UPPER HUTT CITY COUNCIL

CODE OF PRACTICE

FOR CIVIL ENGINEERING WORKS

CONTENTS

INTRODUCTION

1. Purpose of Code

The purpose of this Code of Practice for Civil Engineering Works ("The Code") is to provide a single comprehensive management framework for the development of land and infrastructure within Upper Hutt City. It is applicable to works within both urban and rural parts of the City, whether or not a Resource Consent is required under the Resource Management Act.

The Code is performance based in that it sets out the overall engineering and environmental outcomes that are being sought and the standards that development has to meet in order to meet those outcomes.

The Code is divided into the following four parts:

Part A	Engineering Performance Criteria
Part B	Mandatory Requirements
Part C	A Means of Compliance - Design
Part D	A Means of Compliance - Construction.

Parts A and B form part of the District Plan and Parts C and D form a means of compliance but remain outside the District Plan.

The outcomes being sought for work done within Upper Hutt City are specified in the form of *engineering performance criteria.* All development in Upper Hutt shall meet these criteria.

The means of meeting these criteria is to design and construct engineering works in accordance with sound accepted engineering standards. The standards are of two types; those that are *mandatory requirements* and those that would provide a *means of compliance* with the performance criteria specified in this Code.

The *mandatory requirements* establish minimum levels of design and construction in key elements of civil engineering works. Compliance with these requirements has been determined to be essential in developing and maintaining a unified and consistent infrastructure with an acceptable economic life and level of environmental impact.

The *means of compliance* are standards that provide an acceptable solution to meeting the performance criteria. A development that has been prepared in accordance with these standards may be expected to be processed in the minimum time. If alternative means of compliance are proposed for the design and construction of civil engineering works the consent process checks such means against the performance criteria to determine whether or not compliance with the performance criteria is achieved and whether any conditions should be imposed to ensure that the criteria are met.

Thus, the Code is seeking to provide:

- ***Consistency,*** in bringing together in one document all the appropriate standards for civil engineering works in Upper Hutt City.

- ***Coherence,*** in applying development standards under one overall management framework, the Upper Hutt City District Plan.

- ***Certainty,*** in specifying standards and procedures to address all aspects of civil engineering works within a document, significant parts of which can only be changed through a public consultation process; and

- ***Flexibility,*** in providing a way of determining the means of achieving the desired environmental result according to the individual circumstances, the available technology and the cost-effectiveness of different development options.

The Code has been prepared to be compatible with the Upper Hutt City District Plan, which seeks to promote the sustainable management of the City's natural and physical resources in accordance with the Resource Management Act 1991. The Code is intended to ensure that Civil engineering works in Upper Hutt are undertaken according to a set of consistent engineering standards, which have been established to achieve acceptable environmental outcomes, and the development and maintenance of well constructed and safe services and infrastructure.

Generally, the standards in this Code are based on nationally recognised development standards adapted where necessary to take into account the policy and environmental and technical expectations of Upper Hutt City Council. This Code, therefore, seeks to bring together, in one document, all the relevant requirements for Civil Engineering Works, which have been reviewed in terms of their effectiveness in meeting the purpose and principles of the Resource Management Act ("the Act").

Parts A and B of the Code, as part of the Upper Hutt City District Plan, are part of a public document, and are subject to the procedures and requirements for preparing or making changes to district plans under the Act, including the need to consult widely, and the ability of anyone to make submissions to proposed changes to the Code.

Parts C and D as technical design and construction aids will be available to interested parties on request. Changes to these parts of the Code may be made by Council from time to time to suit changing technology and policy directions.

2. Definitions Used In Code

In this Code the following meanings shall apply:

The “Act”, unless otherwise specified, refers to the Resource Management Act 1991.

“Annual Exceedance Probability (AEP)” means an occurrence, in this Code, generally a storm, which has the specified probability of being equalled or exceeded in any given year.

eg. 5% AEP storm is that storm which has a 5% (1 in 20) chance of being equalled or exceeded in any given year. Alternatively a storm which on average could be expected to be equalled or exceeded once every 20 years.

The “Code” means the Upper Hutt City Council's “Code of Practice for Civil Engineering Works”.

“Consent” means any consent that is required under any empowering legislation and can include a Resource Consent.

“Contractor” means the person or entity responsible for constructing the physical works.

“Construction Supervisor” means the person responsible for observing construction standards for Civil Engineering works to ensure that the required standards are achieved. The Construction Supervisor shall be appropriately qualified and experienced in the areas of work being undertaken and shall be engaged and paid for by the Developer. The Construction Supervisor shall be responsible to the Designer and the latter shall retain final responsibility for ensuring the works are undertaken in compliance with the design. The Construction Supervisor may be the same person as the Designer. The person shall carry either personally or through their employing company, professional indemnity insurance to the value of $250,000 (or such higher sum as the Council may stipulate from time to time).

“Designer” means a named person who is suitably experienced and qualified, who shall be the Developer's representative on matters of the design and construction of a proposed Civil Engineering project. For the purposes of this Code, a suitably experienced and qualified person shall generally be a registered engineer holding an annual practising certificate.

Alternatively, in respect of subdivisions, a registered surveyor holding an annual practising certificate may be accepted as a suitably experienced qualified person. Notwithstanding this, Council may accept designs, certifications, and reports from non-registered persons who have, in Council's viewpoint, sufficient recent experience in the particular aspect of the work, and carry the requisite insurances. The person shall carry either personally or through their employing company, professional indemnity insurance to the value of $250,000 (or such higher sum as the Council may stipulate from time to time). The Designer shall be responsible for ensuring that the design and its construction satisfy the requirements of this Code and good engineering practice.

"Developer", means an individual or organisation under whose name an application for subdivision and/or land use consent is made and for which engineering works are proposed.

"Independent Qualified Person (IQP)", means a named person who shall be independent of the "Designer" and "Construction Supervisor" on a Civil Engineering project. The person shall be suitably experienced and qualified in the types of work involved and shall be engaged and paid for by the Developer but shall be responsible for performance to Upper Hutt City Council. For the purposes of this Code a suitably experienced and qualified person shall generally be a registered engineer holding an annual practising certificate. Alternatively in respect of subdivisions involving limited engineering infrastructure or earthworks, a registered surveyor holding an annual practising certificate may be accepted as a suitably experienced and qualified person.

The IQP shall monitor the Design, Construction and Maintenance phases of any project. At the design phase the IQP shall review the design to ensure its compliance with this Code of Practice for Civil Engineering Works, the Resource Management Act and other relevant legislation bylaws and Codes. During the construction and maintenance phases the IQP shall ensure that the construction complies with the design documents and intent, this Code of Practice and other relevant legislation bylaws and Codes, and incorporates all Consent conditions.

The IQP shall carry either personally or through their employing company, professional indemnity to the value of $250,000 (or such higher sum as the Council may stipulate from time to time).

"Network Utility Operator (NUO)" means the authority accepted by law at any time as being responsible for operations and maintenance of particular infrastructure utilities, such as:

- The river or waterway controlling authority
- The telecommunication or information system controlling authority
- The electrical and/or gas controlling authority
- The stormwater, water and sewerage controlling authority
- The public transport controlling authority
- The state highway controlling authority
- Neighbouring Territorial Authorities
- Road controlling authority

Any reference to controlling authorities used in this document shall be taken as meaning Network Utility Operator (NUO).

"Regional Authority" or "Regional Council" means the Wellington Regional Council.

"Resource Consent" means any consent that is required under the Resource Management Act.

"Scheme Plan" means a plan lodged to support an application for subdivision in accordance with section 88 of the Resource Management Act.

"Service Lateral" is applicable to all services other than water supply. It is the length of utility service running from the network operator's main to the boundary of any Lot, that is designed

to service the subject lot. The service lateral may be owned and maintained by either the NUO or the Lot owner depending on the policy of the NUO. For wastewater and stormwater laterals the length from the main to the road reserve boundary shall be owned and maintained by the applicable private lot owner.

"Service Pipe" is defined by Council's water supply bylaws as being that section of water pipe between a water main and the point of supply (first joint on the private side of a toby). The service pipe is owned and maintained by the water supply authority.

3. Need for IQP

An IQP shall be used on all projects unless determined otherwise by Council at the Resource Consent stage and advised to the Developer with the consent conditions. Exemptions from the use of an IQP will generally only be approved for developments involving no construction of earthworks or public assets beyond individual service connections. In such cases any reference to IQP in this document shall be taken to be UHCC.

4. Responsibility for Compliance and Costs

Responsibility for payment of all costs associated with complying with this Code shall be the responsibility of the Developer. The responsibility for satisfying the requirements of the Code during both the design and construction phases shall rest with the Designer who may engage appropriately qualified people to carry out any parts of the project under his/her direction.

5. Developer to obtain Consents

The Developer, through the Designer, shall be responsible for identifying all Consents required for a development, applying for and obtaining such Consents and payment of all associated fees.

Consents under the Resource Management Act shall be in the name of Upper Hutt City Council where the work is to be taken over by the City on completion.

6. Procedures for Application for and Approval of Civil Engineering Works

The following stages will normally apply for the undertaking of subdivisional or land development activities in Upper Hutt.

6.1 Land Use/Subdivisional Consent Application

i. The Developer shall engage a Designer to prepare and submit an application for a Land Use or Subdivisional Consent to carry out the works. The application shall be made up of information such as the following to enable planning and engineering acceptability to be assessed.

- A Scheme Plan and description of site along with the Scheme Plan for the full development when the consent application is for only part of a staged development. The Scheme Plan shall show sufficient levels for Council to see the shape of the finished ground, proposed services and all proposed easements.
- A development "Feasibility and Effects" report. *(B1.4)*
- An "Assessment of Environmental Effects" and any supporting specialist reports.
- Specialist reports supporting the engineering basis of the project as required under this Code including:
  - Geotechnical reports. *(B2.1)*

- Traffic Management report. *(B3.2)*
- Land clearance aspects where applicable. *(B4)*
- Calculations and references used in developing the various reports and solutions proposed.
- Supporting preliminary engineering drawings showing in adequate detail the nature and layout of the Civil Works and any known hazards. The drawings must show as a minimum earthworks, roading, dimensions and layout, parking, turning and access facilities, service sizes and layouts.
- An outline of any Consents needed from the Wellington Regional Council or other Territorial Authorities, copies of applications made or a statement as to the status of such applications.
- A design statement or details on how utility services not controlled by Council (eg power, gas, telecommunication) are to be provided.
- Descriptions of any areas where it is proposed to deviate from Council's acceptable solutions for Civil Works and documentation supporting any alternative solutions.

The extent of documentation required will vary depending on the nature and impact of the project but in all cases it is the developer's responsibility to provide a level of information adequate to clearly show the engineering standard and all impacts of the proposal.

ii. Council will consider the application and advise as to whether it will be treated as notified or non notified and whether any additional information is required.

iii. If after due consideration in terms of the Resource Management Act a Consent is granted, the Developer will be advised in writing along with a series of conditions including the need for an IQP.

6.2 Detailed Design Stage

The Designer shall develop the detailed design and full working drawings for the project in consultation with the IQP in terms of this Code. Areas where deviation from Part C of this Code "A Means of Compliance" are proposed shall be supported with suitable justification.

The information shall include, but is not necessarily limited to, the following matters as relevant:

i. Full engineering documentation in accordance with this Code. *(B1.5)*

ii. Full working drawings in accordance with this Code. *(B1.6)*

iii. Designs covering utility services not controlled by Council (eg. power, gas, and telecommunication) and letters from the network utility operators confirming that the designs have been approved by them.

iv. All documents prepared for the Resource Consent application. *(B11.1)*

v. Any other documentation required by part B of this Code to satisfactorily support the design.

vi. The Designer's Certificate and the IQP Design Certificate. *(B1.8.1, B1.8.2)*

Once satisfied with the design and documentation, the IQP shall pass a set of documentation to Council with his/her own Certificate and Council will issue an approval as to Design within 5 working days.

6.3 Construction Phase

The Construction works shall be observed by the Construction Supervisor under the direction of the Designer and monitored by the IQP.

6.4 Completion Certification

6.4.1 Completion Documentation

To enable the Council to be satisfied that the works have been completed and in order to sign off the Completion Certificate, all Completion Documentation as required by *B11* shall be provided, through the IQP, to Council.

6.4.2 Works without bonding

Where all works are complete and no bonds are required, then provided Completion Documentation *(B11)* is lodged with Council, Council will issue a completion certificate for the work and arrange sealing of the survey plan pursuant to Section 224 of the Resource Management Act.

6.4.3 Works with bonding

In exceptional circumstances, where the bulk of the work has been completed but where small components cannot be completed immediately, due to it being out of season or else beyond the control of the Developer, Council may accept a bond from the Developer, registered against the titles of all lots.

Where bonds are required to be posted, the Developer shall sign the Bond documents at the time of submission of the Survey plan for sealing by Council. Council will then issue the Completion Certificate and arrange sealing of the survey plan pursuant to Section 224 of The Resource Management Act.

6.4.4 Notification of Plan Number

As soon as the survey plan has been lodged with the Land Information NZ (LINZ) the Developer shall provide the Council with a copy of the plan lodgement notice showing the number of the plan.

When the plan formally deposits, a copy of the final numbered DP shall be lodged with Council.

6.5 Council takeover of Assets

Council will take over assets agreed as being public at the date of the plan being formally deposited unless an earlier date is agreed by Council.

6.6 Maintenance Period Start and End

The maintenance period shall commence at the date on which the plan is formally deposited unless an earlier date is agreed by Council.

The Developer will be released from his/her Maintenance/Bond obligations after the IQP has inspected the works and provided the certification as required by this Code.

7. Building Works and Consents

A building consent shall be uplifted for all construction activities requiring building consent in terms of the Building Act and all other cases that may be described in the District Plan.

For all buildings to be erected on lots to which a vehicle crossing and or access was not constructed at the time of subdivision, or where alteration to the existing crossing or access is proposed, details are to be provided with the building consent application and constructed at the building consent stage. The proposed access shall comply with the provisions of this Code

and the proposal supported with all drawings, calculations and engineering reports as may be required by Council and described in the Code of Practice.

For non reticulated urban, rural or rural residential areas, details of water supply, stormwater discharge and on-lot wastewater disposal shall be provided to detailed construction standard before the Building Consent will be issued. This is in addition to information that will have already been provided to Council as part of any subdivisional Resource Consent.

All works shall be completed to the satisfaction of Council before issue of the Certificate of Compliance in respect of building consent.

PART A

ENGINEERING PERFORMANCE CRITERIA

CONTENTS

PART A ENGINEERING PERFORMANCE CRITERIA

A1. Purpose

The purpose of these criteria is to define expectations for acceptable minimum levels of performance for all land and infrastructure development subject to consents under the Resource Management Act 1991 or Council approvals under empowering legislation or bylaws.

A2. Scope

These criteria cover the design and construction of earthworks, roading, stormwater, wastewater, water supply and other utility services. They also cover minimum standards for use of existing lots with respect to flood protection, wastewater disposal and water supply, passenger transport provisions, vehicular access-crossings, undergrounding of services and stormwater disposal. They apply to both urban and rural situations.

The criteria are performance based with emphasis on outcomes and effects. They are not a prescription of methods or materials, but are intended to permit flexible and innovative approaches or solutions to all aspects of engineering works.

A3. Environmental Outcome

The environmental outcome from the application of these Engineering Performance Criteria shall be:

- to achieve the intention of the design and the utilisation of natural and physical resources in a safe and efficient manner which will enhance or minimise reduction of amenity values and avoid, remedy or mitigate any adverse effects.

- to minimise the discharge of dust or vapour into the air, to minimise noise and health risk, to protect the neighbouring environment from the adverse effects of changes in surface, shape or level and to protect the neighbouring environment from the adverse effects of migration of silt and soil.

- to minimise the likelihood of erosion, slippage, subsidence or inundation, to protect the neighbouring properties from the adverse effects of such occurrences, minimise alteration of the natural landscape, and to protect both the land and the neighbouring environment from adverse effects caused by groundwater flows.

- to minimise the risk of flooding on developed land and infrastructure, to reduce silting of waterways through soil carried in surface water runoff, to reduce the likelihood of erosion, slippage, subsidence and inundation caused by surface water runoff and to minimise the likelihood of contaminants entering the stormwater system with consequent effects on the environment.

- to minimise the risk of contamination of the environment by wastewater discharge and the consequent effect on the ecosystem, to minimise the risk of contamination of groundwater by seepage of pollutants, to minimise the likelihood of wastewater spills through wastewater network breakdowns and to minimise the volume of wastewater discharge through preventing inflow of ground and surface water.

- to provide safe potable water supply and to protect it from contamination, and with fire fighting capability satisfying current fire standards.

- to minimise the risk of damage to land and infrastructure from earthquakes, thereby minimising the loss of service to the community and potential consequential damage caused by infrastructure failures.

A4. General Criteria

All engineering works carried out to these Engineering Performance Criteria shall conform with all provisions of applicable legislation, and shall comply with all Council bylaws especially the water supply, wastewater and trade waste bylaws. They shall satisfy as a minimum the following requirements.

- minimise any adverse effect on the environment,
- be adequate for their intended use or the intended land use,
- take into consideration hazard mapping prepared by Upper Hutt City Council or the Wellington Regional Council from time to time, in particular those regarding liquefaction and slope stability hazards,
- provide mitigation measures to deal with matters relating to seismic risk,
- permit or provide access for the maintenance of the completed work including all utility and infrastructure networks,
- not require undue maintenance,
- be such that net present value of life cycle costs shall be minimised,
- consider appropriate passenger transport infrastructure,
- provide safe roading fronting all lots and provide evidence that safe vehicular access to lot boundaries and to building sites within lots can be formed,
- be compatible with existing facilities in all respects,
- have a life expectancy in compliance with that stated in Part B of the Code, 'Mandatory Requirements' and comparable with the highest standards for the relevant asset.

In order to satisfy these criteria all design and construction shall be to the highest accepted technical standards and codes.

A5. Design

A5.1 Objective

To provide a sound technical standard for the work thereby providing an assurance that the work will be suitable for its purpose over its intended lifetime, to provide a clear definition of the physical works and to achieve the specified environmental results.

