

Waipa
DISTRICT COUNCIL

Volume 4

QUALITY SYSTEMS

Table of Contents

Part 1: General

1.1 Introduction

1.1.1 This volume comprises a series of quality checklists that shall be used for all Works. The checklists shall be completed as the Works progress to enable any compliance issues to be addressed as early as possible.

1.1.2 For subdivision developments, application for a Section 224(c) completion certificate will not be considered unless the checklists have been forwarded to Council at the appropriate times during the course of the Works, complete with all test certificates, all duly completed and signed by the Engineer.

1.1.3 It is the responsibility of the Engineer to:

(a) Supervise construction of the works;

(b) Arrange for the necessary testing and inspections;

(c) Complete each checklist as the Works progress and submit to the allocated Council Officer; and

(d) Identify any non-compliant work and arrange for correction.

1.1.4 The Engineer may delegate some of the quality assurance process to others (e.g. Contractor). However, the Engineer shall remain responsible for certifying the quality and compliance of the Works.

> Advice Note: The Engineer is the person having the roles defined in General Information, Section 4.1 and not Council's Asset Manager or Site Auditor.

1.1.5 Council staff are not responsible for quality assurance.

1.2 Continuous Improvement Process

1.2.1 In common with the rest of this Manual, Council is keen to improve the quality checklists on a continuing basis. To that end, Council encourages feedback from users with suggestions for improvement. Please use the "Opportunity for Improvement" (OFI) form in the back of this Manual.

Checklist 1.1: Final Site Inspection and Release

In Attendance at Site Field Meeting:
Waipa District Council:
Contractor:
Consultant:
Waikato Regional Council:

Action Required	Yes	N/A
1) Check all items which failed previous inspections		
a) Earthworks		
b) Drainage		
i) Wastewater		
ii) Stormwater		
c) Water Reticulation		
d) Roading		
e) Reserves		
f) Environmental Mitigation		
2) General		
a) Surplus material removed		
b) Drainage reticulation top soiled and grassed		
c) Manhole lids level with surrounding area/clear of boundaries		
d) Carriageway and berms clear of rubbish		
e) Grass take on top soiled areas		
f) Water reticulation, boxes and kerb markings in place		
g) Check concrete paths, vehicle crossings & drives for cracks		
h) Channel swept and cesspits empty of debris		
i) Road surface acceptable		
j) Fences erected, where required		
k) Warning sign at end of stage roads		
l) Restoration after telecommunication, electricity, gas, etc.		
m) Right of entry releases		
n) See details of Bond Schedule in Appendix No.5		
o) Uncompleted items to be bonded for		
p) See Consent details		

Items to be Provided/Corrected

No	Action Required	Party to Action	Party to Accept	Acceptance	
				Approved	Date

Planning/Regulatory Representative ______________________

Engineer ______________________

Date ______________________

Part 2: Earthworks

2.1 General

2.1.1 Council has no direct involvement in Formal Inspections other than the audit of the Geotechnical Assessment in conjunction with the Scheme Plan approval and to confirm that its recommendations are being carried out.

2.1.2 Council will monitor and check the following:

(a) Noise nuisance - hours of working.

(b) Dust or smoke nuisance.

(c) Adjacent neighbour's property protected.

(d) Topsoil stockpile locations.

(e) Works on reserves or future reserves.

(f) Permission to place unsuitable on reserves or other agreed areas.

(g) Specific features/trees to be protected.

(h) Contractor has seen or has access to geotechnical assessment.

2.1.3 The Engineer will check the following:

(a) Silt pond constructed and maintained.

(b) Inspection by EW before stripping topsoil.

(c) Subsoil drainage.

(d) Clean water rerouted – cut off drains catered for.

(e) Soil testing - lines of responsibility between geotechnical engineer and engineer, inspection of stripped areas, fixing subsoil's, etc. for as-builts, fixing soil tests positions. Notification of test results - reworking if required, construction equipment, records of machinery working - wet days, interruptions, recommendations in Foundation Investigation Report carried out.

(f) Bulk earthworks completed, check levels, roads cut to subgrade stage and unsuitable and/or topsoil re-spread, fill as-built completed. Alignment to overland flow path, floor level restrictions, design levels adhered to, Foundation Completion Report compiled and submitted to Council for approval.

Checklist 2.1: Geotechnical Assessment – Scheme Plan Approval

To:

____

____

____

Statement of Professional Opinion as to Suitability of Land for Subdivision

Subdivision ______________________________

Owner ______________________________

Location ______________________________

I ______________________________

(full name)

of ______________________________

(name and address of firm)

Hereby confirm that:

1. I am a Professional Engineer experienced in the field of soils engineering and, more particularly, land slope and foundation stability, as applicable, and was retained by the subdividing owner as the Soils Engineer on the above subdivision. I have a current policy of Professional Indemnity Insurance.

2. Site investigations have been carried out under my direction and are described in my report dated

3. I am aware of the details of the proposed scheme of subdivision and of the general nature of proposed engineering works as shown on the following drawings:

____

____

____

(Insert references to all figures including dates of latest amendments)

4. In my professional opinion, not to be construed as a guarantee, I consider that the proposed works give due regard to land slope and foundation stability considerations and that the land is suitable for the proposed subdivision providing that:
   (a) ______________________________
   (b) ______________________________
   (c) ______________________________

5. This professional opinion is furnished to Council and the subdividing owner for their purposes alone, on the express condition that it will not be relied upon by any other person and does not remove the necessity for further inspection during the course of the works.

Signed ______________________________

Date ______________________________

Checklist 2.2: Geotechnical Assessment – Completion of Earthworks

To: ______________________________

____

Statement of Professional Opinion as to Suitability of Completed Earthworks

Subdivision ______________________________

Owner ______________________________

Location ______________________________

I ______________________________
(full name)

of ______________________________
(name and address of firm)

Hereby confirm that:

1. I am a Registered Engineer experienced in the field of soils engineering and was retained by the subdividing owner as the Soils Engineer on the above subdivision.

2. The extent of my inspections during construction and the results of all tests carried out are described in my report dated.

3. In my professional opinion, not to be construed as a guarantee, I consider that:
   (a) * The earth fills shown on the attached Plan No have been placed in compliance with the requirements of the Waipa District Council.
   (b) * The completed works give due regard to land slope and foundation stability considerations.
   (c) * The filled ground is suitable for the erection thereon of residential buildings not requiring specific design in terms of NZS 3604 and related documents providing that:

      (i) ______________________________
      (ii) ______________________________
      (iii) ______________________________

   (d) * The original ground not affected by filling is suitable for the erection thereon of residential buildings not requiring specific design in terms of NZS 3604 and related documents providing that:

      (i) ______________________________
      (ii) ______________________________
      (iii) ______________________________

4. This professional opinion is furbished to Council and the subdividing owner for their purposes alone on the express condition that it will not be relied upon by any other person and does not remove the necessity for the normal inspection of foundation conditions at the time of erection of any dwelling.