The functional requirement of the design is to define the extent of the works, to provide sufficient information for correct construction, to provide a technical basis for approvals and acceptance and to ensure that any adverse effect on the environment is minimised.

A5.2 Performance Criteria

The design shall:

- incorporate all the components of the Engineering Performance Criteria as required for the intended project,
- be legible and easily understood and supported by sufficient drawings, calculations and background information to allow assessment and review,
- consider the proposal in terms of impact on the existing infrastructure and address such impacts both technically and environmentally,
- provide supporting information in the form of specialist reports and calculations,
- take into consideration the safety factors appropriate to the type of development proposed and the effects of sudden or catastrophic failure of any component or portion of the project,
- ensure that safety of construction, operation and maintenance is maximised,
- ensure that, and provide supporting evidence and calculations to show that, all conditions of any Resource Consent will be complied with,
- minimise any loss of amenity value.

To adequately satisfy the Engineering Performance Criteria all engineering design shall be carried out by a "Designer" who shall be appropriately qualified and insured as defined under that part of this Code entitled "Definitions". *(Intro. 2.)*

The Designer shall be responsible for the engineering suitability of the design and its compliance with this Code and good engineering practice and at completion of the design shall provide to the IQP a design certificate in the form detailed in *B1.8.1* of this Code.

A6. Construction and Maintenance

A6.1 Objective

To complete the physical works to the definition and technical standards specified in the design and to achieve the environmental results required under these Criteria.

The functional requirement of the construction is to construct the works in a safe and efficient manner whilst achieving the specified technical and environmental standards and to maintain them for a period (12 months minimum) long enough to provide an assurance to Council that the assets are to such acceptable standards.

A6.2 Performance Criteria

The construction and maintenance shall:

- be undertaken to the approved design so as to ensure that performance in terms of the design intent is achieved,
- be undertaken in accordance with good engineering practice,
- be carried out with due consideration for the safety of both work site personnel and the general public,
- be carried out so as to minimise any degradation of materials and systems being used in the works,
- minimise any disruption or nuisance to neighbours, the general public, vehicular and pedestrian traffic as applicable,
- minimise short and long term effects on surrounding land, vegetation and facilities,
- ensure and artificially promote where required the reinstatement of grass and vegetation growth,
- ensure that temporary and permanent earthworks and land slopes are adequately stable for their purpose,
- minimise the spread of dust soil or mud and take special measures to achieve this as necessary,
- restore all surfaces and services to not less than their pre-existing condition where disturbed by the project,
- by the provision of a maintenance period of not less than 12 months, provide an assurance to Council that the assets are free of maintenance needs beyond those normally associated with such works.

To adequately satisfy the Engineering Performance Criteria all construction supervision shall be carried out by a "Construction Supervisor" who shall be responsible to the Designer and appropriately qualified and insured as defined under that part of this Code entitled "Definitions". *(Intro. 2.)*

On completion of the construction the Designer shall, based on information provided by the Construction Supervisor, forward to the IQP the completion documentation as described in *B11* of this Code.

A7. Independent Monitoring

A7.1 Objective

To provide verification by personnel independent of the Designer, Construction Supervisor and Contractor that the design and construction works satisfy Council's Code of Practice and all relevant legal requirements and Consents.

The monitoring is to provide, to a level appropriate to the nature of the project an independent assessment of:

i. The compliance of the design with all Consent conditions set, Council's Code of Practice for Civil Engineering works, Resource Management Act and other relevant legislation, bylaws and codes.

ii. The compliance of the construction with the approved design documents and all relevant Consent conditions, Acts and Codes.

To adequately satisfy the Engineering Performance Criteria the independent monitoring shall be carried out by an IQP who shall be appropriately qualified and insured as defined under that part of this Code entitled "Definitions". *(Intro. 2.)*

A7.2 Performance Criteria

A7.2.1 Design Phase

The IQP carrying out the design monitoring *(B1.8)* shall ensure that the design:

- satisfies council's engineering and environmental standards as laid down under Council's District Plan, Code of Practice for Civil Engineering Works and all applicable bylaws and codes;
- satisfies all legislative requirements and conditions including all those set under any Consents;
- is incorporated in engineering documents of adequate detail to satisfy Council's requirements and to enable construction to be carried out in strict compliance with the design;
- is supported by all necessary design analysis and Consents to enable immediate review by the IQP and to provide long term records capable of being clearly understood and reviewed at any time in the future.

Once satisfied with the design and documentation and before any construction shall commence the IQP shall forward the approved documentation with the IQP's supporting Certificate in the form detailed in *B1.8.2* of this Code to Council who will then issue a written approval as to Design within 5 working days.

A7.2.2 Construction Phase

The IQP monitoring the construction phase shall ensure that:

- construction standards and techniques are appropriate to the size, importance and complexity of the project,
- the construction method minimises the potential adverse effects of the project on the environment, both during and on completion of construction,
- the construction works comply with the contract documents, the design intent and all relevant Consents, Codes and Standards,
- on completion of the project all completion documentation required by *Part B, "Mandatory Requirements"* of this Code is passed to Council.

On completion of the construction and before Council will commence the processing of takeover arrangements the IQP shall forward all completion documentation to Council along with a supporting certificate in the form detailed in *B13* of this Code.

A7.2.3 Maintenance/Bond Phase

The IQP monitoring the Maintenance/Bond Phase shall ensure that:

- any items bonded are satisfactorily addressed,
- any maintenance matters developing out of the construction works are attended to during the maintenance period,
- on completion of the maintenance and bond periods the work that has been taken over by Council is free of all maintenance and bond obligations.

On completion of the Maintenance/Bond periods the IQP shall forward a Maintenance Certificate to Council on the form required by *B15* of this Code.

A8. Earthworks

A8.1 Objective

To improve infrastructure and land utilisation, to safeguard people, property and the environment from the adverse effects of unstable, compressible or floodable land whilst improving, or minimising the loss, of environmental values.

A8.2 Performance Criteria

The earthworks shall be designed to:

- provide safe stable lots with all weather vehicular access able to be gained to a building site on each lot for road going vehicles. It is not sufficient to provide access only able to be used by four wheel drive or specialised off-road vehicles,
- provide lots with building sites satisfying the Stormwater performance criteria for protection against inundation,
- not unnecessarily alter the natural landscape,
- provide fills and fill batters that are safe and stable in seismic and/or saturated conditions for the duration of the intended land use and are maintainable without specialised equipment,
- minimise erosion both during and after completion of construction,
- take into consideration the hazard maps prepared by Upper Hutt City Council and/or Wellington Regional Council regarding areas prone to liquefaction and slope stability problems,
- not unnecessarily rely on artificial or special structures for stability, and if utilising such structures ensure their long term safety and integrity,
- cater for the natural groundwater flows,
- not be compressible except where approved specifically by Upper Hutt City Council for shallow non-structural fills,
- comply with all Consent conditions set under the Resource Management Act,
- satisfy *Part B, "Mandatory Requirements"* of this Code.

Developers will be required to provide adequate calculations and specialist reports to provide clear evidence of the earthworks philosophy and standards and to show how these performance criteria are being met.

A9. Land Transport

A9.1 Objective

To ensure safe and efficient movement of people, vehicles and goods with minimum adverse effect on the environment and to achieve the environmental results required under these Criteria.

A9.2 Performance Criteria

Roads shall be so designed geometrically and structurally as to fit logically within Council's current road network hierarchy. In particular the following shall apply.

A9.2.1 Capacity and Layout

The road and vehicular provisions shall be designed to:

- adequately and safely service traffic needs both vehicular (including cyclists) and pedestrian likely to be expected during their design life,
- provide sufficient on and off road parking, loading and manoeuvring space so as to ensure that the roading network is able to provide adequate capacity and ensure that the performance of the roading network is not compromised,
- ensure that road designs do not encourage excessive speeds, by provision of traffic calming measures,
- provide adequate space for all utility services placed in locations as required by Council and the relevant Network Utility Operators,
- mitigate the expanses of impermeable surfacings,
- ensure that all lots are able to be provided with all-weather vehicular access to a building site within each lot,
- link and be compatible with the existing road network,
- provide sufficient space for the later addition of passenger transport infrastructure such as bus shelters and bus bays where a bus route could be reasonably foreseen,
- provide adequate access for emergency vehicles,
- provide adequate and sufficient pedestrian and cycle accessways to link roads, shops, schools and passenger transport facilities,
- incorporate a means of artificial lighting to provide visibility, public safety and security to standards appropriate to the roading hierarchy and pedestrian accessways,
- incorporate a suitably designed stormwater system complying with the requirements of this Code,
- satisfy *Part B, "Mandatory Requirements"* of this Code.

A9.2.2 Structure

The road and vehicular provisions and associated structures shall:

- withstand the expected loads for the design period,
- transfer applied loads so as not to adversely effect the underlying subgrade, utility services, other road facilities or abutting properties,
- be constructed from materials suitable for the intended use and recognised as such by the engineering profession,
- not undergo excessive deflection or surface deformation such that ride or pedestrian use are adversely affected, stormwater disposal is compromised or the pavement surface or under layers is put at risk of premature failure,
- be protected from the adverse effects of surface water or groundwater,
- satisfy *Part B, "Mandatory Requirements"* of this Code.

A10. Stormwater Drainage & Flood Control

A10.1 Objective

To safeguard people, property, infrastructure and the environment from the adverse effects of surface water and to achieve the environmental results required under these Criteria.

A10.2 Performance Criteria

A10.2.1 Capacity and Layout

Stormwater drainage and flood control facilities shall:

- be compatible with the existing stormwater drainage network,
- utilise gravity operation where feasible,
- utilise a piped reticulation system through urban areas unless otherwise approved by Council,
- provide protection for new urban, houses and buildings against inundation in floods of 1% AEP using a protection method appropriate to the intended land use,
- provide protection for all houses or buildings on rural and rural residential lots, with the exception of non occupied out buildings, against inundation in floods of 1% AEP using a protection method appropriate to the intended land use.
- provide lots utilising on site wastewater disposal with a site suitable for wastewater disposal which is free of inundation in floods of 20% AEP (5 year return period) and which can be shown to not cause a health hazard during any inundation,
- adequately service the catchment and accommodate the design flows
- not unduly restrict the location of any future building or development,
- be located within the road reserve except where particular difficulties preclude this,
- be protected by easement where difficulties necessitate the placing of public pipes or channels in private property,
- not provide an undue risk to the health and safety of persons,
- be laid out in such a way as to facilitate ongoing maintenance, including access,
- provide for efficient and safe water inflow and discharge, minimising risk of debris or gravel blockage, outlet scour or land instability,
- minimise any adverse effects on upstream or downstream properties and on the existing stormwater system,
- comply with all Consent conditions set under the Resource Management Act and other applicable legislation and bylaws,
- where utilising mechanical or electrical equipment have adequate emergency provisions and alarm systems to minimise the chances and length of system failure,
- provide alarm and telemetry systems that are compatible with those being used by Council at the time of the project,
- satisfy *Part B, "Mandatory Requirements"* of this Code.

A10.2.2 Structural Integrity

Stormwater drainage and flood control facilities shall:

- withstand any anticipated superimposed loads,
- be constructed from materials suitable for the intended use and with a proven, record of performance,
- ensure safety in operation,
- in the case of piped systems, minimise the penetration by roots,
- in the case of open channels, provide bank and batter slopes, resistant to erosion, piping or collapse, to standards appropriate to the importance and location of the channel,
- satisfy *Part B, "Mandatory Requirements"* of this Code.

A11. Reticulated Wastewater

A11.1 Objective

To safeguard people from injury or illness caused by infection or contamination resulting from wastewater, to convey wastewater to treatment systems and/or final discharge points and to achieve the environmental results required under these Criteria.

A11.2 Performance Criteria

A11.2.1 Capacity and Layout

Wastewater facilities shall:

- consist of an underground piped reticulation system where adjacent reticulation is available,
- be located within the road reserve except where special difficulties preclude this,
- be protected by easement where special difficulties necessitate the placing of reticulation pipes on private property,
- be of capacity suitable for carrying peak flows anticipated during the lifetime with due allowance for ground and surface water infiltration and inflow,
- adequately service the catchment including all current and future lots compatible with the district plan zoning,
- adequately convey wastewater to an approved discharge point,
- minimise adverse environmental effect and comply with all Consent conditions set under the Resource Management Act,
- maintain adequate self cleansing velocities to ensure a daily flush at dry weather flow,
- minimise the risk of ingress of flood water without unduly restricting maintenance access,
- be compatible with the existing wastewater drainage network,
- utilise gravity operation where feasible,
- not unduly restrict the location of any future buildings or development,
- be laid out in such a way as to minimise the potential for blockage and facilitate ongoing maintenance or development,
- where utilising mechanical or electrical equipment have adequate emergency provisions and alarm systems to minimise the possibility of discharge to natural land or water,
- provide alarm and telemetry systems that are compatible with those being used by Council at the time of the project.
- satisfy *Part B, "Mandatory Requirements"* of this Code.

A11.2.2 Structural Integrity

Wastewater facilities shall:

- be constructed from materials suitable for the intended use and design life and with a proven record of performance,
- minimise the likelihood of leakage and infiltration and the penetration of roots,
- minimise the likelihood of blockage,
- withstand all anticipated superimposed loads,
- satisfy *Part B, "Mandatory Requirements"* of this Code.

A12. On Lot Wastewater Treatment and Disposal

A12.1 Objective

To enable safe hygienic disposal of all household wastewater by surface or subsurface land disposal without creating any adverse environmental impact outside the bounds of the lot. Such systems may only be used where a connection to the existing reticulation is not considered reasonable by Council.

A12.2 Performance Criteria

On lot wastewater treatment and disposal facilities shall:

- provide appropriate and safe treatment and disposal facilities in accordance with the Regional Plan for Discharges to Land,
- have a life expectancy in line with the best available systems at the time,
- satisfy all consents given under the Resource Management Act,
- be adequately separated from private water supplies, watercourses and boundaries, such that there are no adverse effects within or outside the lot served,
- have minimum maintenance needs and be as fail safe as practicable,
- have maintenance needs defined and a maintenance regime set.
- be unobtrusive,
- not be permitted where water supply is on demand/unrestricted,
- satisfy *Part B, "Mandatory Requirements"* of this Code.

A13. Water Supply

A13.1 Objective

To collect and distribute water for domestic, commercial, industrial and fire fighting purposes and to achieve the environmental results required under these Criteria.

Council will not provide an on demand supply from the reticulated water supply system in urban areas unless a reticulated wastewater system is available in a new development.

A13.2 Performance Criteria

Water supply facilities include intake systems both above and below ground, treatment and storage facilities both open and closed, pumping systems trunk and local network distribution systems.

Water supply facilities shall be designed to accepted health and safety, capacity and structural standards.

A13.2.1 Water Quality

Water supply facilities shall:

- produce water complying with the current Drinking Water Standards for New Zealand.

A13.2.2 Capacity and Layout

Water supply facilities shall:

- have capacity to service at adequate flow and pressure the anticipated demand over the lifetime of the facility,
- in the case of piped components be located below ground,
- when serving multiple properties, wherever practical, be located within the road reserve and if located in private property be protected by easement,
- satisfy appropriate fire protection standards and permit access for fire fighting,
- be located in such a way as to adequately service each lot, development or road area,
- be compatible with the existing water reticulation network,
- be compatible with all other utility systems,
- provide reasonable access for maintenance,
- minimise the extent of network without supply during maintenance works,
- keep trunk mains separate from local reticulation systems,
- minimise any adverse environment effects and comply with all Consent conditions under the Resource Management Act,
- where using mechanical or electrical equipment, have adequate emergency provisions to minimise the chances and length of system failure and loss of service,
- provide alarm and telemetry systems that are compatible with those being used by Council at the time of the project,
- satisfy *Part B, "Mandatory Requirements"* of this Code.

A13.2.3 **Structure**

The water supply facilities shall:

- ensure that any mechanical or electrical plant requiring special maintenance or component upgrades to satisfy design life requirements is identified as such but has componentry with a life comparable with that expected from the best current technology,
- withstand all anticipated superimposed loads,
- withstand all anticipated pressures including those transient loads reasonably expected from uncontrolled pump stops, pump start up and emergency valve closures,
- minimise the likelihood of leakage,
- minimise the likelihood of potable water contamination,
- be clearly identified as water pipes.
- satisfy *Part B, "Mandatory Requirements"* of this Code.

A14. Electrical Power

A14.1 Objective

To provide a safe electrical source for energy demands to all developments, street lighting to all urban developments, and a minimum of flag lighting of intersections in rural developments so as to achieve the environmental results required under these Criteria.

The Developer shall organise and pay all costs associated with electrical design and installation.

A14.2 Performance Criteria

Electrical power facilities shall:

- utilise separate cables for normal consumer supply and street lighting,
- utilise underground cabling except in those rural areas where overhead cabling is specifically approved by Upper Hutt City Council, or in urban areas, where the existing house of a lot to be cross leased or unit titled may continue to utilise an existing overhead connection,
- have capacity suitable for carrying peak loads anticipated during their lifetime,
- have a design life which is compatible with the facilities being served,
- be compatible with the existing network,
- be laid out in such a way as to facilitate ongoing maintenance and enable servicing of all expected lots and abutting sites, pedestrian accessways and streets,
- utilise lighting which provide visibility and security to standards appropriate to the importance of the locality,
- be designed and incorporate safety and alarm provisions to the highest accepted standards at the time,
- minimise adverse environmental effects,
- be located at a safe distance from other services,
- ensure that electrical equipment that is constructed above ground is sited, designed and built to acceptable aesthetic standards and so as to minimise visual impact,
- be the maintenance responsibility of owners where installed in private property or rights of way. Lights and associated circuitry in private ways or rights of way shall also be supplied from a metered private circuitry and maintained by the property owners,
- satisfy *Part B, "Mandatory Requirements"* of this Code.

A15. Gas

A15.1 Objective

To provide a reticulated gas supply in a safe manner and to the environmental criteria of this Code, wherever existing gas reticulation is available within 30 metres of the boundary of the Development.

The Developer shall organise and pay all costs associated with the design and installation of the gas supply system.