Signed ______________________________

Date ______________________________

Part 3: Roading

3.1 General

3.1.1 Roading includes that portion of Earthworks testing of the subgrade, the carriageway construction including under channel drains, kerb and channel, metal construction, sealing, paths, vehicle crossings, access lot and right-of-way construction, top soiling and grassing of berms.

3.1.2 Council's function is a combination of audits of the above works for adherence to Council Standards and more formal acceptance tests of:

(a) Subgrade.

(b) Base course metal on completion.

(c) Base course metal on completion prior to sealing.

(d) Sealing during and on completion.

(e) Completed carriageway including carriageway surface, paths, crossings and berms.

3.2 Testing

3.2.1 The Engineer will carry out the appropriate test to determine the compliance of the following:

3.2.1.1 *Naturally occurring subgrade*

(a) Depth.

(b) Strength.

(c) Shape.

3.2.1.2 *Imported subgrade, sub-base and base course*

(a) Quality and source.

(b) Compatibility (with other material immediately above and below).

(c) Layer depth.

(d) Total depth.

(e) Compaction.

(f) Strength.

(g) Final shape.

3.2.1.3 *Sealing (Chip seal)*

(a) Surface of base course after sweeping.

(b) Chip size, type and application rate (theoretical and actual).

(c) Binder type and temperature.

(d) Additive.

(e) Design application rate.

(f) Chip coverage.

(g) Rolling.

3.2.1.4 ***Sealing (Asphalt)***

(a) Surface of chip seal after sweeping.

(b) Binder.

(c) Depth of asphalt (design and actual).

(d) Sequence of runs.

(e) Mix temperature.

(f) Rolling.

3.2.1.5 ***Kerb & Channel***

(a) Levels.

(b) Alignment.

(c) Metal base.

(d) Concrete strength.

(e) Kerb profile.

3.2.1.6 ***Services***

(a) Location, depth and alignment for:

   (i) Stormwater.

   (ii) Wastewater.

   (iii) Electricity ducts (if necessary).

   (iv) Telecommunication.

   (v) Gas.

   (vi) Backfill provisions and compliances.

   (vii) Installation to standards.

3.2.1.7 ***Concrete Footpaths***

(a) Alignment, location and configuration.

(b) Subgrade depth and strength (natural and imported).

(c) Depth of concrete.

(d) Concrete strength.

(e) Crack control.

(f) Surface finish.

3.2.2 In all cases of non-compliance, the Engineer shall determine remedies and then consult with Council's Development Engineering Department for the satisfactory outcome. No remedy shall be undertaken until the method is approved by the manager of the department.

3.3 Testing Guidelines

3.3.1 The following guidelines are a summary of the testing requirements in Volume 3: Technical Specifications. These guidelines are provided for the assistance of developers. If there is any ambiguity between the requirements of Volume 3 and these guidelines, then Volume 3 takes precedence.

3.3.2 Scala Penetrometer Use (Insitu & Imported Subgrades)

3.3.2.1 The Scala Penetrometer shall only be employed where a significant part of the subgrade particles pass a 9.5mm sieve.

3.3.2.2 The cone is bedded into the soil with one (or more) blows. The zero point for depth and the number of blows is taken neglecting the bedding blows.

3.3.2.3 There are two methods of recording the results and all test sites must comply.

Table 53: Scala Penetrometer Use

CBR	Max mm/blow	min blows/100mm
7	32	3
10	23	4
15	17	6

3.3.3 On Carriageways

3.3.3.1 Scala tests are to be taken at the following locations and frequency:

(a) Carriageway 4m wide and less - Along centreline

(b) Carriageway between 4m and 8m - At the kerbside wheel tracks

(c) Carriageway 8m and wider - At centreline and kerbside wheel tracks

3.3.3.2 As a means of compliance for an acceptable CBR in carriageways at the insitu subgrade, the scala readings are averaged for the top 600mm. At the imported subgrade or lower sub base surface, the scala readings are averaged for the full depth of the pavement layer being tested.

3.3.3.3 The test sites are to be at a maximum of 15m centres for each line or where 2 or 3 lines are required; these may be staggered at 10m intervals, giving a space of 20 and 30m for each line.

3.3.4 Footpaths

3.3.4.1 Scala readings are to be taken to a depth of 300mm below the final subgrade level to ensure that the appropriate CBR's are achieved at the appropriate depth.

3.3.5 Vehicle Crossings

3.3.5.1 A minimum of three scala penetrometer tests randomly spread shall be taken to a depth of 300mm below the final subgrade level per crossing.

3.3.5.2 One test per $5m^2$ on crossings greater than $15m^2$ (kerb to boundary).

3.3.6 Shape And Relative Height Tolerances

Table 54: Shape and Relative Height Tolerances

At top of layer	Centreline and near pavement edge	At channel edge	Deviation from 3m straight edge or camber board
Surface			1 : 12mm 2 : 8mm
Base course	-5mm to +15mm	1: 0mm to +10mm	12mm
Sub-Base	-25mm to +5mm	-25mm to +5mm	15mm
Subgrade	-30mm to 0mm	-30mm to 0mm	15mm

1: Chip sealed surface

2: Asphalt surface (typically 25mm thick)

3.3.6.1 Construction levels are based on lip of channel, appropriate cross fall and designed pavement layer thickness.

Checklist 3.1: Base course Shape and Relative Height (Final Layer)

Subdivision ______________________

Stage ______________________

Road Name/No ______________________

Ch From ______________________

Ch To ______________________

Date ______________________

Chainage	1m from Kb & Ch (L)	Centreline	1m from Kb & Ch (R)

Analysis of Results

________ Base course shape completed

________ Remedial work required

From ____________ To ____________

From ____________ To ____________

From ____________ To ____________

Suggested remedial work to be considered by Manager Road Corridor

____

____

____

____

Signature of Developer's Representative ______________________

Signature of Development Engineer ______________________

Checklist 3.2: Base course Compaction

Compliance CIV 34 (equivalent to CBR80)

Subdivision ____________________

Stage ____________________

Road Name/No ____________________

Ch From ____________________

Ch To ____________________

Date ____________________

Chainage	300mm from Kb & Ch (L)	Centreline of Lane	Centreline of Lane	300mm from Kb & Ch (R)

Analysis of Results

_______ Base course shape completed

_______ Remedial work required

From ________ To ________

From ________ To ________

From ________ To ________

Suggested remedial work to be considered by Manager Road Corridor

____

____

____

____

Signature of Developer's Representative ____________________

Signature of Development Engineer ____________________

Checklist 3.3: Sub-base Compaction/Shape

Clegg Hammer Compliance CIV 24 (equivalent to CBR40)

Subdivision ______________________

Stage ______________________

Road Name/No ______________________

Ch From ______________________

Ch To ______________________

Date ______________________

Chainage	300mm from Edge of Carriageway (L)	Centreline of Lane	Centreline of Lane	300mm from Edge of Carriageway (R)

Analysis of Results

_______ Base course shape completed

_______ Remedial work required

From __________ To __________

From __________ To __________

From __________ To __________

Suggested remedial work to be considered by Manager Road Corridor

____

____

____

____

Signature of Developer's Representative ______________________

Signature of Development Engineer ______________________

Checklist 3.4: Subgrade

Subdivision ______________________

Stage ______________________

Road Name/No ______________________

Ch From ______________________

Ch To ______________________

Date ______________________

Chainage	Centreline of Lane	Kerb Side Wheel Tracks	
		Left	Right

Analysis of Results

________ Base course shape completed

________ Remedial work required

From ________ To ________

From ________ To ________

From ________ To ________

Suggested remedial work to be considered by Manager Road Corridor

____

____

____

____

Signature of Developer's Representative ______________________

Signature of Development Engineer ______________________

Checklist 3.5: Scala Penetrometer Test

Subdivision ______________________

Stage ______________________

Road Name/No ______________________

Ch From ______________________

Ch To ______________________

Date ______________________

Chainage	Centreline of Lane	Kerb Side Wheel Tracks	
		Left	Right

Analysis of Results

______ Base course shape completed

______ Remedial work required

From ________ To ________

From ________ To ________

From ________ To ________

Suggested remedial work to be considered by Manager Road Corridor

____

____

____

____

Signature of Developer's Representative ______________________

Signature of Development Engineer ______________________

Part 4: Stormwater and Wastewater Reticulation

4.1 General

4.1.1 Council's role includes random audits of a sample of the works for compliance and witnessing and acceptance of:

(a) All pressure testing.

(b) All connections to existing infrastructure.

(c) The final inspection prior to 224(c) approval.

4.1.2 The Engineer shall carry out the following checks on all works to certify quality and compliance:

(a) Before pipe laying commences check that pipes are on the correct alignment and level to join existing mains. Connection procedures are agreed.

(b) Design and re-design compliance.

(c) Trench safety – OSH.

(d) Pipe specification compliance including size, quality and use of approved materials.

(e) Foundation conditions suitable - undercut and hard fill, replace where necessary.

(f) Pipe grade and alignment with specified tolerances.

(g) Pipe bedding and surround correctly placed and compacted.

(h) House connections, Lundun junctions and ramped risers laid and located correctly both horizontally and vertically.

(i) Bulk backfilling and surface reinstatement to specifications.

(j) Manhole construction to HCC Technical Specification, including: connections and leads, benching, precast base, mastic sealing strip, rungs, concrete lid, cast iron, frame and cover, hard fill to under drops, surface levels conform, etc.

(k) No debris in pipelines.

(l) All QA checklists and test certificates completed, checked for compliance and submitted to Council as the work progresses.

(m) Council present to witness required testing and for final inspection.

(n) Catch pit construction to Technical Specification, including plastering, and that they are clear of debris.

(o) As-built information logged and trench width noted for deep pipelines.

4.2 Stormwater Detention Facilities

4.2.1 Where required by the Resource Consent, stormwater detention facilities shall be constructed in accordance with this Manual and completion inspections shall be undertaken using Checklist 4.6. Part of the process for obtaining 224(c) release for developments involving stormwater facilities is the preparation of an Operations Manual that complies with the requirements in Checklist 4.7.

4.2.2 The following flowchart outlines the development process for these facilities.

Figure 158: Stormwater Detention Facilities (flow chart for developers)

PLAN	Consent issued requiring stormwater detention facility. Submit engineering plans for for approval including a planting plan and maintenance plan
CONSTRUCT	Apply for Waikato Regional Council (WRC) resource consents and building consents if stormwater activity is not permitted and retaining structure required.
	Construct facility once plans are approved and necessary consents obtained. Comply with Waipa DC and WRC consent conditions.
	Carry out mulching and landscaping to the approved planting plan and Manual requirements, (Vol 3, Part 7)
	Apply for first 'defects liability' inspection (notify Development Engineering 7 days in advance). Complete checklist 4.5. Once all works satisfactory, DE will notify developer to initiate defects liability period.
MAINTAIN	During defects liability carry out maintenance requirements of facility and rectify problems as they occur (eg weed and plant mortality). Comply with consents. Council will undertake audits during this time.
	At the end of the defects liability period, apply for Final 'Defects liability' inspection. Development Engineering must be notified 7 days in advanced. Carry out further works as required.
TRANSFER	Apply for 224c approval once: (All weather access is provided to the forebay (Physical works completed to Waipa DC standard in accordance with the approved plan (Asbuilt plans and datasheets (Vol 3 Part 4) have been submitted (Planting has been completed in accordance with the approved plan, (Operations manual complying with Checklist 4.6 has been received and approved (Site complies with check list 4.5, including Waipa DC approval of defects liability inspections
	Vested to Waipa DC via 224C approval
	Request WRC transfer of WRC Resource Consent to Waipa DC ownership

Advice Note: To obtain 224(c), the pond has ideally been completed to standard and the defects liability period is complete. If the defects liability has not yet lapsed, consult with Development Engineering about options for obtaining 224(c). This will include requirements such as a programme of works detailing who will undertake the maintenance during the defects liability period and the proposed process for transferring ownership of the pond to Council at a later date.

Checklist 4.1: Stormwater and Wastewater Pipe Laying

Pipe Laying Checks

Location	Pipe Length (MH to MH)				
	To	To	To	To	To
Trench Safety					
a) Shield					
b) Batter					
c) Other					
Pipe size, quality, approved materials confirmed					
Set out checked					
- Surveyors name ____________________					
- Control points identified					
Foundation support					
- penetrometer results available					
- if under cutting required, note chainage and CBR results					
Record daily level check and confirm on grade					
Bedding type and surround material ______________________________					
Bulk Backfill material ______________________________					
Bulk backfill compaction (CBR results from pipe to ground level attached)					
Alignment control points identified					

Service Connections

All service connections in place, taped and staked					
Connections correctly located horizontally and vertically					
Connections to main correctly formed					
As-built measurements taken					
CCTV pipe inspection					

Signature of Contractor ______________________________

Date ______________________________

Checklist 4.2: Manhole

Manhole Construction

Location:	MH number				
Manhole size, quality, approved materials checked					
Set out /orientation					
Sealing strip between risers					
Benching					
- Height					
- Alignment and cross section					
- half pipe lining (wastewater only)					
- Step recesses (if applicable)					
Flexible joints					
Cutting and plastering of connections					
Access details per figures					
Step irons including epoxy to outside recesses					
Bedding type and surround					
Bulk backfill compaction (CBR results attached)					
No debris in pipelines					
Invert of pipes in and out					