A15.2 Performance Criteria

Gas reticulation and associated facilities shall:

- have capacity appropriate to the anticipated peak demand during its lifetime,
- be laid underground and in road reserve unless specifically approved otherwise by Upper Hutt City Council.
- be laid out in such a way as to be able to service all relevant lots or demand points and to facilitate ongoing maintenance,
- have a design life compatible with the facilities being served,
- be designed to standards and incorporating materials, safety and alarm provisions to the highest accepted standards at the time,
- minimise adverse environmental effects,
- be located at a safe distance from other services,
- be capable of carrying all anticipated superimposed loads without movement of ground or components,
- ensure that gas equipment that is constructed above ground is sited, designed and built to acceptable aesthetic standards and so as to minimise visual impact,
- satisfy *Part B, "Mandatory Requirements"* of this Code.

A16. Telecommunications and Information Cabling

A16.1 Objective

To provide telecommunications reticulation and, wherever existing information reticulation is available within 30 metres of the boundary of the development, information systems reticulation in a safe and efficient manner.

The Developer shall organise and pay all costs associated with the design and installation of the telecommunications and information systems.

A16.2 Performance Criteria

Telecommunications and information reticulation shall:

- have capacity appropriate to the anticipated peak demand during its lifetime,
- utilise underground cabling except in those rural areas where overhead cabling is specifically approved by Upper Hutt City Council, or in urban areas, where the existing house of a lot to be cross leased or unit titled may continue to utilise an existing overhead connection,
- be laid out in such a way as to service all lots and demand points and to facilitate ongoing maintenance,
- have a design life compatible with the facilities being served,
- be designed to standards and incorporating materials, safety and alarm provisions to the highest accepted standards at the time,
- minimise adverse environmental effects,
- be located at a safe distance from other services,
- ensure that any equipment constructed above ground is sited, designed and built to acceptable aesthetic standards so as to minimise visual impact,
- be capable of carrying all anticipated superimposed loads without movement of ground or components,
- satisfy *Part B, "Mandatory Requirements"* of this Code.

A17. Street Scape

A17.1 Objective

To mitigate the density of urban subdivision by the provision of suitable trees in public roads.

A17.2 Performance Criteria

Selection of tree type and planting location and patterns shall be undertaken by a suitably qualified person, paid for by the Developer, in consultation with the IQP, so as to achieve the following minimum performance criteria:

- satisfy any Resource Consent and enhance the subdivisional environment,
- be located in such a way that access to utility services is available,
- take into account the effect of a mature canopy on street lighting, daylight, access to houses, footpaths and views from adjacent properties,
- be located in such a way that traffic and pedestrian safety is able to be maintained,
- be selected, located and installed so as to minimise future damage to roadscape, services and private property,
- satisfy *Part B, "Mandatory Requirements"* of this Code.

A18. Traffic Services and Road Signage

A18.1 Objective

To provide traffic control and guidance including traffic signals, markings and signage, road name and information signs, rapid numbering systems, culvert and bridge numbers, reflectors and edge markers, appropriate to the roading hierarchy and location and to achieve the environmental results required under these Criteria.

A18.2 Performance Criteria

Traffic services and road signage shall be designed and constructed to the highest accepted technical standards and codes so as to achieve the following minimum performance criteria:

- be laid out and marked to the standards current in Upper Hutt City at the time,
- be designed to satisfy existing and future traffic needs, expected within the design life of the facility,
- be laid out in such a way as to facilitate ongoing maintenance,
- be located in such a way as to minimise public and traffic obstruction or inconvenience,
- incorporate fail safe and telemetry systems to minimise public danger and provide early notice of faults,
- comply with any applicable Consent conditions,
- provide sign directory information in accordance with Council's policy at the time,
- satisfy *Part B, "Mandatory Requirements"* of this Code.

A19. Land Clearance and Associated Works

A19.1 Objective

To enable changes in land use to be made on private property whilst minimising adverse effects on the surface soils, slope geology, stormwater flows and other physical environmental values.

A19.2 Performance Criteria

Land clearance and associated works shall be designed and constructed to standards current at the time so as to achieve the following minimum performance criteria:

- ensure that landslopes or surface soils are not put at increased risk of slip or erosion,
- ensure that cleared or broken growth is not able to be carried into waterways.
- design and build roading and drainage works so as to minimise adverse visual impacts and the potential for land instability,
- the water quality in receiving water shall not be detrimentally affected,
- control storm runoff peak flows so that they are not significantly increased nor do they impact detrimentally on other parties or the downstream drainage system,
- comply with all applicable Consent conditions,
- satisfy *Part B, "Mandatory Requirements"* of this Code.

PART B

MANDATORY REQUIREMENTS

CONTENTS

PART B MANDATORY REQUIREMENTS

B1. General Requirements

B1.1 Introduction

Part B of the Code sets out minimum standards for Civil Engineering works with which compliance is mandatory if the works are to satisfy the District Plan and gain the approval of Upper Hutt City Council.

The Code, being performance based, allows for deviation from the acceptable methods and solutions covered under *Parts C, "Design: A Means of Compliance"* and *D "Construction: A Means of Compliance"*. However, all Civil Engineering works, whether using the acceptable solutions or alternative methods, shall satisfy these mandatory requirements and shall achieve standards of construction and long term performance not less than those expected by compliance with Parts C and D of this Code.

Where any deviation from the acceptable methods and solutions as outlined in Parts C and D is proposed, alternative solutions shall be discussed with the IQP before commencement of detailed design.

B1.2 Definitions

Refer to the "Introduction" to the Code for definitions relevant to all Parts of the Code.

B1.3 Development Standards

Developments whether involving subdivision or not shall be undertaken to the standards and incorporating the infrastructure required by this Code. The following minimum criteria apply.

B1.3.1 Subdivisions

Every allotment shown on a scheme plan shall be provided with or be serviced by:

- Adequate engineering design to show the feasibility of obtaining a practical vehicular access to a formed legal road.
- Water supply from Council mains for all urban subdivisions in urban areas and other reticulated areas. In non-reticulated areas acceptable water supply solutions shall be demonstrated at the time of subdivision consent application.
- Stormwater drainage to Council's mains, or to an alternative discharge point approved by Council in terms of Council's Priorities for Stormwater Disposal. *(B6.9)*
- Wastewater disposal to Council's mains in all urban residential commercial and industrial areas and rural areas where considered reasonable and desirable by Council.
- Electrical power supply.
- Gas supply where reticulated gas is available within 30 metres of the boundary of the development.
- Telecommunication reticulation.
- Information cabling reticulation where reticulated supply is within 30 metres of the boundary.
- Street lighting, signage and roadmarking.
- Protection against flooding, inundation erosion and slippage.

The provision of roading, infrastructure and utility services (both public and private) to enable allotments to be serviced to these requirements shall be the responsibility of the Developer.

B1.3.2 Developments With No Public Infrastructure (Multi-Unit, Comprehensive and Rear Lot Developments)

In such developments roading and utility services within the Lot remain private.

The following minimum development requirements apply.

i. At subdivision/land use stage

- Unless agreed otherwise by Council install one connection for each utility service from the mains to the road reserve boundary except that existing services where able to be proven to be of suitable size and in good condition may be retained. *(B5.9)*

- for all vehicle accesses, provide a vehicle crossing from the kerb or seal edge to the road reserve boundary *(B3.14)*, form the driveway and manoeuvring areas and surface it to the extent necessary to prevent gravel and debris from being carried onto the road reserve. Permanent all weather surfacing shall be placed for at least 5 metres into private property. *(B3.18)*

- provide adequate stormwater drainage to prevent runoff onto adjacent properties, public footpaths or crossings.

- submit a plan showing proposed internal services layout, accesses (drives) common and individual, parking and turning heads as required by this Code.

ii. At Building Consent stage

- install all internal services. All dwelling units shall be provided with individual tobies and provision for water meters located within the common area accessible to a meter reader.

B1.4 Development Feasibility and Effects Report

As part of any Subdivision or Land Use consent application the Developer shall provide a report to Council demonstrating how the development is to be serviced and the impact of the development on the existing infrastructure *(B4.1)*. The report shall cover, as a minimum, the following:

- the impact of the development on the existing infrastructure and where the development cannot be adequately serviced by existing infrastructure, or is likely to significantly effect service to existing infrastructure users, how such effects will be overcome or mitigated;

- the impact of the development on stormwater runoff from the site and the impact of the changes on upstream and downstream water quality, flood flows, flood levels or silt and debris movement. How such changes are to be addressed so as to minimise the effects on upstream or downstream land;

- in the case of rural or rural residential subdivisions, demonstrate that suitable and safe water supply, wastewater and stormwater disposal systems are available;

- the philosophy on which the roading and service sizes and layout has been based, and enough preliminary design and drawings to adequately show the development proposals and how they are addressing the requirements of the Code.

- all appropriate supporting specialist reports such as

- geotechnical engineer's report where significant earthworks are involved *(B2)* or land clearing being undertaken; *(B4)*
- traffic management report *(B3.2)*, dimensions and layout.

This report shall be submitted along with any reports required under the Resource Management Act including the "Assessment of Environmental Effects".

B1.5 Minimum Engineering Design Documentation

Engineering documentation for Civil Engineering works shall be prepared by the Designer who shall retain final responsibility for the standards and performance of the design. Documentation shall incorporate the following:

- The concept plan showing the development and the full development when works cover a staged development,
- All resource consents required and/or obtained for the project,
- Background reports as appropriate to the nature and complexity of the project,
- Calculations to support the design and show its compliance with standards set by the Code,
- Design drawings of adequate detail to enable easy assessment of the project's impact, to show that its technical standards satisfy the requirements of this Code and to ensure accurate construction,
- Contract specifications to ensure that construction complies with the standards required by the design and the Code.
- The submitted design documentation shall also include the provision of computer based media containing all drawings and design information where public infrastructure is provided.

B1.6 Design Drawings

B1.6.1 Minimum Design Drawings to be Provided

Clear design drawings shall be prepared for all Civil Engineering works. As a minimum they shall include:

- Drawings showing existing services, known hazards, and protected biological and heritage features on the site.
- Earthworks drawings showing existing contours, proposed finished contours, batter slopes, cut and fill depths, subsoil drainage and culverting.
- Roading plans and long sections showing detailed horizontal geometrics and road levels, typical cross-sections, road marking and signals, signs, and location of permanent survey marks.
- Plans and longitudinal sections showing wastewater and stormwater drainage.
- Drawings showing water supply reticulation layout.
- Drawings showing telecommunication, electrical supply and street lighting layout.
- Drawings showing gas and information system cable layouts, where these services are provided.

- Plans and tree list showing tree layout and species.

- Other drawings or details (or references to publicly available Upper Hutt City Council standard drawings where applicable) necessary to ensure clear understanding of the project, its compliance with the Code and relevant design standards and its ability to be built accurately.

B1.6.2 Drawing and Computer Media Standards

Drawings in support of land development projects, whether for Design or As Built purposes shall be neatly drawn in permanent ink on A1 sheets (original size) at standard scales as follows.

• Road plans	1:500, 1:250
• Utility service plans	1:500, 1:250
• Road longitudinal sections	1:500 or 1:250 longitudinal with a distortion of 5 or 10 longitudinal to vertical scales
• Service longitudinal sections	1:500, 1:250 longitudinal distorted by up to 10 vertical
• Road cross-sections	1:100 true scale

Detail drawings shall utilise appropriate scales selected from any of the above or at 1:100, 1:50, 1:20, or 1:10. Draughting standards shall comply with NZS/AS 1100.401 (1984), *Technical Drawing, Supplement No.3* (January 1984), *Engineering Survey and Engineering Survey Design Drawing — Sewerage and Water Supply*; *Supplement No.4* (January 1984), *Engineering Survey and Engineering Survey Design Drawing — Roads*.

All As Built drawings shall be computer based for all projects involving new public infrastructure, with the exception of developments that involve only service connections from the road boundary to the main. In the latter case hand drawn As Builts are acceptable provided all different service connections are clearly identifiable.

Computer based drawings shall be prepared in layers so that roads, drains, water and other utility services can be easily separated out by Council for entry into their database.

All drawings shall be made available to Council in paper form and on computer media that is compatible with Council's document record system. All computer media shall be accompanied by appropriate certification that it has been virus checked and found to be free from known viruses.

B1.7 Design Documentation for Utility Services Not Controlled by Council

The Designer shall contact all relevant controlling authorities to establish their requirements for servicing subdivision and land development projects. Relevant services shall be designed as part of the design documentation.

B1.8 Design Monitoring and Approval

The Designer's work shall be monitored as to compliance with this Code by an Independent Qualified Person (IQP). The IQP shall discuss the project and any unusual design features with Council from time to time to ensure Council's intent and wishes are adequately interpreted.

The Designer shall communicate with the IQP during the design process to ensure that Council's standards are being met. On completion of the Design, full documentation including investigation results, reports, design calculations, working drawings and specifications shall be passed to the IQP for review along with a certificate from the Designer in the form given below. Once the IQP is satisfied that the design satisfies Council's requirements (after amendment if necessary), three sets of full documentation shall be bound and initialled by the

Designer and IQP. One set shall be held by the Designer, one by the IQP and one lodged by the IQP with Council along with the Designer Certificate and a certificate from the IQP in the form given below. In addition to the signed documentation Council shall be provided with all documentation on computer media. The IQP shall provide the IQP Certificate and lodge all documentation with Council within 10 working days of receipt from the Designer of the final documentation (incorporating any extra information that may be required by the IQP).

On receipt of this documentation Council will provide a written approval to the Designer within 5 working days.

B1.8.1 Format of Designers Certificate

I (name) _____
of (firm and address) _____
have designed the subject works and confirm that the design is to current good engineering practice, and that it satisfies all Resource Consent conditions, relevant Council requirements, and applicable Codes and Standards. I hold/My Practice currently holds professional indemnity insurance in the sum of $ _____
(minimum of $250,000). My qualifications and experience relevant to this project are: _____

_____

Signed: _____ Formal Qualification: _____

Date _____

B1.8.2 Format of IQP Certificate for Design Phase

I (name) _____
of (firm and address) _____
have reviewed the documentation and design given to me with respect to this project and advise that from my review I believe that the project is designed to current good engineering practice and that it satisfies all relevant Council requirements and Resource Consent conditions. I hold/My Practice currently holds professional indemnity insurance in the sum of $_____
(minimum of $250,000). My qualifications and experience relevant to this project are: _____

_____

Signed: _____ Formal Qualification: _____

Date _____

B1.9 Survey Marks

Survey and level marks shall be installed by a registered surveyor in all new developments that incorporate new public roads. The quality and positioning of the markers shall satisfy the following minimum requirements:

- marker points shall be constructed of weather resistant non-ferrous metal permanently affixed to concrete kerbs (surface to surface gluing is not acceptable),
- they shall possess a clearly evident protrusion which shall be the point levelled,
- they shall be located at distances of not more than 1000 metres apart on any road but all roads shall have at least one marker point,
- they shall be located to be clear of likely driveway positions and to minimise risk to pedestrian and cycle traffic.

The markers shall be precisely levelled in terms of MSL and their location coordinated in terms of geodetic datum. Information shall be provided in both paper and computer media format to Council. *(B1.7, B12)*

B1.10 Maintenance Corridors, Easements, and Building Controls for Services

Where utility services must cross one allotment to service another or others and where such services are under the control of Upper Hutt City Council, other network utility operator or private entity, then the service shall be protected by means of an Easement registered against the title.

Maintenance corridors shall also be provided where required to ensure maintenance access to services, waterways or special structures.

B1.10.1 For Trenched Services

Maintenance corridors shall be of such a width as to;

- enable future maintenance excavation to be undertaken without putting any adjacent buildings at risk;
- minimise any need for extraordinary trench protection measures during maintenance works;
- enable passage of excavation plant along the corridor.

To satisfy these criteria corridor widths shall be derived based on the method shown on *Appendix B, Figure 7*.

In no case in new developments shall the corridor width be less than 2.6 metres nor shall any service be laid nearer than 1.3 metres to a boundary. When, due to no feasible alternatives, it is necessary to lay mains through property that is already built on or where it can be shown that adjacent foundation depths are adequately deep, then corridor widths may be reduced based on the foundation depth, in accordance with *Appendix B, Figure 7*, provided the following minimum criteria are achieved:

- distance to boundary at least 1.3 metres
- distance to the subject building at least 0.7 metres from pipe edge
- total corridor width at least 2.6 metres.

Where an existing maintenance corridor exists of greater than 2.6 metres width a builder of a new structure may request its reduction if the building foundations are taken to such a level as to satisfy *Appendix B, Figure 7*. The minimum criteria as noted above shall apply.

B1.10.2 Accessways to Services for Vehicles

Maintenance corridor widths for accessways to services shall be adequate for their purpose but in no case less than 3 metres in width.

B1.10.3 Along Stream Waterways

Maintenance corridors over waterways shall be adequate to enable maintenance access for vehicles along the waterway banks.

B1.10.4 Responsibility for and Nature of Easement

Easements shall be created by the Developer at the Developer's expense.

The maintenance corridor shall be identified on the survey plan and listed in a Schedule of Easements. The Easement shall be subject to the Council standard conditions relating to Maintenance Corridors in private property as covered in *Appendix B, Figure 5*.

B1.11 Commencement of Physical Works

No construction work shall start until all statutory consents have been obtained, engineering design drawings and specifications prepared to standards laid down in this Code and such drawings, specifications and any necessary associated calculations and reports, along with the associated IQP Design certificate, received and approved in writing by Upper Hutt City Council.

B1.12 Design Life of Infrastructure Components

Components of the engineering infrastructure shall be designed to provide the following minimum life. For individual components of that facility where the state of the art is such that it is generally accepted that these design lives cannot be achieved (eg. some electronic and mechanical equipment) a design life appropriate to the state of the art shall be specified by the designer and provision made for easy maintenance and replacement of the subject componentry so that the required design life of the total facility can be achieved.

B1.12.1 Earthworks

Earthworks shall be designed to minimise settlement or deformation, or slips which could place infrastructure or building improvements at risk, over the lifetime of the asset for which the earthworks are intended to provide.