Signature of Contractor ______________________

Date ______________________

Checklist 4.3: Trench Backfill Compaction Test Summary

(Attach individual test reports)

Location ______________________________

Plan Number ______________

From MH ______________ To MH ______________

Acceptance Criteria: ______________________________

Tests by: ______________________________ (attached)

Analysis of Results

____

____

____

______________ Trench backfill completed satisfactorily

______________ Trench backfill requires remedial work

Signature of Engineer ______________________________

Date ______________________________

Checklist 4.4: Catch pit Construction

Catch pit Construction

Location	Catch pit number				
Catch pit, type, size, quality, approved material checked					
Set out /orientation					
Location checked					
Depth of sump below outlet correct					
Cutting and plastering of outlet connection					
Floating debris baffle installed correctly					
Backfill compaction around pit checked					
Seating and plastering of surround and grate to sump barrel					
All silt and debris removed from sump					

Signature of Contractor ______________________

Date ______________________

Checklist 4.5: Final Inspection for Stormwater and Wastewater Drainage

Location

Plan Number

Task		Developer Checklist		WWS Rep
		SW	WW	Pass
Developer to verify prior to meeting:				
1	Checklists 4.1, 4.2 ,4.3, 4.4 completed			
2	All lines flushed out			
3	All required CCTV inspections carried out, reviewed and any re-work completed			
4	All manholes checked (e.g. infiltration, plastering)			
5	Catch pits checked			
6	All backfilling complete and tidied up			
7	Pressure test completed and witnessed			
8	Final as-built plans attached for approval			
9	Inspection arranged with Council			
Site Meeting				
1	Inspect all lines			
2	Inspect all manholes and catch pits			
3	All manholes and catch pits set to level			
4	Inspect SW inlet and outlet structures			
5	Secondary flow paths and detention ponds			
6	Works on third party land completed to satisfaction of owner			
7	Wastewater pumping station			
8	Overland flow from adjoining properties not affected			
9	All works satisfactorily			
10	Remedial work required			

Signature of Developer

Date

Signature of Development Engineering Representative

Date

Checklist 4.6: Landscape Engineering Stormwater Device Inspection/ Signoff

For completion by Developer prior to requesting: 224(c) approval/First defects liability inspection/Final defects liability inspection/Remedial works completion inspection

Location **Plan Number**

		Date	Date	Date	Date
Pre-Inspection					
Type of Inspection (record 1,2,3 or 4)		Tick if satisfactory	Tick if satisfactory	Tick if satisfactory	Tick if satisfactory
1	Final as-built plans sent to Council				
2	Checklist 4.4 completed for all pipelines and manholes				
3	Planting Plan approved by Council				
		Date	Date	Date	Date
Site Meeting					
1	Forebay accessible and has all weather access				
2	Forebay clear of sludge				
3	Boundary pegs sighted				
4	Works align with as-built plans				
5	Spillway/s clear of obstruction				
6	Erosion and soil stability				
7	Inlet and outlet has structural integrity				
8	Plants at least 2m clear of inlet and outlet				
9	Planting done to approved planting plan				
10	Plant density (approx 1 per m^2)				
11	Plants in good condition				
12	No plant pests				
13	Weed (%) compliant with WDC DM				
14	No notifiable weeds				
15	Plants sourced from Waikato Ecological District				
All works satisfactory					
Remedial work required					

Signature of Developer ______________________ **Date** __________

Signature of Development Engineering Representative ______________________ **Date** __________

Checklist 4.7: Landscape Engineering Stormwater Device Management Manual

Location ____________________

Manual includes the following information:

Administration Details	Developer Tick if correct	Dev. Eng. Rep Tick if correct	Comments
Developer name and contact details			
Detention facility location street address			
Detention facility type (wet pond, dry, wetland)			
NZ map reference			
Site plan number			
Resource consent number			
Catchment name			
Contributing catchment area			
Coordinates for detention facility centre			

Levels	Developer Tick if correct	Dev. Eng. Rep Tick if correct	Comments
Levels to LINZ datum			
Top of dam (RL)			
Top of spillway (RL)			
Toe of dam (RL)			
2 yr. ARI water level			

Dimensions	Developer Tick if correct	Dev. Eng. Rep Tick if correct	Comments
Max pond length			
Max pond width			
Height of dam in meters to 0.1 m			
Approx max water depth to 0.1 m			
Normal water depth to 0.1 m			
Operating surface area (m^2)			
Normal storage volume (m^3)			

Dimensions	Developer Tick if correct	Dev. Eng. Rep Tick if correct	Comments
Spillway details Type Width or diameter			
Inlet details Type Width or diameter			
Outlet details Type Width or diameter			

Flow Design	Developer Tick if correct	Dev. Eng. Rep Tick if correct	Comments
2 yr. return period design (m^3/s)			
10 yr. storm controlled at high level weir (m^3/s)			
50 yr. storm at spillway (m^3/s)			

Sediment Treatment	Developer Tick if correct	Dev. Eng. Rep Tick if correct	Comments
Estimated suspended solids removal (%)			
Estimated sediment accumulation rate in tonnes/year			

Planting details	Developer Tick if correct	Dev. Eng. Rep Tick if correct	Comments
Date of planting			
Plants source			

Maintenance Requirements	Developer Tick if correct	Dev. Eng. Rep Tick if correct	Comments
Methodology for the on-going and long-term maintenance			
Estimated cleaning frequency in years Forebay Main pond			

Details for permanently wet areas			
Details for surrounding areas			
How facility should be dewatered and de-silted			

Attachments	**Developer** **Tick if correct**	**Dev. Eng. Rep** **Tick if correct**	**Comments**
Location map			
Legal description of site			
Detailed scale plan of total contributing catchment			
Construction detail plans of the pond including all structures			
Approved As-built plan showing truck maintenance access, working and storage areas			
EW resource consent			
Geotechnical report if applicable			
Design calculations			
As-built Planting plan			
Consent compliance reports from EW			

All information included in required format			
Further information required			

Signature of Person Reviewing the Manual ____________________

Date ____________________

Signature of Development Engineering Representative ____________________

Date ____________________

Part 5: Incorporated Into Part 4

Part 6: Water Reticulation

6.1 General

6.1.1 Council's Role includes random audits of a sample of the works for compliance and witnessing and acceptance of:

(a) All pressure testing and sterilization;

(b) All thrust blocks, valves, hydrants and other specials; and

(c) The final inspection prior to 224(c) approval.

6.1.2 The Engineer shall carry out the following checks on all works to certify compliance:

(a) Position and depth of pipeline relative to boundary conforms with approved figures.