B1.12.2 Roading (including pedestrian and cycle facilities)

• Geometric standards	50 years
• Structural standards - based on best available load predictions, to be compatible with the existing network, and accepting that asphalt based surfacing will generally need non structural protection within this time frame.	50 years
• Bridges and Culverts	100 years

B1.12.3 Stormwater and Waste Water Facilities

• Reservoirs, detention structures, river control works	100 years
• Pipework, appurtenances, and all associated concrete work	80 years
• Coatings on exposed pipework, with provision made for easy cleaning and recoating	15 years
• Mechanical and electrical plant, with provision made for easy maintenance and replacement.	20 years

B1.12.4 Water Supply

• Reservoirs, intake structures	100 years
• Pipework, appurtenances and associated structures	80 years
• Coatings on exposed pipework, with provision made for easy cleaning and recoating	15 years
• Valves, hydrants etc (with provision for replacement)	80 years
• Mechanical and electrical plant, with provision made for easy maintenance and replacement.	20 years

B1.13 Levels of New Lots

Wherever feasible new lots shall be designed to be above road level so as to avoid the potential for flooding from the road. Where even with good design some lots are unable to be so designed, the ground level immediately adjacent to the carriageway shall be graded upwards from the carriageway (for un-kerbed roads only), or kerb at not less than 1 in 25 for at least 3 metres.

For existing lots below the road accessways shall be designed so that the stormwater from the road is not able to flow down the drive putting housing at risk should sumps block or the capacity of the public stormwater system be exceeded. *(B6)*

B2. Earthworks

Earthworks shall be designed to the highest engineering standards available at the time of the project so as to ensure stable and environmentally acceptable land forms and safe and stable platforms for buildings and roads.

For projects involving cut batters greater than 2 metres in height, fills of greater than 0.5 metres depth, or any situation where building sites will be located on ground formed by earth fill, then the design shall be supported by appropriate geotechnical site investigations, reports and design criteria.

B2.1 Geotechnical Site Investigations

B2.1.1 Predevelopment Report

As part of any Resource Consent application the Designer shall engage a suitably qualified person having experience appropriate to the project and acceptable to the IQP to undertake a preliminary evaluation of the general nature and character of the site. This investigation is to be 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 evaluation shall identify any geotechnical testing or analysis required to confirm the sites suitability for the earthworks proposed. Any such testing or analysis shall be carried out under the control of the suitably qualified person.

The report shall address:

- the results of the preliminary investigation;
- the results of the geotechnical testing or analysis;
- conclusions as to batter slopes and fill type and standards;
- conclusions as to subsoil drainage requirements and extent of unsuitable materials and how they are to be treated;
- materials to be used as fills, their suitability for the subject fills any special requirements for their use as fills to achieve the required strengths and densities. (In no case shall organic or other soft or compressible soils be used in fills for land development and infrastructure purposes);
- the availability of a suitable building site on each lot along with a feasible stable all weather access drive suitable for normal road going vehicles.

The above report shall be accompanied by a statement of Professional Opinion such as that incorporated as *Appendix B, Figure 1*.

B2.1.2 Geotechnical Design Report

Where identified as being necessary by the Predevelopment Report, or considered necessary to address issues arising during the detailed design, more detailed geotechnical investigation and analysis shall be carried out and a detailed Geotechnical Design report prepared. For some projects this level of detail will be necessary at Resource Consent stage and for other projects its preparation as part of Engineering approvals may be acceptable.

The Geotechnical design report shall detail all investigation and design work carried out, conclusions reached and requirements for the detailed design and construction of the development.

B2.2 Earthworks Design

Earthworks design shall incorporate the requirements of the Geotechnical reports.

The extent of mass earthworks for subdivisions or infrastructure development shall be clearly defined in the design documentation which as a minimum shall include drawings showing:

i. the extent of cut and fill, batter slopes and heights and the extent and nature of subsoil, drainage and culverting.

ii. the pre-existing contours including the extent of upstream catchments affected by the earthworks.

iii. details of all culverts including alignment sizes and types of culverts, inlet and outlet details. These shall include details of temporary or long term silt control or runoff attenuation where required.

B2.3 Earthworks Construction Standards

A specification of workmanship and materials shall be provided covering earthworks standards, methods of quality control to be achieved during construction and systems of checking to be undertaken by the Construction Supervisor monitoring the Works.

As a minimum, the specification shall include:

i. standards for preparing the existing ground and removal of unsuitable materials.

ii. standards for placing and control of the fill including control of the quality of the fill material being used.

iii. compaction standards and moisture content control, how control testing is to be carried out and the results presented.

iv. control of finished levels and position, including batter slopes and compaction.

B2.4 Earthworks Maintenance

Earthworks and associated silt control facilities shall be maintained by the Developer until there is clear evidence that instability, erosion and runoff of silt associated with earthworks has ceased for a period of at least three months. Where this has not occurred at the time application for the IQP Completion certificate is made Council will only consider the processing of the Completion Documentation if the problem is minor and if a bond is placed to cover ongoing maintenance and potential repairs of the applicable earthworks. The bond will be taken for a period determined by Council but not less than 12 months and will only be released when protecting vegetation has been established, the evidence of instability/erosion or siltation has ceased for a period of at least 3 months, any temporary silt traps removed and any site or downstream instability or siltation made good.

B3. Roading

B3.1 Roading Hierarchy and Design

Design of roads shall recognise the various components of a road as including the following:

- road carriageway, including bridges and culverts,
- pedestrian and cycle facilities (including paths and cycleways that are at some distance from road carriageways),
- berm and amenity provisions (including planting and seating),
- vehicle parking and manoeuvring areas,
- associated utility services.

Road designs shall be to Codes and Guidelines acceptable to Council and current at the time of the project. Roads and associated facilities shall provide for safe, efficient use by all anticipated users, including persons with disabilities, over its lifetime, based on the position of the subject road (and pedestrian/cycle links where applicable) in Council's long term road hierarchy network plan. *(Appendix B, Figures 3 and 4)* Roads shall be designed on the assumption that the land will be fully developed to the extent defined in the District Plan.

Road design shall provide for safe pedestrian and cycle movement and street scape enhancement to mitigate harsh formed surfaces. It shall include for all associated detailing including road marking, signals, signs, lighting and all road furniture required for traffic, pedestrian safety and for landscaping (eg. seating, planting etc.).

B3.2 Traffic Management Report

As part of the development "Feasibility and Effects" report *(B1.4)* and if required by the nature of the development a traffic management report shall be prepared and submitted with the Consent application. This report shall show the basis for selection of the roading dimensions and layout proposed and how it will cope with expected traffic needs over its lifetime. The report shall cover the requirements of Public Transport and Traffic calming where applicable as required under the following clauses of this Code.

In addition it shall evaluate the effects of the proposed development at its ultimate extent (and staged, where applicable) on the surrounding road network *(B1.4)*. Where the evaluation shows the changed traffic volumes and patterns to have detrimental impacts on the surrounding road network the Consent process may require that either financial contribution be made or works carried out at the Developer’s expense to mitigate the detrimental impacts.

B3.3 Public Transport

Urban land development shall plan to maximise convenient access to public transport or potential public transport.

B3.4 Traffic Calming in Residential Streets

In residential streets, traffic calming measures shall be taken to ensure that the design speed regime is not able to be significantly exceeded and that through traffic is discouraged from residential roads of category "Local Residential" and lower.

B3.5 Road Furniture

Seats, signs and other street furniture shall be designed and placed in accordance with Council's standard drawings but shall not be positioned such that they may cause impediment or sight obstructions to pedestrian and vehicular traffic. Furniture used in the CBD shall unless expressly approved otherwise be compatible with existing CBD furniture. Street signs shall incorporate Council's bird logo and shall comply with Council's current signwriting standards.

B3.6 Trees and Landscaping

A tree and shrub planting plan shall be provided with the design documentation for all urban subdivisions. Trees shall be selected after discussion with the IQP and shall provide for not less than one per two lot frontage on average. Innovative design incorporating group planting of shrubs and trees is also encouraged. Trees shall be identified by scientific name and planted in locations in which topsoils has been locally deepened to not less than 450 mm deep by 450 mm diameter. If required by the IQP trees shall be fully enclosed within root guards to a minimum of 600 mm depth to provide long term protection to roads, paths and services. *(A17)*

B3.7 Road Lighting

Unless approved otherwise by Council, lighting columns shall be positioned as close as practical to the road reserve boundary and on the line of boundaries between properties such that they cause minimal impediment to pedestrian traffic and possible accessway locations. Illumination shall comply with design standards accepted and in use for Council projects at the time of the work. Pedestrians and bicycle accessways separate from roads shall be illuminated to a similar standard as for minor roads.

All road lighting layouts including rural developments shall incorporate as a minimum flag lighting of all intersections.

B3.8 Special Road and Footpath Provisions Near Places of Assembly

Adjacent to places of public assembly including schools, hospitals, shopping areas, public halls etc. designs shall incorporate special provisions such as extra parking spaces, stopping laybys, widened footpaths, bus and taxi stops, pedestrian crossings, loading zones and any associated facilities desirable to ensure the safety of concentrations of vehicles and pedestrians.

B3.9 Road Surfacing

All roads shall be provided with a permanent, hard wearing surfacing layer, which shall be either impermeable or formed over an impermeable base. The surfacing shall be capable of carrying all stresses expected during its lifetime.

B3.9.1 Procedure for 2 Coat Chip Seals

When conventional single grade chip seals are used as the sole surfacing of a road they shall consist of a first and second coat seal. Because of the time frame required for a first and second coat seal procedure Council will accept either of the following options to enable the submission of full Completion Documentation to Council.

The first coat seal shall be placed as part of the works construction.

For the second coat seal two options are available:

i. The Developer may complete the second coat seal 9 to 12 months after the first coat seal and before submission of Completion Documentation.

ii. The Developer may enter into a bond with Council, in which case Council will take over the responsibility for the second coat seal and carry out the work at their convenience. In this case the Developer shall maintain the first coat seal for 12 months after its placing.

B3.10 Footpaths, Pedestrian Accessways, Bicycle Tracks, Berms

B3.10.1 Urban

Footpaths shall be provided to adequately service all urban developments.

Footpaths in Commercial/Industrial areas shall be a minimum of 3 metres wide, shall be surfaced over the full width and shall occupy the full width between the road reserve boundary and rear face of the road kerb. In addition they shall be of adequate width to enable landscaping and all current and expected future services to be installed. Footpaths shall be designed appropriately for their purpose as to dimensions, appearance, strength, durability and finish.

Footpaths in residential areas shall be not less than 1.4 metres wide and shall be surfaced over their full width. Where necessary to adequately serve their purpose wider footpaths or areas of local widening shall be provided.

Grassed berms shall be provided over the widths between path and kerb and path and road boundary. The berm shall incorporate not less than 100 mm compacted thickness of loam topsoil placed over a base material capable of allowing root penetration and sustaining growth.

In all cases the combined berm and footpath width shall be adequate to enable landscaping and all current and expected services to be installed.

Pedestrian accessways, including reserves, shall be a minimum of 2.2 metres wide. They shall be surfaced over their full width and provision shall be made for the collection and disposal of stormwater. Both sides of the accessway shall be fenced with solid fencing at least 1.8 metres high and provided with mowing strips to all sides of the fence base. The palings or approved fence facing shall face the accessway or reserve as applicable. Cycle barriers shall be provided at both ends of pedestrian accessways suitable for disabled access including wheelchairs.

Cycle tracks shall be designed to the standards as set out in Austroads Part 14.

Stormwater disposal and lighting shall be provided to all pedestrian accessways and off road cycleways.

B3.10.2 Rural

In rural areas, the combination of carriageways and shoulders shall be of adequate width to allow safe passage and stopping of bicycles, pedestrians and motorised traffic.

Rural berms shall be of adequate width to

- allow running of utility services and placing of power poles within the berm
- provide adequate space between the road reserve boundary and the carriageway edge to enable residents to safely enter the road traffic
- allow room for ongoing road edge and edge drain maintenance
- ensure that all cut and fill batters are within road reserve.

In no case shall berms provide less than 2 metres of width between the road side channel and road reserve boundary.

Pedestrian accessways or cycle tracks where required shall be of the same minimum dimensions as for the urban case. They shall be formed and surfaced full width with provisions made for disposal of surface water. They shall be fenced each side with fencing at least 1.2 metres high and of a style in keeping with the surrounds.

B3.10.3 Footpath and Cycleway Surfacing

All footpaths and cycleways shall be surfaced with a permanent surfacing layer appropriate to the surrounding environment and level of use expected. The surface texture on cycleways shall be not rougher than would be achieved by use of asphaltic concrete or a grade 6 chipseal.

B3.11 Deflection Testing Prior to Surfacing

Prior to placing the surfacing layer (except for cast-in-situ concrete roads) deflections shall be tested by the Benkelman Beam method. At least 95% of all tests shall comply with the standards appropriate to the road type as follows. In addition no test shall give deflections greater than 25% above the specified maximum.

Residential		Other	
		Industrial road	1.00 mm
Cul-de-sac	1.20 mm	Industrial service lane	1.00 mm
Minor Residential	1.20 mm	Collector road	0.80 mm
Subcollector	1.00 mm	Arterial road	0.80 mm

Readings shall be taken in the wheel path in both lanes and at a maximum interval of 10 metres.

B3.12 Road Surface Tolerances

The finished surface of new roads shall have a NAASRA roughness satisfying Council's standards at the time of the work. No abrupt or abnormal deviations shall occur and no areas shall pond water. The surface shall be of uniform texture expected by best trade practice and satisfy density standards applicable to the surfacing being used.

B3.13 Surface Finish and Tolerances on Kerbs, Paths etc

B3.13.1 Kerbs and channel

All curves both horizontal and vertical shall be tangential to straights and the lines and levels of kerbs shall be such as to give the finished kerbs smooth lines free of kinks and angles. Construction joints shall be placed in all unreinforced kerb and channel at 10 metre centres.

Workmanship standards shall be such that, on straights, kerbing, shall not deviate from a straight line by more than 6 mm in any length of 3 metres. Similar standards shall apply to the gradient line. No visible ponding in new channels shall occur.

The exposed faces of the kerb and channel shall present smooth, uniform appearance free from honey-combing or other blemishes to at least U3 standard in terms of NZS 3114: 1987.

B3.13.2 Paths, accessways

Concrete paths and accessways shall be laid with construction joints at not more than 5 m centres. The paths shall be finished with a crossfall to shed water and an even nonskid brush surface to finish U5 in terms of NZS 3114: 1987 "Specification for Concrete Surface Finishes".

The surface of other paths/accessways shall be of uniform texture as would be expected from best trade standards for the surfacing used. Crossfalls of 3% to 4% shall be provided.

The surface of all paths/accessways shall not deviate by more than 6 mm from a 3 metre straight edge at any point and no abrupt changes in line or level shall occur. No path/accessway shall pond water.

B3.14 Crossings

B3.14.1 Urban

Vehicle crossings shall be provided between the kerb line or carriageway edge and the road boundary at the entrance to all private-ways and service lanes and to any lots, front or rear where access points are clearly identifiable at the subdivisional or development stage. *(B1.3.2)*

Where access points are not clearly identifiable at the subdivisional or development stage, crossings shall be constructed at the Building Consent stage.

Vehicle crossings shall be designed to enable the 90% car to use them without grounding of any part of the vehicle. *Appendix B, Figure 6* shows details satisfying this requirement. Structural design shall be adequate to carry the loads to be expected over its design life. All crossings shall be surfaced with a permanent wearing surface.

The overall grade of the crossing and stormwater provisions shall be compatible with the requirements of "Levels of New Lots" and "Non Public Accesses". *(B1.13, B3.18)*

Pram and wheelchair crossings shall be provided at all road intersections and pedestrian crossings. The crossings shall be sited to facilitate normal pedestrian movements in the road and where possible sumps shall be sited so as to reduce the flow of stormwater in the channel at the crossing entrance. Pram and wheelchair crossings shall satisfy current relevant Codes for disabled persons access and shall incorporate tactile tiles.

B3.14.2 Rural

All shared crossings and any where the location is obvious at the design stage shall be installed at the Development stage. Other crossings shall be provided at the Building Consent stage.

Crossings shall be provided between the sealed road edge and the lot boundary at a defined and formed access point to every rural lot. The crossing shall be sealed to not less than the standard of the road, from at least the road reserve boundary to the road carriageway edge. *(B1.3.2)*

The crossing shall not obstruct the side drain. Where the side drain is shallow and only carries small flows during rain, the crossing may pass through the side drain. Where the side drain is of an unsuitable shape or carries flows for significant parts of the year the side drain shall be culverted under the crossing. Culverts shall be sized appropriately for the catchment intercepted but shall be a minimum of 450 mm diameter. *(B5.10)*

Rural crossings shall satisfy *B3.14.1* above with respect to passage of the 90% car and control of stormwater and debris runoff.

B3.15 Fencing

Fencing shall be provided along the road reserve boundaries of all rural and rural residential subdivisions unless agreed otherwise by Council. Standards and requirements shall be in accordance with Council fencing policy at the time.

In respect of all subdivisions, Council will require a fencing covenant protecting Council from any cost in connection with the construction and maintenance of boundary fences along reserves within or adjoining a subdivision.

For fencing of pedestrian, cycle and reserve accesses refer *B3.10* of this Code.

B3.16 Parking

All developments shall provide sufficient on and off road parking to satisfy the District Plan and to ensure that the roading network is able to operate efficiently and without obstruction.

B3.17 Safety Provisions on Hills

Where roads, rights of way or other vehicular or pedestrian access, whether public or private, run parallel with land which drops away on one or more sides, the sides shall be provided with safety barriers to protect the pedestrian and vehicular traffic.

B3.18 Non Public Accesses (Urban and Rural)

Refer also *B1.3* for additional requirements relating to multi unit and comprehensive developments.

Non public accesses include all access types that remain in private ownership after completion of a development. They include:

- private drives - individual or shared,
- private ways - shared,
- formed accessways - shared.

In all cases in urban and rural situations an access shall be formed at the time of subdivision/development where it is to be used or shared by more than a single lot. For rear lots or multi unit or comprehensive developments the provisions of *B1.3* apply. For individual lots, whether urban, rural, or rural residential, the Designer shall show that it is possible to form an access to each lot, that can be safely traversed by normal road going vehicles. The maximum grade for the 5 metres of any non public access immediately abutting a carriageway or back of footpath shall not exceed 1 in 8.

Accesses sloping up from the road shall have a stormwater collection system at the road reserve boundary so as to avoid stormwater runoff and debris migration onto the public road.