(b) Type, class, size of pipes and fittings confirms to Technical Specification Acceptable Products (Volume 3).

(c) Before pipe laying commences check that pipes are at correct level and alignment to join existing mains and jointing procedures are agreed.

(d) Thrust blocks installed where required. Check adequacy of bearing.

(e) Correct bedding and surround.

(f) Backfilling to specifications.

(g) All QA checklists and test certificates completed, checked for compliance and submitted to Council as the work progresses.

(h) No debris in pipelines.

(i) Ensure that Contractor carried out successful pre-test prior to advising Council of formal test.

(j) Council present to witness required testing and for final inspection.

(k) As-built information logged.

Checklist 6.1: Water Reticulation Pipe Laying

Location ______________________________

Name ______________________________

(of qualified water service person)

Pipe Laying Checks	From To	From To	From To	From To	From To
Pipe size, quality, approved materials checked.					
Set out checked (control points).					
Foundation support - penetrometer results available - if under cutting required, note chainage and CBR results.					
Alignment and cover.					
Bedding type and backfill material (CBR results available for road crossings and driveways).					
All service connections in place.					
Connections and Toby Box correctly located horizontally and vertically.					
Hydrants and valves positioned correctly.					
Thrust blocks installed.					
No debris in pipelines.					
As-built measurements taken.					
Pressure test witnessed and passed by Council representative.					
Bacto sample taken and passed by Council representative **PRIOR** to connection to the live Council main.					
Connection to live main by Council (unless specifically approved).					

Signature of Contractor ______________________________

Date ______________________________

Checklist 6.2: Trench Backfill Compaction Test Summary

(attach individual test reports)

Location ______________________

Plan Number ______________________

From MH ______________________

To MH ______________________

____

Acceptance Criteria ______________________

Tests by ______________________ (attached)

Analysis of Results

____

____

____

__________ Trench backfill completed satisfactorily

__________ Trench backfill requires remedial work

Signature of Engineer ______________________

Date ______________________

Checklist 6.3: Final Inspection for Water Reticulation

Location ______________________

Plan Number ______________________

Developer to verify prior to meeting

	Developer Check	Dev. Eng. Rep Check
All lines flushed out		
All backfilling complete and tidied up		
Checklists 6.1 and 6.2 completed		
Pressure test completed and witnessed		
Bacto test completed and passed		
Final as-built plans attached for an inspection arranged with Council		
Connected to existing supply by Council		

Site Meeting

	Developer Check	Dev. Eng. Rep Check
Valves and hydrants correctly marked		
Toby boxes installed correctly		
All valves checked on/off		
All works satisfactory		
Remedial work required		

Signature of Developer ______________________

Date ______________________

Signature of WWS Rep ______________________

Date ______________________

Part 7: Street Landscaping

7.1 General

7.1.1 Council will make periodic audits at random intervals to ensure compliance with the specifications.

7.1.2 The Engineer shall carry out checks as required to ensure that:

(a) Soil preparation is carried out properly.

(b) Tree planting and staking is done at the best time and carried out properly.

(c) Grass areas are well prepared, sown, fertilised and tended during the establishment phase.

(d) Irrigation system is installed correctly.

7.1.3 The following checklists shall be completed and provided to Council.

Checklist 7.1: Street Trees & Gardens Pre-Defects Liability Period

Pre-Meeting Tasks

Organisation	Action Required		Yes	No	N/A
Contractor	1	Complete all work indicated on figures			
	2	Trees staked, tied and mulched			
	3	Mow grass			
	4	Gardens planted, barked and weed-free			
	5	Irrigation installed to specification			

Site Meeting - In attendance:

Planning Guidance Officer ______________________

Parks Officer ______________________

Development Engineer ______________________

Contractor ______________________

Consultant ______________________

Items		Yes	No	N/A
1	Inspect site			
2	Plans and specifications complied with			
3	Check mowing			
4	Acceptable standard agreed upon			

Defects Liability Period

______________ 6 months ______________ 1 year (delete as required)

Stat of Defects Liability Period ______________________

End of Defects Liability Period ______________________

Items to be Provided/Corrected

No	Action Required	Party to Action	Party to Accept	Acceptance	
				Approved	Date

Signature of Parks & Reserves Rep. ______________________

Signature of Consultant/Contractor ______________________

Date ______________________

Checklist 7.2: Final Inspection – Street Trees and Gardens

Pre - Meeting Tasks

Organisation	Action Required		Yes	No	N/A
Contractor	1	Make sure site complies with standards as agreed at pre-maintenance inspection			
	2	Trees staked, tied and mulched			
	3	Dead and damaged trees replaced			
	4	Mow grass			
	5	Gardens planted, barked and weed-free			
	6	Irrigation in working order			

Site Meeting - In attendance:

Planning Guidance Officer ______________________

Parks Officer ______________________

Development Engineer ______________________

Contractor ______________________

Consultant ______________________

Items		Yes	No	N/A
1	Inspect site			
2	Trees staked, tied and mulched			
3	Gardens barked and weed-free			
4	Gardens and planting meet agreed standards			
5	Dead and damaged plants replaced			

Handover		Yes	No	N/A
1	Gardens & street trees acceptable for hand-over to Council for on-going maintenance			

Council to take over maintenance from: ______________________

Items to be Provided/Corrected

No	Action Required	Party to Action	Party to Accept	Acceptance	
				Approved	Date

No	Action Required	Party to Action	Party to Accept	Acceptance	
				Approved	Date

Signature of Parks & Reserves Rep. ______________________

Signature of Consultant/Contractor ______________________

Date ______________________

Part 8: Network Utilities

Checklist 8.1: Work Clearance from Network Operators

To: **Manager Planning and Regulatory** Date: ____________

Waipa District Council

Re: ______________________________ **Subdivision Development**

I HEREBY CERTIFY all of the required work in relation to the installation, commissioning, and reinstatement of our network services have been satisfactorily completed in this development area.

As-built plans have been completed.

Subdivision ______________________________

Stage ______________________________

Developer's Name ______________________________

Contractor's Name ______________________________

Signed on behalf of Electrical Service Provider ______________________________

or

Signed on behalf of Natural Gas Corp of NZ ______________________________

or

Signed on behalf of Telecommunication Service Provider ______________________________

(one form required from each network operator)

Part 9: Appendices

Appendix 1 – Notice of Intention to Commence Development Works

(This form to be completed by the Developer and sent to Manager Development Engineering, Waipa District Council).