Accesses required to slope down from the road shall satisfy the requirements of Levels of New Lots *(B1.13)*. Side drainage such as kerbs or side ditches (rural) shall be provided to stop the concentration and discharge of stormwater and debris onto adjacent properties or any land which could be at risk of instability or erosion.

A turning head in the common area shall be provided at the end of all accesses serving 3 or more rear lots or dwelling units and on all commercial/industrial accessways.

For accesses serving less than 3 residential lots or potential dwelling units, turning heads in the common area are not required where it can be shown that adequate turning area is available within each lot or private area.

All non public accesses (rural/urban) shall be surfaced with permanent impermeable surfacing for at least the first 5 metres from the road carriageway or such greater length as necessary to prevent debris being carried onto roads. *(B1.3, B3.14)*

B3.19 Road Safety Marking and Signage

All road safety marking and signage shall be carried out and installed to the relevant standards and guidelines adopted by Council at the time.

B3.20 Bridges and Culverts

A Building Consent is required for all bridges and culverts of cross sectional area 3.4 m^2 or greater.

Where passing above traffic lanes, bridges shall have the full clearance for the passing of all vehicles permitted to operate on public roads under the Transport Regulations. Clearances to all bridges shall be signposted with pre-warning signs and clearance signs shall be posted on each side of the bridge structure.

They shall be founded to resist settlement or scour. Abutments shall be designed to ensure bank stability and provide erosion or scour protection as applicable.

Design loads shall be appropriate to the location based on accepted Codes at the time.

B4. Land Clearance and Associated Works

Land clearance and associated works shall be designed to engineering standards available at the time to maintain stable and erosion free landforms and stormwater systems which are not hydrologically or biologically inferior. The land clearance may be in preparation for subsequent earthworks, or a changed land use or as part of forest harvesting and applies to work on public or private land.

B4.1 Development Feasibility and Effects Report

Where a Consent or Notice is required by the District Plan, a report covering as a minimum those matters required under *B1.4* of this Code shall be submitted with the Consent application. The report shall clearly describe the work staging and techniques to be used and show how they will minimise any detrimental land stability, hydrological and environmental effects.

B4.2 Waterway Protection

Riparian strips of land not less than 15 metres wide on each side of natural gullies or waterways shall not be cleared if already in bush or trees, unless the existing trees are exotic plantation trees. In such situations clearing may be done only after any upslope clearing has been replanted with either trees or pasture and the new planting can be clearly seen to be providing ground and erosion protection to these upslope areas.

B4.3 Staging of Clearance Works

Works within a catchment shall be staged as necessary to minimise impact on the catchment.

B4.4 Replanting of Clearance Works

All areas cleared shall be immediately protected against erosion and land instability by replanting or the provision of a sown grass sward.

B4.5 Temporary Roading/Access

Temporary roading/access to land clearance works shall be planned and designed so as to minimise earthworks and disturbance to the landform. They shall be metalled or sealed and drained so as to:-

- discharge stormwater in a safe and controlled manner,
- minimise the potential for erosion,
- minimise the potential for road metal, vehicle emissions or other contaminants discharging onto roads or debris being washed into bush areas or waterways,
- prevent dirt and debris from being washed or carried onto public roads.

Cuts, fills or batters shall satisfy the relevant parts of this Code so as to minimise the risk of landslip.

B5. Utility Services - General

B5.1 Mandatory Services

Checks with all utility service operators shall be made at the design phase and any such operator planning to service a new development within five years of its take-over by Council shall arrange to have its services or suitable ducting installed as part of the development. If this opportunity is not taken any utility operator wishing to install new services in the road will be subject to special laying techniques and surface reinstatement as required by Council's requirements for opening up of roads.

B5.2 Utility Services to be Underground

B5.2.1 Piped Services

All piped utility services shall be laid underground except where exceptional geographic conditions make localised exceptions necessary. Exceptions such as above ground gully and stream crossings shall only be used where below ground options can be shown to be not reasonably feasible. In such cases crossings shall satisfy *B5.3*.

Wherever possible stream or river crossings shall be made by trenching beneath the stream bed and laying the piped service with adequate antiscour clearance or other protection.

B5.2.2 Cable Services

Cables shall be laid underground as for pipes except in rural areas with existing overhead cables in which case, where approved by Council, the use of overhead cable reticulation may be accepted.

B5.3 Pipe Bridging

Pipe bridging where shown to be the only feasible way of crossing a geographical feature such as a stream or gully, shall be located above the 1% AEP water level with due allowance for freeboard and debris clearance. Crossings shall utilise appropriate materials resistant to vandalism, sunlight, salt and freshwater and abrasion and provide for easy access and maintenance.

B5.4 Water Area Metering

When required by Council water reticulation zones serviced by new underground mains shall be provided with area metering and telemetry compatible with Council's existing systems unless otherwise advised by Council.

B5.5 All Components to be New

All materials used for utility services shall be new and in as new condition when placed. Materials that are not new or have been damaged prior to or during placement shall not be used in the works.

B5.6 Materials Not Listed as Acceptable Solutions

Materials specified in this Code as acceptable solutions have been selected based on proven performance, suitability for Upper Hutt ground conditions and compatibility with existing materials.

Alternative materials will only be accepted if their use can be supported with the following documentation:

- documentation from a recognised reputable independent institution covering the material quality and its suitability for the proposed use.
- an appropriate standard covering the material and its use, produced by a recognised Standards Institution from New Zealand, Australia, United States or the United Kingdom.

B5.7 Unreinforced Concrete Pipes Unacceptable

Unreinforced concrete pipes are not acceptable for use in any projects covered by this Code within Upper Hutt City.

B5.8 Location and Accessibility of Pump Stations and Reservoirs

All pump stations where feasible shall be located within road reserves or land vested in Council and clear of the road carriageway and likely access points to lots. They shall be provided with impermeable surfaced vehicular access complying with this Code.

Reservoirs shall be located in land which shall be vested in Council. The compound shall be security fenced with fencing appropriate to the location and surfaced with an impermeable surfacing and serviced with a stormwater system complying with this Code.

All weather access, suitable for light cars and vans, surfaced over its full width and provided with stormwater control shall be provided to the compound and the compound itself shall be large enough to enable both vehicle turning and access to the facility and installed plant and equipment. For reservoir compounds, a 3 metre minimum width of flat land, impermeably surfaced and capable of being traversed by road going vehicles shall be provided around the reservoir. The access shall be provided with fencing appropriate to and in keeping with the location. Vandal resistant gates shall be provided at the compound entrance and at the road reserve entrance and each shall be complete with locking systems compatible with those used by Council at the time.

B5.9 Service Pipes, Service Laterals and Their Connections

B5.9.1 Required for Both New and Existing Lots

All new urban residential, industrial and commercial lots shall be provided with individual service pipes and laterals (refer *Intro 2., "Definitions"*) for all utility services required under this Code. All service pipes and laterals shall be connected direct to the main public service except that in those parts of streets where mains are not provided, residential stormwater laterals may be discharged to the kerb. *(B6.9)*

All industrial/commercial stormwater service laterals whether from new or pre-existing lots shall be taken to mains.

Any existing undeveloped urban residential, industrial and commercial lots without such service pipes and laterals in place will be required to install them when a Building Consent is applied for.

All sewer service laterals connected to a main (includes manholes) shall be provided with cleaning eyes and inspection pipes as detailed under *B5.9.5*. Where any service pipe or service lateral on road reserve is to be shared, in terms of use and ownership, by more than one title/unit title then the joint ownership is to be recorded by Consent Notice on the titles concerned.

B5.9.2 Connections To Existing Services

Connections of new service pipes and sewer and stormwater laterals to existing mains and any connections of new mains to existing mains shall be carried out at the cost of the Developer whose Contractor shall make the final connection under IQP supervision. Arrangements for connections to existing mains and any payments shall be made by the Developer by application to Upper Hutt City Council in terms of the current Bylaw.

All wastewater service laterals when connected to an existing main, shall be provided with an inspection pipe on the private side of the junction to enable testing of the service lateral. *(B5.9.5)*

B5.9.3 Service Pipes or Laterals Requiring Enlarging

Where, at any time an existing service pipe or lateral is found to be inadequate in size or condition to service the site needs, then it shall be upgraded by the Developer as part of the works approved by the Consent.

B5.9.4 Stormwater Laterals taken to Kerbs

Stormwater laterals to kerbs will only be allowed from residential lots where a stormwater main is not required for overall stormwater control at the subdivisional stage. In such cases the lateral shall utilise 100 mm dia uPVC or mPVC pipe through the berm and footpath and a uPVC kerb adaptor.

B5.9.5 Cleaning Eyes and Inspection Pipes on Wastewater Laterals

Wherever an existing wastewater lateral is renewed an inspection/cleaning eye shall be brought to the surface at a point within 600 mm of the road reserve boundary and on Council's side of the boundary (for all renewed laterals of 150 dia or smaller). The cleaning eye shall be orientated to allow rodding of that part of the lateral within the road reserve. *(Appendix B, Figure 9)*

For laterals of greater than 150 dia the cleaning/inspection facility shall be in the form of a manhole or mini manhole.

For new laterals, an inspection pipe shall be installed immediately on the private side of the road reserve boundary to enable temporary installation of a bung to facilitate the testing of all the private drainage. *(Appendix B, Figure 9)*

When wastewater laterals are carried to an existing main the lateral shall, in addition to the above inspection pipe, be provided with an inspection pipe immediately adjacent to the Y junction with the main. This is to enable the temporary installation of a bung and testing of the full length of installed lateral. *(Appendix B, Figure 9)*

B5.9.6 Service Pipes and Laterals to Rear Lots

All access ways serving rear lots shall be provided with a single service pipe or lateral for each service to the road reserve boundary of the accessway. Services within the property shall be private and installed at Building Consent stage. *(B.1.3)*

All common private services shall be laid in the common area.

B5.9.7 Service Laterals and Service Pipes For Multi Unit, or Comprehensive Developments

Only one service pipe or lateral to a Council utility will be allowed for any lot used for any of the above uses except for large developments where the security or public benefit of more than one service pipe or lateral is recommended by Council or the Network Utility Operator.

Internal services will remain private and shall be extended into the lot at the Building Consent Stage. *(B.1.3)*

B5.9.8 Location of Service Pipes and Laterals, Meters

- Stormwater laterals shall be located approximately 1 metre and waste water laterals approximately 1.5 metres from the low side of the lot and shall extend approximately 600 mm into the lot.

- Water service pipes shall be located approximately centrally on the lot frontage and shall extend to a toby which shall be located 400 to 600 mm on the public side of the road reserve boundary.

- For multi unit or comprehensive developments where tobies, meters etc are required within private lots they shall be located in or immediately adjacent to the common areas at the point where the individual unit laterals leave the common area. *(B.1.3)*

B5.10 **Minimum Sizes for Public Utilities**

Utility services of less than the following sizes will not be accepted as public facilities by Upper Hutt City Council even though in some cases different sizes may be justifiable by analysis.

Service	Situation	Minimum Size
Water	Principal main	100 mm ID
	Rider main	40 mm ID
	Connections	18 mm ID
Stormwater	Mains	300 mm nom ID
	Culverts - linking open drains or waterways	450 mm nom ID
	Sump leads	225 mm nom ID
	Connections	100 mm nom ID
Wastewater	Mains	150 mm nom ID
	Pressure mains	100 mm nom ID
	Pressure mains - where used in conjunction with grinder/macerator pumps, subject to satisfying acceptable velocity criteria	75 mm nom ID
	Connections	100 mm nom ID

B5.11 **Location of Services, Clearance from Structures and Other Services**

Utility services owned by network operators (including Council) shall be located in public roads and in the general corridors required by Council standards relevant at the time of the development, unless it can be shown that such locations will create major engineering difficulties for developing the subdivision. Any utility services laid in private land or private services crossing other lots shall be protected by easement. All services shall be readily accessible for maintenance.

The reticulation system shall be laid out so as to provide adequate clearance from services, boundaries and kerbs and so as to enable excavation and access to be obtained to each service without affecting another service.

Watermains may only be laid in the same trench as wastewater mains when the watermain invert is above and at least 300 mm horizontally clear of the wastewater main.

The vertical clearance from any two services crossing shall be at least 75 mm, or in the case of services controlled by non Council utility operators the clearance set by them.

Services crossing carriageways or other services shall cross at as near to right angles as possible.

All private shared services, including tobies and meters to individual units shall be located in accessible common areas for rear lots, comprehensive and multi unit developments where this can be reasonably achieved.

Trenched services shall be laid at such a distance from structures as to satisfy the requirements of this Code. *(B.10)* In addition:

- Manholes or other form of access chambers shall be sited completely on one lot.

- Service laterals or mains serving rear lots shall be sited in areas that will not reduce the building area available on the lot.

B5.12 Pipeline Location Marking

All drains without regular surface opening, watermains and any other non current carrying utility services shall be marked with a metallic backed plastic marker tape laid along the full length of the service at a depth of between 200 mm and 300 mm below the finished ground surface. The tape shall have repeated along its length in suitably large letters the type of utility service being marked.

The metallic tape shall be extended to the ground surface at the ends of the service lines and tested for continuity by the passing of a current.

B5.13 Seismic Standard for Pipelines

All pipe services shall be designed with adequate flexibility and special provisions to minimise risk of damage during earthquake. Specially designed flexible joints shall be provided at all junctions between rigid structures (eg. reservoirs, pump stations, bridges, buildings, manholes etc.) and natural or made ground.

B5.14 Minimum Cover to Utility Services

Pipe services shall be laid within the following ranges of cover unless sound engineering reasons can be provided for alternative covers in which case supporting analysis shall be provided to show special pipe standards or other protection measures.

Depths of Services		
Type	**Cover to top of pipe barrel**	
	Min [mm]	**Max [mm]**
Power	450	900
Telecommunication	450	750
Other information cabling	450	750
Gas	600	900
Water mains in carriageway	900	1500
Water mains in berms and footpaths	750	1500
Rider mains and service pipes in carriageway	900	1200
Rider mains and service pipes in berms and footpaths	450	600
Wastewater and stormwater		
Wastewater and stormwater service laterals at Lot boundary	900 600	1800 1200

B5.15 Services Controlled by Non Council Utility Operators

B5.15.1 Design and Construction to Operators Approval

Services such as gas, power, telecommunication and information cabling shall be designed to standards set by the relevant network utility operator as being acceptable for the authority to take over the utility service on completion of the development.

The relevant operator shall approve the design and on completion of construction provide to the IQP, the certification required under this Code. *(B11.9)*

B5.15.2 Above Ground Installation to be Flood Free

Above ground equipment shall be located so as to remain operational during the 1% AEP flood.

B5.16 Appurtenances and Surface Openings for Pipe Services

The following requirements are mandatory to ensure ease of identification, access, maintenance and to minimise costs of holding spares.

All sluice valves (100 mm ID and larger) shall be anti-clockwise closing.

All gate valves of less than 100 mm ID shall be clockwise closing.

All fire hydrants shall be tall pattern screw down clockwise closing.

The following surface openings shall be supplied and placed to the standards shown on the specified details.

- Water sluice and rider main valve boxes *(Appendix B, Figure 10)*
- Hydrant boxes *(Appendix B, Figure 11)*
- Water toby boxes (domestic connections) *(Appendix B, Figure 12)*
- UHCC Cycle Friendly kerb sump and gratings *(Appendix B, Figure 8)*
- UHCC Standard manhole and lids *(Appendix B, Figure 14)*

B5.17 Marking of Surface Openings

Hydrants shall be painted and marked in terms of NZS 4501 "Code of Practice for Location, Marking of Fire Hydrants".

Blue raised pavement markers shall be provided on the road centreline or, where there is a painted centreline, within 100 mm of the centreline immediately in line with the hydrant. All markers shall be of a type acceptable to Council.

All valves, manholes and other service lids, except toby boxes, shall be painted white.

All sumps shall be painted with a 100 mm white band along the adjacent seal edge.

A 100 mm wide white marker line shall be painted across the full kerb top and face opposite all tobies. A 300 mm wide white strip shall be painted on the kerb top opposite all water valves.

B5.18 Levels of Surface Openings

All surface openings shall be brought to 0 to 5 mm above the abutting ground level in roads, berms or private property. In paths and cycleways, surface openings shall be flush with the abutting ground level. In no case shall ponding occur on the surface opening. Surface openings in road carriageways shall be located clear of normal wheel paths, cycleways and the road crown wherever possible.

B6. Stormwater Drainage

B6.1 General

Stormwater drainage shall be considered as the total system protecting people, land, infrastructure and improvements, against flooding. It shall consist of a primary drainage system of pipes and open channels, and a secondary system consisting of open channels, controlled flood plains and flow paths utilised in conjunction with the setting of building levels to ensure that buildings remain free of inundation in the 1% AEP flood.

B6.2 Catchments

All stormwater systems shall provide for the collection and controlled disposal of stormwater from within the land being developed together with any runoff from upstream catchments. In designing downstream facilities the upstream catchment shall be considered as being fully developed to the extent defined in the current District Plan.

B6.3 Minimum Protection Standards

All new stormwater systems and buildings shall be designed to cope with design storms of at least the following Annual Exceedence Probability (AEP).

Function		AEP
i.	Primary protection - satisfied by an appropriate sized pipe or channel drainage system.	
	Rural and rural residential	10% (10 year return period)
	Residential	4% (25 year return period)
	Commercial and industrial	4% (25 year return period)
	All areas where no secondary flow path is available	1% (100 year return period)
ii.	Secondary protection satisfied by a combination of the primary protection system and appropriately designed secondary flow paths, controlled flood plains and setting of appropriate building levels.	1% (100 year return period)

B6.4 Upstream and Downstream Effect

For all land development works (including urban and rural subdivisions and all projects involving changes in land use or coverage) the design of the stormwater disposal system shall include the evaluation of stormwater runoff changes on upstream and downstream properties. This evaluation will generally be required at the Resource Consent stage *(B1.4)*.

Upstream flood levels shall not be increased by any downstream development unless any increase is small and can be shown to have no detrimental effects on the upstream properties.