Council Consent # ______________________ Stage ______________________

Development Location ______________________

Engineering Design approval issued on ______________________

Name of Developer ______________________ Contact Phone ______________________

Developer's Engineer ______________________ Contact Phone ______________________

(responsible for certifying quality and compliance)

Works Commencement Date ______________________ Proposed Duration ______________________

Name of Contractor ______________________ Contact Phone ______________________

Pre-construction Meeting Arranged

Venue ______________________ Date ______________________

Engineer's Rep Contact ______________________

Contractor's Rep Contact ______________________

Council Project Engineer Contact ______________________

Waikato Regional Council Contact ______________________

Waikato Regional Council advised of works and consents issued ______________________

Disposal of surplus soil required ______________________

Disposal site approved ______________________

Road Opening Notice issued ______________________

Rights of Entry from neighbours obtained ______________________

Health and Safety Plan prepared and approved by Engineer ______________________

Insurances in place ______________________

Traffic Management Plan approved by Manager Road Corridor ______________________

Name ______________________ Signed ______________________

Date ______________________ *(Signed by Developer)*

Appendix 2 – Items to be Corrected or Requiring Action

Job ______________________________

Site ______________________________

Date ______________________________

Inspection

- Type ______________________________
- Area ______________________________

Correction Form No.: ____________

Number	Action Required	Party to Action	Party to Accept	Acceptance	
				Approved	Date

Copy for: Contractor / Developer / Council

Master form to be retained by developer and returned at time of final acceptance duly completed.

Appendix 3 – Compliance Acceptance Release Checklist

Reference Number ______________________

Date ______________________

Title ______________________

Site ______________________

Development Engineering Office ______________________

LT No(s)

	N/A	Confirmed Provided		Final Check	
		Yes	No	OK	Not OK
1) Completed checklists					
2) Correction action items					
3) Schedule of work to be bonded for					
4) Bonding arrangements:					
a) Refundable deposit details					
b) In-house bond details					
c) Deposit paid					
5) Resource consent approval conditions satisfied					
6) Engineering figure approval conditions satisfied					
7) Final certified as-builts					
8) Certification of works					
9) Details of arrangements for connection to public lines:					
a) Wastewater					
b) Stormwater					
c) Water main					
10) Overland flow paths:					
a) As-builts					
b) Floor Levels					
c) Easements					
11) Right to entry release confirmation					
12) Other items:					

Appendix 3 – Compliance Acceptance Release Checklist (continued)

	N/A	Correct	Not Correct
13) Final Release (for Planning Guidance office use)			
Inspection form completed and signed off			
Bond figures and conditions numbers confirmed			
LT's to be issued 303/222 Completion Certificates noted on release			
Conditions covered by bonding noted on release memo			
Lots to be placed on L15 noted on release			
Foundations			
Overland flow			
Scheme plan advice notes			
Signed copy of as-builts			
Flood protection plans (x3)			

Processing check by: ________________________________ Date: ________________

Appendix 4(i) – Certification Upon Completion of Roads, Pipelines and Other Services

Issued by ______ *(suitably qualified professional)*

To ______ *(Development owner)*

To be Supplied to ______ *(Territorial authority)*

In Respect of ______ *(Description of development project)*

At ______ *(Address)*

______

______

______ has been engaged by ______

(Survey firm) *(Development owner)*

to provide construction observation, review and certification services in respect of the ______

above development which is described in the specification and shown on the figures ______

numbered ______

approved by ______ *(Territorial authority)*

I have sighted the ______ *(Territorial authority)*

consent and conditions of consent to the ______

Development and the approved specification and figures.

As an independent professional, I or personnel under my control, have carried out periodic reviews of the works appropriate to the engagement and based upon these reviews, information supplied by the contractor during the course of the works and the contractor's certification upon completion of the works (copy attached) **I BELIEVE ON REASONABLE GROUNDS** that the works, other than those outstanding works listed below, have been completed in accordance with the above consent and sound engineering practice.

Signed ______ Date ______

(Signature suitably qualified Professional)

Member of ______

(Professional Qualifications)

Address ______

CSNZ		NZIS	
ACENZ		IPENZ	
CPEng			

Outstanding Works ______

______

______

______

______

Appendix 4(ii) – Certification for Construction

CONTRACTOR'S CERTIFICATE UPON COMPLETION OF SUBDIVISIONAL WORK

Issued by ______________________________ *(Contractor)*

To ______________________________ *(Principal)*

To be supplied to ______________________________ *(Territorial authority)*

In respect of ______________________________ *(Description of subdivision work)*

At ______________________________ *(Address)*

____

____

______________________________ has contracted to ______________________________

(Contractor) *(Principal)*

to carry out and complete certain subdivisional work in accordance with a contract, titled

Contract Number ______________ **for** ______________________________ ***("the contract")***

I, ______________________ a duly authorised representative of ______________________

(Duly Authorised Agent) *(Contractor)*

hereby certify that ______________________________

has carried out and completed the subdivisional works, other than those outstanding works listed below, in accordance with the contract.

______________________________ Date ______________________

(Signature of Authorised Agent on behalf of

(Contractor)

____

(Address)

Outstanding Works

____

____

____

____

____

____

____

Appendix 4(iii) – Certification for As-Built Figures

Development

I,

a Suitably Qualified Professional, hereby certify that all of the information shown on the "as-built" figures and spread sheets is correct as to location (x, y and z co-ordinates), size, materials.

This applies to the following "as-built" figures:

Figure Number	Title

(Suitable Qualified Professional)

Date

Appendix 4(iv) – Quality Assurance Certificate - Pavements

(one form per feature)

Consent name:	Consent number (e.g. SP/LU)	Location

Council to ENTER

Lot numbers with ROW rights:	Property reference	Address

Design – materials used: type & depths (e.g. gap/whap/tnz m4/brown rock/pit sand)

Design			Actual		
Base course	Material	Depth	Base course	Material	Depth
Sub base	Material	Depth	Sub base	Material	Depth
Subgrade	Material	Depth	Subgrade	Material	Depth
Subgrade	CBR		Test method		

Construction - compaction during construction

	Target	Result
Tests used - Sub-base		
Tests used - Base course		

EITHER: Construction – sealing (two coat seal to be provided based on 15 years minimum life span)
– asphaltic concrete (one coat seal)

Date of seal	Grade of Bitumen
Grade of chips	Application rates

OR: Construction – concrete/asphaltic concrete* (delete non-applicable option)

Concrete/ac* depth (mm)	Concrete compressive strength (Mpa)
Reinforcing Mesh size Number of layers	Date of pour

Certification

The ROW detailed meets all the specifications and requirements of Waipa District Council's Code of Practice and all the resource consent conditions relating to the ROW in the consent approval dated

Designer	Signed	Date
Constructor	Signed	Date
Supervisor	Signed	Date

Appendix 4(v) – Quality Assurance Certificate for Pavement - Drainage

QUALITY ASSURANCE CERTIFICATE FOR PAVEMENT - DRAINAGE

(one form per feature)

Subdivision name:	Subdivision number	Location

Council to ENTER

Lot numbers with ROW rights:	Property reference	Address

Drainage type

Soak pits		Piped system	
Number		Number of sumps	
Results of percolation tests		Pipe size and length	
Water tables	Meterage	lhs	rhs
Outlet location & details			