Downstream impacts investigated shall include (but are not limited to) changes in flow peaks and patterns, flood water levels, contamination levels and erosion or silting effects. Where such impacts are considered detrimental the Consent process may require the provision of mitigation measures (eg. peak flow attenuation, velocity control, contamination reduction facilities) on or around the development site, or the upgrading of downstream stormwater disposal systems (channels or pipes) all at the Developer's expense.

B6.5 Minimum Requirements to Satisfy Protection Standards

The following minimum requirements shall apply to the development of new land and building sites to ensure that flood risk in the 100 year event is minimised.

i. The ground level of all building sites shall be developed at a level to be free of inundation during the 100 year flood. Lots shall generally be shaped such that they fall towards roadways which may be used as secondary flow paths.

ii. Where secondary flow paths cannot, with good design, be kept solely on roads they shall be kept on public land such as accessways, parks, reserves.

iii. Secondary flow paths shall be designed so that erosion or land instability caused by the secondary flows will not occur. Where necessary the design shall incorporate special measures to protect the land against such events.

iv. Ponding or secondary flow on roadways shall be limited in height and velocity such that the carriageway is passable to light vehicles in the 100 year flood.

v. The secondary flow path sizing and location shall be supported by adequate analysis to show:

- that it is of adequate capacity to cope with the design volumes.
- that it discharges to a location that does not detrimentally affect others and can safely dissipate via a controlled disposal system as the storm peak passes.

vi. The ground level at the location of any proposed wastewater disposal soakage field shall be above the 5 year flood level.

B6.6 Stormwater Drains to be Piped

All new stormwater drainage systems shall incorporate piped reticulation through urban areas unless otherwise approved by Council.

B6.7 Open Drains, Natural Watercourses

Where approval is granted to retain or upgrade open drains or watercourses, they shall be sized to carry the full design flow and shall incorporate features to make them aesthetically attractive to abutting properties.

Berms shall be provided along at least one side of any watercourse to satisfy design flood needs and to provide for stream and berm maintenance using road going vehicles. Berms and banks shall be grassed and laid at slopes that are stable, not prone to scour in flood flows and are able to mowed by Council. Berms or drains which will be maintained by Council shall be provided with Maintenance Corridors protected by Easement. *(B.1.10)*

B6.8 Stormwater Quality

Stormwater discharges shall satisfy all applicable Wellington Regional Council plans.

Where permanent stormwater quality standards are set under Resource Consents, systems to control the discharge of sediment and pollutants shall be designed.

B6.9 Priorities for Stormwater Disposal

The following priorities shall apply for the disposal of stormwater from commercial/industrial or new urban lots or developments. A lower priority will only be approved as a disposal solution after the higher priority has been considered and found to be not feasible.

i. Gravity discharge to manholes, mains or waterways.

ii. Gravity discharge to kerb (applies to single residential lots only).

iii. Provision of soakage disposal systems. This requirement applies only to residential lots and where approved each lot or dwelling unit shall be provided with its own soakage system.

iv. Pumped disposal, with or without associated storage to attenuate flow peaks.

Design philosophy and requirements shall be discussed and agreed with the IQP before commencement of design.

B6.10 Stormwater Soakpits

Stormwater soakpits may be used for residential development where, after considering available disposal options as outlined under *B6.9* above, soakpits are found to be the only feasible alternative for stormwater disposal. In such cases the Designer shall demonstrate that soakage is available and submit percolation tests (NZ Building Code Section E1 Cl 3.6 provides an acceptable method of soakage testing) along with engineering calculations to show that the soakpit adequately copes with the 25 year, storm in urban areas. Measured soakage rates shall be factored down in accordance with good practice to recognise the reality of slow clogging of the soakage interface. Soakpits shall be designed to allow easy access for maintenance and located so that access by maintenance machinery is available.

Adequate soakage testing and design shall be carried out at the Resource Consent application stage to show that soakpits will be of such a size that they can be realistically located on the lot in addition to the house.

B6.11 Sumps

Sumps shall be located as necessary to ensure that the total system design flow can adequately enter the pipe system and so that surface flows across intersections and pedestrian/disabled crossing points are minimised. Sumps used in Upper Hutt roads shall utilise cycle friendly grates with widened rear entry and side entry *(Appendix B, Figures 8a-d)*. Sumps shall be located clear of identifiable access points.

B6.12 Flood Detention Facilities

Where flood detention ponds are required as a Condition of Subdivision or development they shall incorporate safety features and control, monitoring, alarm and telemetry systems compatible with Council's current system.

B6.13 Stormwater Pumping (Public Systems)

Stormwater pumping will only be approved where gravity options have first been considered and found not to be feasible.

Pumping systems shall be specifically designed using a multi pump system to best balance the need for regular pump operation against the relative infrequency of major storm events.

The peak storm frequency designed for shall be set to match the upstream and downstream stormwater system but shall be not less than:

- 25 year (residential/commercial/industrial) return period when a suitable secondary flow path is available
- 100 year return period when no secondary flow path is available.

All pumps in a station shall be of the same size and the number used shall be such that at peak flows one pump remains unused as a standby.

All pumps shall be isolated by valves and incorporate an easily dismantled pipe point near the pump which enables easy removal of the pump. Pumps shall be designed for not more than 8

starts per hour but shall utilise starters capable of 15 starts per hour. For pumps of over 2 kW soft start systems shall be provided.

On all pump stations the control switchboard shall be provided with a plug and wiring capable of allowing an emergency generator of size suitable for coping with the wet weather flow, to be used to drive the pumps.

A metered water supply and tap outlet shall be provided to the immediate vicinity of the station. The supply shall be fitted with an approved reduced pressure backflow preventer.

Chamber lids shall provide access openings centrally over each pump and shall be designed to withstand heavy traffic loadings when in roads (including paths and berms).

Stormwater pump stations shall incorporate valving control, monitoring, alarm and telemetry systems to Council standards at the time of the design and incorporating at least the features covered in *Appendix B, Figure 15*.

B6.14 Stormwater - Non Reticulated Rural and Rural Residential Areas

House stormwater connections need not be constructed as part of rural land development works. However it shall be shown at the design stage that a discharge location is available clear of the preferred house site, safe from causing or being affected by potential erosion or land instability and unlikely to cause surface ponding or nuisance. Acceptable solutions include drainage to a gully, drainage ditch, a natural drainage path or a soakpit. A solution must be demonstrated even if it is likely that roof water will be collected for water supply in which case a safe overflow is required.

B7. Wastewater Drainage

B7.1 General

Wastewater drainage systems shall include for all collection treatment and disposal systems necessary for the safe and hygienic servicing of a development.

A wastewater reticulation system shall be installed in areas where an operative wastewater system is available. In certain situations Council may require the provision of a treatment and disposal system as part of a development approval.

B7.2 Wastewater Design

Wastewater design shall include an assessment of the impacts of the new development on the existing wastewater disposal network *(B1.4)* upstream and downstream of the development. Where detrimental impacts are shown to arise from the development mitigation measures shall be developed and implemented at the Developer's expense unless decided otherwise by Council.

All wastewater design shall be based on peak wet weather flows including allowances for ground and stormwater inflow and infiltration. Systems shall be capable of serving the entire upstream catchment assuming it is developed in terms of the District Plan. Population density shall be derived based on the District Plan and use, subject to a minimum of 45 persons per hectare or 3.5 persons per household for urban development. The actual design flows shall be not less than those given under *B7.3*.

B7.3 Minimum Design Flows

i. Domestic Flow

Average Dry weather flow (ADWF)	275 litres/head/day
Wet weather flow (WWF) is 4 x ADWF	1100 litres/head/day

ii. Commercial and Light Industrial Flow

Average Dry weather flow	0.08 l/sec/ha
Wet weather flow (3 x ADWF)	0.23 l/sec/ha

iii. Industrial Areas

ADWF	1.0 l/sec/ha
WWF	3.0 l/sec/ha

The area used for calculating flows shall be the net zoned land; ie. excluding roads, parks etc.

iv. Retail and Suburban Commercial Areas

These areas shall be designed for:

ADWF	0.25 l/sec/ha
WWF	1.0 l/sec/ha

Design flows for existing domestic areas and all commercial/industrial areas shall be discussed with the IQP before detailed design is carried out. Where possible, for systems serving major industrial projects, flows shall be measured over a period of time or based on a knowledge of the industrial process, as applicable. However in all cases due allowance for infiltration shall be made.

B7.4 Pump Stations (Public Services)

Pumping stations shall only be provided where gravity systems are shown to be not feasible for engineering reasons.

Pump stations shall be designed to cope with not less than 120% of the peak wet weather flow using a multi pump system incorporating pumps of equal capacity. Design shall be to the highest accepted current standards and as a minimum shall incorporate the following.

No pump station shall use less than two pumps in which case each shall be capable of pumping the design peak flow, ie. standby = 100% of peak design flow.

For stations requiring two pumps to cope with peak flows three pumps of equal capacity shall be provided, ie. standby = 50% of peak design flow.

Standby capacity for large pump stations shall be set after discussion with the IQP. The duty sequences for pump stations shall be automatically interchangeable.

Pumping rates shall be set recognising any flow limits on downstream gravity pipes into which the rising main will discharge.

Unless specified otherwise by a Resource Consent, emergency storage of 66% of a day's ADWF shall be provided above the normal pump start level, in the main chamber, or in a special emergency chamber. An emergency overflow shall also be provided to a stormwater system, or watercourse.

All pumps shall be isolated by valves and incorporate an easily dismantled pipe joint near the pump which enables easy removal of the pump. A sealed power plug shall be provided in the wet well to allow disconnection of the pump from the electrical supply.

The pumps and chamber shall be designed to cater for not more than 8 starts per hour but starters shall be capable of coping with not less than 15 starts per hour. For pumps of over 2 kW soft start systems shall be provided to minimise start up power surges. Design shall consider and make due provision for anticipated water hammer effects.

On all pump stations the control switchboard shall be provided with a plug and wiring capable of allowing an emergency generator of size suitable for coping with the wet weather flow, to be used to drive the pumps.

A metered water supply and tap outlet shall be provided to the immediate vicinity of the station. The supply shall be fitted with an approved reduced pressure backflow preventer.

Chamber lids shall provide access openings centrally over each pump and shall be designed to withstand heavy traffic loadings when in roads (including paths and berms).

Wastewater pump stations shall incorporate valving, control, monitoring, alarm and telemetry communication systems to Council standards at the time of the design and incorporating at least the features covered in *Appendix B, Figure 15*. All mechanical and electrical plant in or around wet wells shall be designed to hazard safety rating Zone 1 Class 1.

B8. On Lot Treatment and Disposal of Household Wastes

B8.1 General

On lot treatment and disposal may be approved in rural or rural residential areas where there is no connection to the City Wastewater system and the provision of a community system for take over by Council is not considered appropriate.

Land development or subdivision in such areas shall be conditional on compliance with the Regional Discharges to Land Plan. All wastewater systems as well as complying with the Discharges to Land Plan shall satisfy the Resource Management Act with respect to subsurface, surface, water or air contamination.

B8.2 Preliminary Design to be Provided with Consent Application

For any subdivision on which on lot wastewater disposal is proposed, proof of a suitable effluent treatment and disposal system for each lot shall be submitted to Council with the Land Use/Subdivision Consent application.

The Consent design will not be accepted as a final design, which must be carried out at Building Consent stage when house size and location is known.

The preliminary design and supporting report shall be based on field testing carried out on each lot and designs to standards and Codes acceptable to Council at the time.

The report shall include as a minimum:

- the results of the field testing and the design conclusions reached from the testing
- calculations or technical references to support the pre-treatment and ground disposal types, sizes and layouts selected
- adequate drawings to show how the facility will be laid out on site, distances from adjacent waterways or property boundaries and a feasible location for a reserve area of 100% of the disposal area size
- adequate information to show that:
    (a) the ground disposal system will be at all times adequately above winter ground water tables and the ground surface free from flood inundation in the 20% AEP (5 year) flood events
    (b) surface or groundwater will not be detrimentally affected by the presence of contaminants
    (c) surface or groundwater will not be tainted or contaminated so as to make it unsuitable for irrigation, stockfeeding or industrial abstraction.

The Consent design shall be based on a household population of 5 persons and allow for the use of high water use appliances such as dishwashers, washing machines and waste disposal machines.

Detailed designs required at the Building Consent stage for any dwelling shall be based on the worst situation of house size or population.

B9. Water Supply

B9.1 General

Water supply facilities include water uptake, storage, treatment and distribution via limited access trunk mains and multiple access local networks, along with all appurtenances necessary for a secure supply and adequate fire provision.

A water supply system shall be provided in any subdivision or development in areas where an on demand or restricted water supply system is available.

B9.2 Design Standards

B9.2.1 General

Designs shall be based on the maximum expected catchment demand during the lifetime of the facility. This shall be based on the District Plan zonings. Population density shall be derived as detailed under *B7.2*.

Mains and pump facilities shall be designed to cope with both of the following cases:

i. the peak flow on the maximum flow day.

ii. the fire flow in terms of the current NZ Fire Service "Code of Practice For Fire Fighting Water Supplies" (NZ Fire Service Code) plus two thirds of the above peak flow.

In both cases pressures shall be above the minimum required by this Code.

Pumps where required may be "in line" or "off line" systems satisfying the requirements of *B9.8*. All pump stations shall incorporate a standby pump.

Storage facilities shall provide the storage as required under this Code and shall incorporate adequate overflow and maintenance provisions.

Design of water supply facilities shall be to the highest standards applicable at the time. The layout shall provide for fully looped systems so as to minimise inconvenience during maintenance and all materials used shall be the best available to achieve a corrosion resistance low maintenance system over its design life. Fittings shall be leak free and incorporate stainless steel nuts, bolts and washers for all uses where bolts of 24 mm dia or less are required. Bolts, nuts and washers etc. of larger diameter when required may be hot dip galvanised provided they are given additional protection by the use of a proprietary wrapping system (eg. DENSO).

Water supply design shall include an assessment of the effects of the new development on the existing water supply infrastructure and existing users *(B1.4)*. This shall include such factors as pressure changes, adequacy of existing reservoirs, impact on existing pump operations. Where the new development leaves any part of the existing system at service levels below those normally considered reasonable, mitigation measures shall be developed and implemented at the Developer's expense.

B9.2.2 Minimum Supply Pressures

In assessing requirements it shall be assumed that the highest fitting to be supplied will be 6.0 metres above the ground level of the house site on the lot. If the gardening or recreational area of the lot is higher, it will not necessarily be supplied.

i. Non Fire Flows

For pipelines of diameter 100 mm and larger the required minimum pressure at the point of supply (toby) during peak flows shall be 40 m head of water with a hydraulic gradient line falling at 5 metres per 1000 metres, commencing at the bottom water level (BWL) of the supply reservoir during peak domestic demand. Where existing pressures in Council's mains do not allow the above minimum pressure to be achieved even with the new pipes providing head losses of less than 5 metres per 1000 metres, then pressures of not less than 25 metres may be accepted on discussion with the IQP. Where a 25 metre minimum pressure cannot be achieved the Developer shall provide the means to give pressure of not less than 40 metres in the new development.

Rider mains, including any crossfeeds which serve 5 or more dwelling units shall be designed to serve the peak non fire flow demand with not more than 4 m head loss from the mains pressure to any service connection. Where a rider main serves 2 to 4 dwelling units it shall be designed to serve the peak demand at any service pipe connection with not more than 6 m head loss. However in no case shall the head at peak demand at any points of supply (toby) be less than 20 metres.

ii. Fire Flows

The reticulation shall be able to carry full fire demands along with 2/3 of peak domestic flow with pressure and flow at all hydrants satisfying the NZ Fire Service Code.

B9.2.3 Maximum Supply Pressures

The maximum static pressure shall not exceed 107 metres head.

B9.2.4 Water Demand and Fire Flows

i. Non Fire Flows

Special developments such as schools, hotels, industrial developments etc. shall be taken into account based on best available demand records or assessments. In some cases of existing industry etc. specific metering to accurately assess daily and peak demands may be required.

In other cases flows shall be based on the design population and the following relationship.

- Peak flows on a maximum day shall be based on the following formula.

$Q_{peak} = 0.6 \times H^{0.63}$ l/s

Where H = number of houses being or to be served.

Design peak flows based on this formula are graphed and tabulated on *Appendix B, Figure 13*.

- For design of components where average daily demands are appropriate (eg. reservoirs) average flow on a maximum day shall be taken as 550 litres/head/day.

- A minimum flow rate of 25 l/sec shall be available at the point of supply to any lot.

ii. Fire Flows

The water reticulation shall generally be designed to comply with the requirements of the current NZ Fire Service Code and in particular 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. The NZ Fire Service Code provides risk classification which shall form the basis of protection standards in Upper Hutt City Council.

In industrial areas at least one main in each street shall be 150 mm diameter or larger and in residential streets 100 mm diameter or larger.

iii. Storage Volumes

Storage reservoirs shall provide storage to satisfy the average flow on maximum day along with the fire storage capacity specified in the NZ Fire Service Code.

B9.2.5 Mains to be Adequately Below Hydraulic Grade Lines

All water mains shall generally be laid at least 10 metres below a hydraulic gradient line falling at 5.0 metres per 1000 metres of pipeline length, starting from the floor of the supply reservoir.

This condition need not apply in the immediate vicinity of a reservoir provided the main is always adequately below the 5.0 metre per 1000 metre hydraulic gradeline to avoid the occurrence of air or below atmospheric pressures under normal operations.

This is a maximum height and the actual hydraulic grade line for existing mains shall be checked and any main extensions kept adequately below the hydraulic grade line derived.

B9.2.6 Level of Hydrants

Notwithstanding the requirements for the size of watermains as defined elsewhere, the maximum allowable ground level at hydrant locations shall be:

- At the highest hydrant; 10 m below a hydraulic grade line falling at 6 m per 1000 m of pipeline length, commencing from the floor level of the supply reservoir.
- For hydrants other than the highest; 10 m below a hydraulic grade line falling at 8 m per 1000 m of pipeline length, commencing from the floor level of the supply reservoir.
- Hydrant flow and pressures shall be not less than required by the current NZ Fire Service Code.

B9.2.7 Reticulation Layout

Layout of reticulation shall provide a closed loop system and utilise principal and rider mains so as to:

- avoid dead ends, minimise friction losses, tendencies for water hammer effects and zones of dead water,
- minimise the length of household connections and ensure that they do not cross carriageways, except for areas where formed carriageways are less than 6 m in width.
- provide an alternative feed when any section is cut off for servicing.

In dual carriageway roads, state highways and motorways principal mains shall be provided on both sides of the roads.

B9.3 Hydrants

Hydrants for scouring only and for special fire risks shall be located on mains 375 mm and over, where these mains are without service connections and there are adequate hydrants on parallel mains. Hydrants shall be provided for scouring mains at dips and upstream from valves. Hydrants on trunk mains shall have a long bodied butterfly valve installed beneath to enable the hydrant to be serviced without shutting down the main.

Hydrants for fire protection purposes shall be spaced at intervals in accordance with the current NZ Fire Service Code.

A hydrant shall be placed at the end of any main 100 mm diameter or larger and at any location where a main of 100 mm or larger diameter reduces to a diameter of less than 100 mm.

B9.4 Sluice and Rider Mains Valves

Valves shall be located adjacent to the principal main at branches, and also to isolate any section of a rider main between cross connections to the principal main. At junctions between watermains and or rider mains, valves shall be provided on every branch. On mains 150 mm diameter or larger, scour outlet valves shall be provided at low points along with a suitable discharge pipe. Valves shall be placed on either side of high priority connections (eg. schools, hospitals, elderly persons homes). Valves shall be anchored in such a way that they can be readily removed. Valves 300 mm diameter and greater shall be fitted with either a bypass valve to reduce closure pressures or an enclosed reduction gearbox.

B9.5 Air Valves

Air valves shall be provided at high points and other locations required by good engineering practice on all water mains (including trunk mains with limited offtakes). Locations shall be identified and air valves sized as part of the specific design. Air valves shall be installed with a gate valve on the main offtake to enable removal of the air valve for maintenance. All air valves shall be located in a chamber to give air movement and allow maintenance access. The air valve chamber shall be drained to the nearest stormwater system and the air valve shall be installed at such an elevation that it remains above any possible surcharging from the stormwater systems.

Air valves shall be designed to expel air automatically under working conditions and shall have sufficient capacity to admit air on draining the line, at such a rate that negative pressures do not occur.

B9.6 Water Meters

Individual water meters and check valves located in adequately sized and accessible boxes shall be provided to:

- all industrial/commercial lots,
- all rear lots, multi units, and comprehensive developments where more than one unit or lot is serviced from the service pipe. In such cases individual unit meters shall be supplied on the service pipes to each unit. *(B1.3)* and a single meter at the Council toby on the road reserve boundary.
- all rural lots where a public water supply is provided,
- all new urban residential lots.

unless advised to the contrary by Council in the Consent application.
Each application for a water supply requiring a meter shall be subject to the approval of Council as to availability of water, and position of the meter. The Developer shall provide the necessary hydraulic analysis deriving a suitable meter size.

Meters shall be located on the private side of the toby at locations defined in this Code. *(B1.3, B5.9.8)*

B9.7 Storage Reservoirs

In cases where a storage reservoir is necessitated by the development, it shall be provided at the expense of the Developer.

Storage reservoirs and pump stations where required shall be designed to the best current standards so as to satisfy the Performance Requirements of *Part A, "Engineering Performance Criteria"* of this Code.

All facilities shall be provided with monitoring, alarm and control systems and radio telemetry compatible with Council's current systems.

i. Storage reservoirs, where required, shall be provided according to the following principles.

ii. Storage volumes shall satisfy the demands required by *B9.2.4* of this Code.

iii. System design shall be such that alternative means of supplying the area are available in the event of the reservoir or outlet main being out of action.

iv. Reservoirs shall have separate inlet, outlet, scour and overflow connections. Inlets and outlets shall be provided with appropriate flow meters connected to the telemetry system.

v. Pump control equipment and telemetry and alarms incorporating depth monitoring, cabinet and hatch security and inflow and outflow rates shall be fitted. Controls, monitoring and alarm and telemetry systems shall be to Council's Standards at the time of the design and incorporating at least those features covered in *Appendix B, Figure 15*.

vi. Depth monitoring equipment shall be installed in a separate hatch to the one required for human access.

vii. Reservoir roofs shall be designed with a fall sufficient to prevent ponding of rain water.

viii. Separate access ladders shall be provided to each hatch. They shall be provided with safety provisions to satisfy relevant safety legislation.

ix. The reservoir compound and access shall satisfy *B5.8* of this Code.

x. Seismic protection valves which shall close automatically on fracture of the mains shall be installed on inlet and outlet mains. These shall be compatible with Council's current systems. The valve chamber shall be an integral part of the reservoir foundation. The seismic protection valves shall be connected to the telemetry system.

B9.8 Pump Stations

Pump stations where required shall be designed according to the following principles:-

i. Deliver the total maximum day water requirement without using a standby unit in 15 hours for stations under 35 litres per second and 18 hours for larger stations. The minimum capacity of any one pump shall be 4 litres per second.

ii. Pumps shall normally be of equal in size and of the same make. Standby capacity of 100% shall be provided for stations under 35 litres per second. For larger stations standby capacity of at least 50% shall be provided, eg. total number of pumps = 2; capacity each 100%; total number of pumps = 3; capacity each 50%

iii. Pumps shall be housed in permanent housings readily accessible for maintenance.

iv. Stations shall be designed so that all pumps can be run simultaneously if so required.

v. Stations shall incorporate starters and any other protective features necessary to minimise water hammer and other transient pressures.

vi. Equipment shall be arranged and installed to limit noise and facilitate easy equipment removal and maintenance.

vii. Stations shall be designed for automatic control and fitted with protective devices, valving, metering control, monitoring alarm and telemetry communications systems to Council standards at the time of the design and incorporating at least the features covered in *Appendix B, Figure 15*.

B9.9 Cut-ins to Existing Live Water mains

Cut-ins requiring the shutdown of an existing live Council main shall only be done under the supervision of, and at a time approved by, the IQP. The shutting off of a water supply to enable a cut-in to be made shall comply with Council's current "Policy for Shutting Off Water Supply".

The work shall be organised to minimise any shut off and advance notice given to all affected property residents.

B9.10 Water Supply in Non Reticulated Rural or Rural Residential Areas

Where no reticulated system is in place or expected the Designer shall show at the Land Use/Subdivision Consent stage that adequate potable water supply to service the lot all year round (not less than 180 l/capita/day) is available for every lot from either sources within the lot or at the lot boundary.

On lot sources may include roof water, individual wells, a site stream or a combination of these.

Sources provided at lot boundaries may be private or shared private reticulated systems from such sources as off site streams, dams or wells.

When off site sources are proposed over which a subject lot does not have full legal control the Developer shall provide Council with a written acknowledgment in a form approved by Council that in the event of the supply failing or being terminated for any reason the responsibility for, and all costs of, obtaining an alternative supply will be met by the affected future title holders. This condition will be required to be incorporated into the legal title.

For all supplies involving non roof collected sources, the Designer shall provide tests from a registered laboratory showing the quality of the proposed water source. Where the water is not of potable quality, the Designer shall provide information as to feasible treatment methods to make the water potable.

Where roof supplies are proposed the developer shall provide calculations as to roof size and storage required to provide an average daily household supply based on 180 l/capita/day assuming two months without rain over summer.

B10. Construction

Construction shall be carried out accurately to the design, specification, the requirements of this Code and all applicable legislation and bylaws by a suitably experienced Contractor working under the supervision of a Construction Supervisor.

B10.1 Construction Inspections

All construction work shall be inspected by the Construction Supervisor who may or may not be the Designer. The standard of supervision shall be such that the Construction Supervisor is able to satisfy himself/herself that the work done complies with the Design drawings and requirements of this Code and to provide full Completion Documentation as required under this Code.

The Construction Supervisor shall assess inspections required, but must be present during testing and sterilising of services, after bedding and prior to covering of services, after exposure of subgrades prior to and during road surfacing and during deflection testing of roads.

B10.2 Compliance with Applicable Legislation

All construction shall be undertaken in compliance with relevant statutes and bylaws. eg. Resource Management and Occupational Safety legislation, noise bylaws.

B10.3 Pressure Testing, Flushing and Sterilising of Water Pipes and Reservoirs

All water mains shall be pressure and leak tested, flushed and sterilised to current industry standards and acceptable test results provided to the IQP before being put into service. These requirements also apply to new reservoirs or existing reservoirs where they have been taken out of service for internal repairs or maintenance. All chemical testing shall be undertaken by a registered laboratory.

B10.4 Testing of Stormwater and Wastewater Pipes

All wastewater drains including service laterals and manholes shall be pressure tested to current industry standards and any defects made good.

All stormwater drains of 450 mm diameter or smaller and manholes shall be tested as for wastewater drains. Testing of larger diameter mains shall be undertaken when advised by Council.

B10.5 TV Record of New Pipelines (Stormwater and Wastewater)

A colour TV record shall be undertaken of all new non rigid pipes (HDPE, MDPE, FRP, uPVC) and connections where required by the IQP.

The TV record shall be passed to the IQP for review. Any faults or missing connections shall be made good and the TV record rerun before processing of Completion Documents will be commenced. The TV record shall remain the property of Council.

B10.6 Independent Monitoring - Construction

Council's interest during the construction phase shall be looked after by the IQP.

Appendix B, Figure 16 lists the minimum inspections required of the IQP by Council but this list shall in no way limit the obligations of the IQP under this Code.

The IQP shall carry out all necessary inspections and require adequate quality assurance records from the Construction Supervisor and Contractor to satisfy the IQP that the works have been constructed in accordance with the design documents, all Consent conditions, requirements of this Code of Practice and other relevant Codes and Standards.

The IQP shall advise the Construction Supervisor from time to time of any inspections the IQP requires to make which involve agreement over timing (eg. presence at pressure testing,

inspecting pipes or subgrade before covering). Provided such requirements are made known by the IQP the Contractor shall give the IQP not less than one full working days notice of the Contractors wish for the inspection to be made. The IQP has the same right as Council to require the re-exposure of covered work where such notice was requested and not given or not given adequately in advance.

The IQP, during construction, shall deal through the Designer or Construction Supervisor, the applicable person to be agreed between parties at commencement of construction.

B11. Completion Documentation

On completion of all civil engineering projects, the Designer shall provide to the IQP the documentation listed hereunder.

This shall be reviewed by the IQP and when considered by the IQP to satisfy the requirements of this Code shall be submitted to Council along with a certificate from the IQP as detailed in *B13*.

Council will not commence processing any development for takeover or statutory approval until this documentation has been received in full by Council.

B11.1 Resource Consents

Full copies of all resource consents issued under the Resource Management Act. Such Consents shall be issued in the name of the Council.

B11.2 Geotechnical Reports and Test Results

Reports covering the design and construction phases of the project shall be submitted covering, but not necessarily limited to, the following matters:-

i. Copies of all geotechnical predesign and design reports prepared.

ii. Construction Report

A construction report showing how the requirements of the design reports and relevant specifications have been met in construction.

Matters covered by the report shall include but shall not be limited to:

- Documentation of earthworks monitoring and compaction testing carried out.
- Confirmation that the fill bases have been placed on clean soils of suitable strength and that unsuitable soils have been stripped and not used in structural fills.
- A statement of professional opinion as to suitability of land for subdivision (Refer *Appendix B, Figure 1* for suitable format).
- Confirmation that batters have been laid as designed or modified by the designer on site and explanations for any such changes.
- Confirmation that subsoil drains have been placed as required and that any surface drainage required as part of the earthworks has been installed.
- A statement of professional opinion that filled ground is suitable for the erection of residential buildings not requiring specific design under the Building Act, and related documents. Refer *Appendix B, Figure 2* for suitable format.
- A statement of professional opinion on the suitability of natural ground for the construction of residential buildings not requiring specific design under the Building Act and related documents. Some natural ground may not be suitable for such residential buildings. Refer *Appendix B, Figure 2* for suitable format.

B11.3 As Built Information

As built information shall be provided covering as a minimum the items described in *B12* of this Code.

B11.4 Completion Reports

These are to confirm or certify:

i. That the As Built plans have been prepared by the Designer or under his/her direction and they accurately reflect the work done.

ii. That, based on observations and control testing carried out by or under the direction of the Designer:

- all works have been constructed in the locations and to the levels and details shown on the "as built" plans
- the works have been built to currently accepted design and construction standards and that the design intent as detailed in the specification, design drawings and calculations has been achieved.
- testing of all roads and services has been carried out by or under the direction of the Designer and test results comply with the specified standards. The specified standards along with the dates of testing and test results shall be included. As a minimum the test results shall cover:-
  - deflection and road roughness results
  - pressure and leak testing of gravity pipes, pressure pipes and reservoirs
  - sterilisation and testing of water mains and reservoirs
  - leak testing of any underground chambers
  - any colour TV testing of wastewater and stormwater mains and written log of results.
- all Consent conditions have been met.

B11.5 Operation and Maintenance Manuals

Operation and Maintenance Manuals shall be provided for all facilities involving electrical or mechanical plant. The manual shall include the following information as a minimum:-

- system schematic layout including wiring diagrams
- make and model of all plant
- manufacturers' specifications and performance data for all plant
- the name of the plant supplier and nearest authorised maintenance agency
- the date on which the system was formally commissioned and a summary of any problems and measures taken to remedy them
- actual plant performance results as measured during the commissioning runs and explanation where they differ form the specified standards.

B11.6 Warranties

Warranties shall be supplied for all mechanical and electrical plant. Warranties shall be issued in the name of the Council by the plant supplier, and shall apply for a period of not less than 12 months from the date of Council's takeover of the facility. No mechanical or electrical plant shall be taken over by Council before the plant is satisfactorily commissioned or before all other parts of a total development have been taken over. Where warranties are unable to be provided, Council require the placing of a Bond with Council for the 12 month minimum period.

A letter undertaking Maintenance Responsibility in terms of *B14* of this Code shall also be provided.

B11.7 Execution of and Security for Bonds

The amount of the bond shall be the estimated value of the work covered plus a margin to cover extra costs estimated by Council as likely to be incurred if the work has to be organised by Council outside the Contract at a later date plus GST.

A bond in a form approved by Council shall be executed by the registered proprietor. Security shall be provided either by execution of the bond, by a surety acceptable to Council, or by payment to the Council of cash in the amount of the bond. The Council may, in some circumstances, accept in lieu of a bond, a letter from the registered proprietor accepting responsibility for the works for which a bond would otherwise be required and authorising the Council to complete such work if the registered proprietor fails to do so. Any such letter will be required to be accompanied by a payment of cash as security in the amount which would have been stipulated by the Council had a bond been required.

B11.8 Asset Valuation

An asset valuation covering all Council infrastructure shall be provided. This includes roading and utility services along with earthworks associated with roads. Valuations shall be carried out by a suitably qualified person employed by the Developer and details provided to clearly show its make up. The valuation shall be broken into roading, water supply, wastewater, stormwater and land assets. The valuation shall identify and make provision for any abandoned assets.

The valuation shall use a method which complies with accounting standards approved by the Accounting Standards Review Board and is consistent with the methodology used by Upper Hutt City Council for the valuation of infrastructural assets. A valuation certificate shall be supplied at the time the valuation is submitted to the IQP by the valuer.

B11.9 Certificates from Network Utility Authorities

Letters from all Network Utility Operators advising that reticulation and plant to be taken over by them has been installed to their standards and they have undertaken to take over its operation and maintenance.

B11.10 **Construction Certificate**

The Designer shall prepare and forward a Construction Certificate of the following format to the IQP.

"I (name) _____
of (firm and address) _____
being the Designer of the subject works have , along with staff working under my direction, observed the construction phase of the project (project name) _____
_____
which has been built by (Contractor's name) _____
_____.

In addition I have obtained quality assurance information from the Contractor which I have verified from time to time. Based on my observation and the quality assurance information received it is my opinion that the works have been built in accordance with the design and satisfy the design intent and Council's Code.

This statement is issued on the understanding that the following obligations remain with the Developer for the periods outlined.

- Warranties and maintenance undertaking as required under B11, B12, B13 and B14 of this Code. (12 months minimum from Council's issue of the completion certificate).

- All responsibility for the following specific works for which Council has agreed that bonds can be posted.

List: Work description and reason for bonds, Developer's responsibilities, period of obligation, value and type of security held.

I/My practice currently holds professional indemnity insurance in the sum of $ _____
($250,000 minimum).

Name: _____

My Qualifications and Experience relevant to this project are: _____

_____

Signed _____."

B12. As Built Information

The Designer shall provide neatly and accurately prepared As Built drawings at the same scale as the design drawings. These drawings shall cover all aspects of the project, and shall be submitted in the form of both computer based media and transparency based drawings to the standards required by *B1.6.2*.

Information given on As Built drawings shall include but shall not be limited to:

i. Stormwater and wastewater reticulation - including the coordinated positions of manholes, manhole invert and lid levels, measurements to house connections, and laterals and their length and position. Positions of connections and laterals shall be both coordinated and referenced to adjacent manhole lids and boundary pegs. All levels shall be in terms of Mean Sea Level.

ii. Flood and secondary flow information - the 1% and 4% AEP flood water levels (residential, commercial/ industrial), the 1%, 10% and 20% levels (rural and rural residential) and the extent of any overland secondary flows shall be shown where these have been obtained or derived during the design.

iii. Water reticulation - including the position of mains, location of hydrants, valves, tees reducers, connections, tobies, specials, etc. All features shall be accurately dimensioned, coordinated and referenced to boundary pegs so that they can be accurately relocated in the field.

iv. Ducts - measurements to ducts installed for telephone, power and gas reticulation.

v. Labelling of pipes and ducts to cover diameter, pipe material and class, year laid, jointing type.

vi. Road names - as approved by the Council.

vii. Coordinates of all utility surface features, including tobies.

viii. The co-ordinates of at least 2 points on each plan in terms of NZ Map Grid and the origin of the plan level datum in terms of Mean Sea Level Datum.

ix. The coordinates and concise levels (to MSL datum) of all permanently installed survey and level marks, with the positions shown on the roading plans.

x. Areas of filling - showing the total depth of fill, in the form of lines joining all points of equal fill depth (fill contours), along with the position and levels of all compaction tests taken which shall be able to be read with the earthworks construction report required above.

xi. Road construction, including location, structural details and details of road marking, signals, lighting, signs, landscape features, seating and other amenities and features.

xii. Road Surfacing Information -For sealed roads information shall include binder type and application rate, cutter type and quantity, adhesion agent type and quantity, type and quantity of other additives, the width, length and area of each street sealed, chip size. The design basis for the binder application rate and a discussion on any reasons for differences between the design and applied rate.