Other (please specify):

Certification

The drainage detailed meets all the specifications and requirements of Waipa District Council's Code of Practice and all the resource consent conditions relating to the ROW in the consent approval dated

Designer	Signed	Date
Constructor	Signed	Date
Supervisor	Signed	Date

Appendix 4(vi) – Quality Assurance Certificate - Structures

(one form per feature)

Subdivision name:	Subdivision number	Location

Council to ENTER

Lot numbers with ROW rights:	Property reference	Address

Construction – structures (where involved – bridge, large culvert, retaining wall)

Name & company of designer

Materials used (i.e. steel/precast rc/insitu rc/gabion)

Name of supervising chartered engineer

Certification

The structure detailed meets all the specifications and requirements of Waipa District Council's Code of Practice and all the resource consent conditions relating to the ROW in the consent approval dated

Designer	Signed	Date
Constructor	Signed	Date
Supervisor	Signed	Date

Appendix 5(i) – Requirements & Procedures for Legal Documentation for Minor Works Bonds

As a condition of approving your application, Council requires certain legal documents to be prepared. The form of the documents and the wording of the conditions to be secured shall be to the satisfaction of Council.

- Council shall issue instructions to its own solicitors to prepare these documents upon your:
  - Accepting liability for Council's legal fees and disbursements in this regard by signing and returning the attached copy of this notice; and
  - Paying to Council a deposit on account of those legal fees; and
  - Providing a current search copy of the title or titles of the land involved; and
  - Providing the name and address of your solicitor if you wish the documents to be forwarded to your solicitor
  - Providing the name of the bondsman if guarantor is required (a bank or insurance company is acceptable to Council)

No instructions will be prepared until all these requirements have been met

- As charges are calculated on the basis of the staff time involved, total charges will be contained by correct execution and prompt return of the documents.

I/We ____

accept the liability for Council's charges and disbursement and request it to prepare the documents required.

1 The proposed Guarantor is (if required)

Name ____

Address ____

2 My/our Solicitor is

Name ____

Address ____

3 I/we enclose

a Cheque $100 (cheques are to be made payable to Waipa District Council

b Current search copies of title or titles

Signed ____

(owners) ____

Appendix 5(ii) – Requirements & Procedures for Legal Documentation

REQUIREMENTS & PROCEDURES FOR LEGAL DOCUMENTATION

As a condition of approving your application, Council requires certain legal documents to be prepared. The form of the documents and the wording of the conditions to be secured shall be to the satisfaction of Council.

- Council shall issue instructions to its own solicitors to prepare these documents upon your:
  - Accepting liability for Council's legal fees and disbursements in this regard by signing and returning the attached copy of this notice; and
  - Paying to Council a deposit on account of those legal fees; and
  - Providing a current search copy of the title or titles of the land involved; and
  - Providing the name and address of your solicitor if you wish the documents to be forwarded to your solicitor.
  - Providing the name of the bondsman if guarantor is required (a bank or insurance company acceptable to Council).

No instructions will be prepared until all these requirements have been met

- The deposit is to be lodged with Council on account of legal fees being incurred by Council with its solicitor is:
  - In the case of an application for the release of existing securities the sum of $175.00 for each security being released; and
  - Surrender of easements $500
  - For new securities, the sum of $500.00 for each new document.

- The legal fees and disbursements may exceed this deposit, but will be calculated according to the District Law Society rules in this regard. The balance will be payable to Council before you proceed with your project. If the legal fees are less than you deposit, you will, of course, receive a credit or refund of the difference. You will receive a copy of the account for legal fees.

- As legal fees are calculated on the basis of the number and length of attendances, total legal costs will be contained by swift, accurate responses to Council's solicitors.

Appendix 5(ii) (Page 2 of 2)

To

Chief Executive Officer
Waipa District Council
Private Bag 2402
TE AWAMUTU 3840

Attention: Manager Planning and Regulatory

Date ______________________________

I/We ______________________________

accept the liability for Council's administration costs, legal fees and disbursements, and request it to issue instructions to its solicitors accordingly.

Enclosed

1 The proposed Guarantor is

Name ______________________________

Address ______________________________

____

____

2 My/our Solicitor is

Name ______________________________

Address ______________________________

____

____

3 I/we enclose

a Cheque $ (cheques are to be made payable to Waipa District Council

b Current search copies of title or titles

Signed ______________________________

(owners) ______________________________

Appendix 6 – Application for Acceptance of Water or Drainage Product for Use in the Waipa District Council Water Supply Areas or Drainage Districts

Date			Checklist
Product ID			✓
Purpose of Product			✓
Manufacturer			✓
	Contact Person		✓
	Contact Phone Number		✓
Installation Details		Copies Attached	✓
Product Life		Years	✓
Standard(s)			✓
Licence Number		Attached	✓
Accepted by the following authorities		Letters Attached	✓

for Office Use only			
Received by		Date	D
Requested Further Information		Date	
Accepted by		Date	
File Number			
Added to Technical Specification by		Date	

Appendix 7 – Guidelines for Submission of Digital Data for Water and Drainage As-Built Plans

The following guidelines outline the required format of digital data for water and drainage as-built plans that are submitted to Waipa District Council. Waipa District Council requires digital data to be submitted in the following format:

- File Format: Release 12 (AC1009) ASCII DXF (with" .DXF" Suffix)

Figure Coordinate Datum's:

Required:

- New Zealand Geodetic Datum 2000 (NZGD2000)

Separate files are required for the 3 asset groups and a fourth file is required for the property boundary and road information.

DXF Filename	Figure File Content
BD.dxf	Property & Road Boundary Vectors and lot numbers
WW.dxf	All Wastewater Ass
WS.dxf	All Water Supply Assets
SW.dxf	All Stormwater Assets

Only include layers that are relevant to that DXF: i.e. 'WW.dxf' only has layers of the wastewater assets. Do not include property boundaries, road names, etc. The DXF file does NOT need to have only 1 layer. Multiple layers can be used, so long as the layers included only relate to the asset class of the particular DXF file.

Do not include any extraneous text, tables or borders in the DXF file. Text such as boundary references, pipes sizes, lengths, etc. are not needed in the DXF File. Similarly coordinates are not needed, this information is inherent in the datum and location of features shown in the DXF file.

As-built data not required in this format includes plans relating to construction of wastewater pump stations, long sections and stormwater control devices. Make sure all symbology such as manholes are 'exploded' prior to saving as a DXF file. The files are to be mailed to:

In the case of subdivisions:

Development Engineering Manager
Waipa District Council
Private Bag 2402
Te Awamutu 3840

Include Council's Subdivision Consent Number and the subdivision name and stage number.
Water and Drainage As-Built Plans in DXF Format for Council Subdivision Consent Number and the subdivision name and stage number.

In the case of Council contracts, send to the Engineer for forwarding to the appropriate Council asset manager.

Appendix 8(i) – Subdivider's/Developers Tax Invoice

GST Registered ______________________________

Company Name ______________________________

Address ______________________________

____

____

GST Number ______________________________

Date ______________________________

Issued To **WAIPA DISTRICT COUNCIL**

Dr To ______________________________ (developer)

____

____

For Barter with Waipa District Council of roading, reserve, drainage and water mains included in Scheme Plan No. ______________________________ developed at

DPS Number (s) ______________________________

Construction Cost **Total (A)** ____________________ (incl. GST)

Land to Vest (m²)

Total (B) ____________________ (incl. GST)

Total $ ____________________

NB: GST comprises 0.13 of the above total.

GST Requirements/Asset Register

Schedule of Engineering Value

Date ______________________

Subdivision Name ______________________

Developer Name ______________________

Address ______________________

____

____

Issued To ______________________

DPS Number(s) ______________________

Schedule (A) Construction Costs

1. DRAINAGE

(a)	Sanitary Sewer (GST incl.)	Qty	Cost
	Mains (total meters)		
	Manholes (total number)		
	Connections (total number)		
		Subtotal	
(b)	**Stormwater (GST incl.)**	**Qty**	**Cost**
	Mains (total meters)		
	Manholes (total number)		
	Connections (total number		
	Outfalls (inlet/outlet structures)		
		Subtotal	

2. WATER SUPPLY (GST incl.)

		Qty	Cost
	Mains (total meters)		
	Rider mains (total meters)		
	Services Number		
	Hydrants		
	Sluice & Peat Valves		
		Subtotal	

3. ROADING (new/upgrading/widening) (GST incl.)

	Unit	Qty	Cost
Pavement (incl. surfacing)	m^2		
Kerb and Channel (full height)	m^2		
Berms (incl. landscaping)	m^2		
Footpaths (incl. w/ways & c/ways)	m^2		
Vehicle Crossings	m^2		
Road Drainage (catch pits & leads)	lump sum		
Street Lighting	lump sum		
Signage & Marking	lump sum		
Sundries - bridges/culverts/walls, etc.	lump sum		
Subtotal			
Total (A)			

Schedule B Land Costs

	Area m^2		Value $
Land Values			
Vested as Road	______		______
Reserves:			
Local Purpose Reserves (all types)	______		______
Other (name)	______		______
______	______		______
______	______		______
______	______		______
Total (B)	______	**m^2**	______

NB: All figures are GST INCLUSIVE

Appendix 8 (ii) – Subdivider's/Developers Invoice

Company Name ______________________________

Address ______________________________

____

____

Date ______________________________

Issued To **Waipa District Council**

Dr To ______________________________ (developer)

____

For Barter with Waipa District Council of roading, reserve, drainage and water mains included in Scheme Plan No. ______________________________ developed at

DPS Number(s) ______________________________

Construction Cost **Total (A)** ______________________________

Land to Vest (m^2)

Total (B) ______________________________

Total $ ______________________________

I/We* confirm that for the purposes of the above subdivision/development I am/We are * not registered for GST.

Signed ______________________________

Date ______________________________

** Delete as applicable*

Appendix 9 - Asset Register

Schedule of Engineering Value

Date ______________________

Subdivision Name ______________________

Developer Name ______________________

Address ______________________

____

____

Issued To ______________________

DPS Number(s) ______________________

Schedule (A) Construction Costs

1. DRAINAGE

(a)	Sanitary Sewer	Qty	Cost
	Mains (total meters)		
	Manholes (total number)		
	Connections (total number)		
		Subtotal	
(b)	**Stormwater**	**Qty**	**Cost**
	Mains (total meters)		
	Manholes (total number)		
	Connections (total number		
	Outfalls (inlet/outlet structures)		
		Subtotal	

2. WATER SUPPLY

		Qty	Cost
	Mains (total meters)		
	Rider mains (total meters)		
	Services Number		
	Hydrants		
	Sluice & Peat Valves		
		Subtotal	

3. ROADING (new/upgrading/widening)

	Unit	Qty	Cost
Pavement (incl. surfacing)	m^2		
Kerb and Channel (full height)	m^2		
Berms (incl. landscaping)	m^2		
Footpaths (incl. w/ways & c/ways)	m^2		
Vehicle Crossings	m^2		
Road Drainage (catch pits & leads)	lump sum		
Street Lighting	lump sum		
Signage & Marking	lump sum		
Sundries - bridges/culverts/walls etc	lump sum		
Subtotal			
Total (A)			

Schedule B Land Costs

	Area m^2	Value $
Land Values		
Vested as Road	______	______
Reserves: Local Purpose Reserves (all types)	______	______
Other (name)	______	______
______	______	______
______	______	______
______	______	______
Total (B)	______ **m^2**	______

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Opportunity for Improvement
Development Manual

Waipa District Council, Private Bag 2402, Te Awamutu 3840
Phone: 0800 924 723 | Fax: 07 872 0033 | Web: www.waipadc.govt.nz | Email: info@waipadc.govt.nz

ORIGINATOR TO COMPLETE

Submitted By: ....

Of:
(Address) ....

....

....

Contact phone number:

Suggested amendments to:

Volume No	....	**Part No**	....	**Clause No**	....	**Page No**	....
Volume No	....	**Part No**	....	**Clause No**	....	**Page No**	....
Volume No	....	**Part No**	....	**Clause No**	....	**Page No**	....

Description of Problem:

Suggestion for Improvement:

Send form to Manager Development Engineering.

Waipa District Council
Private Bag 2402
Te Awamutu

***Fax: 07 871 4061 or Email to:* DevEng.Shared@waipadc.govt.nz**

Opportunity for Improvement Development Manual

Waipa District Council, Private Bag 2402, Te Awamutu 3840
Phone: 0800 924 723 | Fax: 07 872 0033 | Web: www.waipadc.govt.nz | Email: info@waipadc.govt.nz

FOR OFFICE USE ONLY

OFI No: …………

Received by Document Controller **Date: ………………..........**

Forwarded to ……………………………………………..……….Unit Manager **Date: ……………………………**

Unit Manager Recommendation:

…….. Amend manual as requested (for simple amendments)

Or

……. I have passed this to …………………………………….for review/action.

Expected date of completion: …………………….

……………………………………
Unit Manager

Return copy to: Document Controller, Development Engineering as soon as possible

Amendments made to Document (where appropriate): ……. Date: ……………………………

Submitter informed of Outcome: ……. Date: ……………………………

Amended pages posted to copy holders: ……. Date: ……………………………

Signed: ………………………………………………………
Manager Development Engineering

…………………………………………………
Document Controller