B13. **Completion Certificate IQP**

On receipt and acceptance of all Completion Documentation the IQP shall prepare and forward a Certificate in the following format to Upper Hutt City Council.

"I (name) _____
of (firm and address) _____
have independently monitored the construction phases of the project (project name) _____
_____

In addition I have obtained information from the Construction Supervisor from time to time when requested during the works and Completion documentation in terms of the Upper Hutt City Council Code.

Based on the monitoring and observation carried out by me or under my direction and my review of documents provided by others it is my opinion, that the construction works have been carried out to the specified standards and Council conditions and the design intent have been met.

Based on my review of the Completion Documentation it is my opinion that it satisfies the requirements of Council's Code.

This final certificate is issued on the understanding that the following obligations remain with the Developer for the periods outlined.

- Warranties and maintenance undertaking as required under B11, B12, B13 and B14 of this Code. (12 months minimum from Council's issue of the completion certificate).

- All responsibility for the following specific works for which Council has agreed that bonds can be posted.

List: Work description and reason for bonds, Developer's responsibilities, period of obligation, value and type of security held.

The Developer has provided a written undertaking to maintain these works for the period of the bond or such other period as necessary to satisfy me that the works formally comply with the requirements of this Code.

I/My practice currently holds professional indemnity insurance in the sum of $ _____
($250,000 minimum).

Name: _____

My Qualifications and Experience relevant to this project are: _____

_____

Signed _____."

B14. **Maintenance Period**

All Civil Works taken over by Council shall be maintained by the Developer for a minimum period of 12 months after issue of Council's Completion Certificate, at no cost to Council (refer to *Intro 6.6* for start of maintenance period). This shall include the mowing of berms and protection and maintenance of all trees on Council roads.

Items for which longer obligations have been accepted in terms of bonds posted remain the full responsibility of the Developer for the designated period or such longer period as may be required if the reasons for posting the bond have not been satisfied within the bonded period. Any need to extend such bond obligations will be made by the IQP in consultation with Council.

Where, in the opinion of the IQP, an arms length contract between Developer and Contractor incorporating maintenance retentions for the 12 month period, does not exist, Council may require a bond to be posted to cover the Developer's maintenance obligations.

The maintenance period does not limit the Developer's obligations under law to provide a development complying with Council's Code and suitable for its purpose.

B15. **Maintenance Certificate IQP**

At the end of the maintenance period or bond period as applicable the IQP shall provide a certificate of the following form to Council:

"The Maintenance (or Bond period where applicable) period for the above contract has ended, and I have inspected the works with the Designer. It is my opinion that all maintenance/bond obligations have been met and it is in order to relieve the Developer from these obligations to Council under this project.

I/My practice currently holds professional indemnity insurance in the sum of $ _____
($250,000 minimum).

Name: _____

My Qualifications and Experience relevant to this project are: _____

_____

Signed _____."

APPENDIX B

CONTENTS

To: Upper Hutt City Council
Private Bag 907
UPPER HUTT

Appendix B, Figure 1

STATEMENT OF PROFESSIONAL OPINION AS TO
SUITABILITY OF LAND FOR SUBDIVISION

Subdivision _____

Owner _____

Location _____

I _____ of _____
(full name)

_____
(Name and address of firm)

Hereby confirm that:

1. I am a Registered 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.

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 drawings 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 the 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 _____

To: Upper Hutt City Council
Private Bag 907
UPPER HUTT

Appendix B, Figure 2

STATEMENT OF PROFESSIONAL OPINION AS TO
SUITABILITY OF LAND FOR BUILDING DEVELOPMENT

Subdivision _____

Owner _____

Location _____

I _____ of _____
(full name)

_____
(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 inspection during construction, and the results of all tests carried out are described in my report dated _____.

3. In my professional opinion, I consider that:

* (a) The earth fills shown on the attached Plan No _____ have been placed in compliance with the Code of Practice of the _____ _____ 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 does not remove the necessity for the normal inspection of foundation conditions at the time or erection of any dwelling.

Signed _____ Date _____

APPENDIX B, FIGURE 5

UPPER HUTT CITY COUNCIL CONDITIONS FOR ISSUE OF EASEMENT OVER PUBLIC MAINS

Any easement issued in Upper Hutt City shall be in favour of Upper Hutt City Council and give it or its agents full right to use the easement for access, repair or replacement of services, or laying of new services within the easement.

Easements shall generally be grassed but the following improvements may be constructed over an easement provided surface openings are left at surface level and accessible and normal Council consents are obtained.

i. Gardens and shrubs excluding trees with expected heights in excess of 4 metres.

ii. Paths and drives.

iii. Lightweight fences. This excludes block, concrete or retaining walls.

iv. Single storey, light frame, relocatable non-habitable outbuildings of maximum dimension 6.5m and maximum area 24 m^2.

v. Above ground portable rubber or plastic formed swimming pools of 3.5 metres maximum diameter.

No improvements shall be built over easements formed for access purposes.

Any improvements built on an easement shall be removed by the owner and at the owner's cost when instructed by Council to enable maintenance or replacement of existing services, or construction of new services to be undertaken in the easement. Reimbursement beyond the placing of topsoil and grass seed shall be the responsibility of and at the cost of the owner.

APPENDIX B, FIGURE 15

MINIMUM REQUIREMENTS FOR PUMP STATIONS AND TELEMETRY

These conditions apply to water, wastewater and stormwater pump stations except where noted as being limited in applicability to certain pump station types. The telemetry requirements also apply to water reservoirs. Refer also to B6.13 and B7.4.

1. Lighting

Pump stations in road reserve shall be located within 10 metres of a street light. If necessary a special street light shall be installed. When located in off road compounds a lighting column and light shall be specially provided. The light shall be switched on to match the normal street lighting except when all night lighting is not allowed by the Resource Consent.

In such cases a column and light shall be installed in the same way but the light shall be switchable by the provision of an on/off switch located in the control cabinet.

The control cabinet shall have a switchable internal light to enable night time reading of meters and cabinet emergency maintenance.

2. Control Cabinets and Controls

i. All electrical equipment, telemetry etc. shall be located above ground level and above the 100 year flood level in a corrosion resistant weather proof cabinet secured against unauthorised entry and seismic movements.

ii. All electrical equipment and cabling shall be safety rated zone 1 class 1 and installed to standards applicable for its location and use.

iii. A 3 pin, single phase plug for portable lighting and equipment shall be provided.

iv. The control panel shall incorporate as a minimum the following controls.

- "Soft" starters which will reduce or eliminate power and pressure surges on pump start and stop (all water supply pumps and all wastewater and stormwater pumps of greater than 2 kW power).
- An ammeter, with switching to enable indication of current in each phase.
- A volt meter, with switching to enable indication of voltage in each phase.
- Motor overload current protection.
- An adjustable pump casing over-temperature sensor with cut-out on temperature rise above 25° - 30°C.
- "No-flow" cut out of pumps.
- Phase failure protection.
- Indicator lights for each of the four above cut-outs all to be manually reset, any one to cause an "alarm" status to be transmitted via the radio telemetry system.
- A delay of not less than 5 minutes on automatic restart when a pump has stopped as a result of fault protection.
- An "hours-run" meter for each pump motor.
- A "number of starts" counter for each pump motor.
- A manual pump duty selector.

- A "reservoir full" signal to stop the pumps even when set on "manual", with indicator light to be on when pumps cut out (for pumps serving reservoirs).

- Ability to isolate the pump control signals to allow for pumps to be run easily for testing purposes. This isolating system should automatically reset after 5-10 minutes.

- Any heater systems required to maintain controls free of moisture.

iv. Pump controls - water supply systems.

For pumps installed "in-line", pump starting shall be achieved via a time clock which will allow for at least two runs per 24 hour periods. The starting time shall be easily adjustable.

For pumps installed adjacent to a reservoir and delivering to a higher level reservoir, pump starting may be achieved via a signal from a "cut-in" float switch or floatless electrode.

Pumps shall stop on a "reservoir full" signal from a float switch or floatless electrode installed at the Reservoir, via a dedicated land line connected between the Reservoir and pumping station.

v. Level controls - stormwater and wastewater.

Pumps shall be supplied with ultrasonic or "Multitrode" level devices to control

- low level stop
- high level start, with additional start levels for pumps 2 and 3 where applicable
- high level alarm

Level devices shall be easily adjustable in setting and accessible.

vi. Other requirements - water supply systems.

a) Pressure gauges

A 100 mm dial liquid filled pressure gauge, with an accuracy of ± 1.6% FSD or better shall be mounted on the pumping station delivery pipework.

For stations piped "in-line" a 100 mm dial LF pressure gauge shall also be mounted on the suction pipework.

All gauges shall have pressure ranges which are appropriate for their duty, and shall read in bar, kPa or metres head (not psi or scale).

Each gauge shall be provided with an isolating valve (either a needle or ball valve).

vii. Flow metering.

Pump flows shall be metered and a pulse output connected to the Telemetry system. The meter selected shall be sized to ensure that the head loss at pump designed flow rate is less than 0.4 metres head.

3. Pump Mounting and Layout

- All pumps shall be isolated with suitable valves and protected by non return valves. Actuated or other form of control valves shall be installed where required to protect the pipework or pump systems.

- Pumps shall be mounted on rubber pads in accordance with the manufacturers recommendation and where appropriate flexible connections shall be installed in the delivery line to reduce vibration and improve seismic security.

- Pump station piping shall be of adequate diameter, friction characteristics and layout to minimise minor losses and ensure discharge velocities are less than 2.0 m/s.

4. Telemetry Standards - pump stations, reservoirs, traffic signals.

All pump stations and reservoirs shall be provided with a radio telemetry system which is fully compatible with the system currently used by Council. The system shall be capable of providing at least the following information:

- "panic" button for pressing by site person in emergency
- high and low level warnings
- pump fault warnings
- duration of pump on/off and pump number
- pump status by number
- door status on control sheds
- status of lockable gates
- hatch security (reservoirs)
- continuous water levels (reservoirs)
- continuous record of inflows and outflows (reservoirs and pump stations on request)
- control and monitoring of the seismic shutoff valves and any other actuated or automated valves to reservoirs.

Traffic signals shall be provided with Telemetry systems providing at least the following information.

- "panic" button.
- fault warning
- signal status at any time

The telemetry system shall be linked to Council's main telemetry computer database and commissioned to ensure it is fault free prior to handover.

5. Other

A metered water supply and tap outlet shall be provided to the immediate vicinity of pumpstations and reservoirs. The supply shall be fitted with an approved reduced pressure backflow preventer when provided at wastewater and stormwater pump stations.

Chamber lids shall provide access openings centrally over each pump and shall be designed to withstand HN HO 72 loadings when at ground level in roads (including paths and berms). A slide across safety grill shall be provided for ground level openings to prevent persons from accidentally falling down the opening when the chamber lid is open. Lids shall be designed to be non-slip, with recessed handles and locks. Lids shall be designed to be easily opened by one person without the need for lifting equipment.

Pump chambers shall be designed to incorporate an adequate factor of safety against flotation when empty.

All below ground metal fittings, bolts etc shall be stainless steel.

All stations shall be designed for automatic control.

APPENDIX B, FIGURE 16

UHCC - MINIMUM CONSTRUCTION INSPECTIONS TO BE UNDERTAKEN BY THE IQP

As the person responsible for looking after Upper Hutt City Council's interest during Civil Engineering Construction, the IQP shall make inspections and enquires of the Supervisor as necessary to satisfy the IQP that standards are being met. Inspections made by the IQP shall include as a minimum:

a) Roading

i. Inspection of all road subgrades after clearing and before placing of any pavement layer.

ii. Inspection of rolled and swept basecourse prior to commencement of surfacing.

b) Stormwater, Wastewater and Water Supply

i. Inspection of trench base prior to commencement of pipelaying.

ii. Inspection after bedding and surround and before pipe backfilling.

iii. Inspection of thrust blocks before covering.

iv. Attendance during pressure testing.

v. Inspection during entering of chlorine for disinfection of water mains and closer pipes.

vi. Inspection of manholes including interior and abutting pipes, after completion.

c) Completion Inspection

i. Receive and review the TV record and ensure any defects have been attended to.

ii. Carry out walkover inspection covering earthworks, road standards, neatness and accuracy of surface openings, standard of landscaping etc. all as necessary to enable the IQP after receiving the required Completion Documentation to forward the necessary Certification to Council.

The above minimum IQP inspections shall be made with the Construction Supervisor who shall in addition make inspections as required to adequately undertake his/her role.

d) Maintenance Bond Release Inspection

i. Walk over the project prior to end of Bond Release/Maintenance period as applicable to enable the IQP to satisfy himself/herself that it is appropriate to forward the Maintenance Certificate to Council.

APPENDIX B

CONTENTS

To: Upper Hutt City Council
Private Bag 907
UPPER HUTT

Appendix B, Figure 1

STATEMENT OF PROFESSIONAL OPINION AS TO
SUITABILITY OF LAND FOR SUBDIVISION

Subdivision _____

Owner _____

Location _____

I _____ of _____
(full name)

_____
(Name and address of firm)

Hereby confirm that:

1. I am a Registered 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.

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 drawings 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 the 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 _____

To: Upper Hutt City Council
Private Bag 907
UPPER HUTT

Appendix B, Figure 2

STATEMENT OF PROFESSIONAL OPINION AS TO
SUITABILITY OF LAND FOR BUILDING DEVELOPMENT

Subdivision _____

Owner _____

Location _____

I _____ of _____
(full name)

_____
(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 inspection during construction, and the results of all tests carried out are described in my report dated _____.

3. In my professional opinion, I consider that:

* (a) The earth fills shown on the attached Plan No _____ have been placed in compliance with the Code of Practice of the _____ 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:

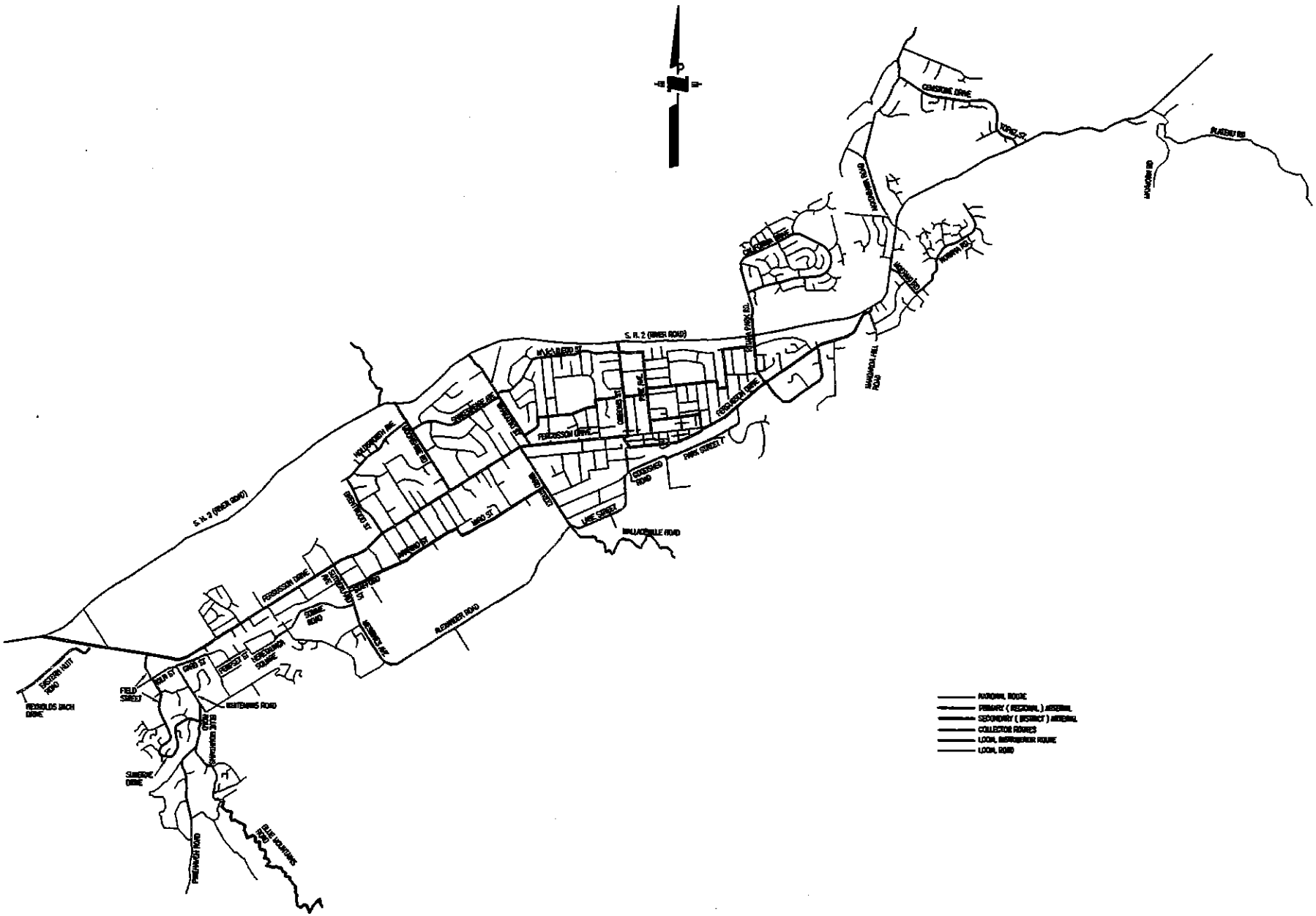
(i) _
(ii) _____
(iii) _____

4. This professional opinion does not remove the necessity for the normal inspection of foundation conditions at the time or erection of any dwelling.

Signed _____ Date _____

A Alterations Rd, Mangorei Hill Rd & Wallaceville Rd altered 24/6/96

B Alterations to Secondary, Collector Local Distributor & Local Roads 17/9/96



ROADING HIERARCHY

URBAN AREA

NOT TO SCALE

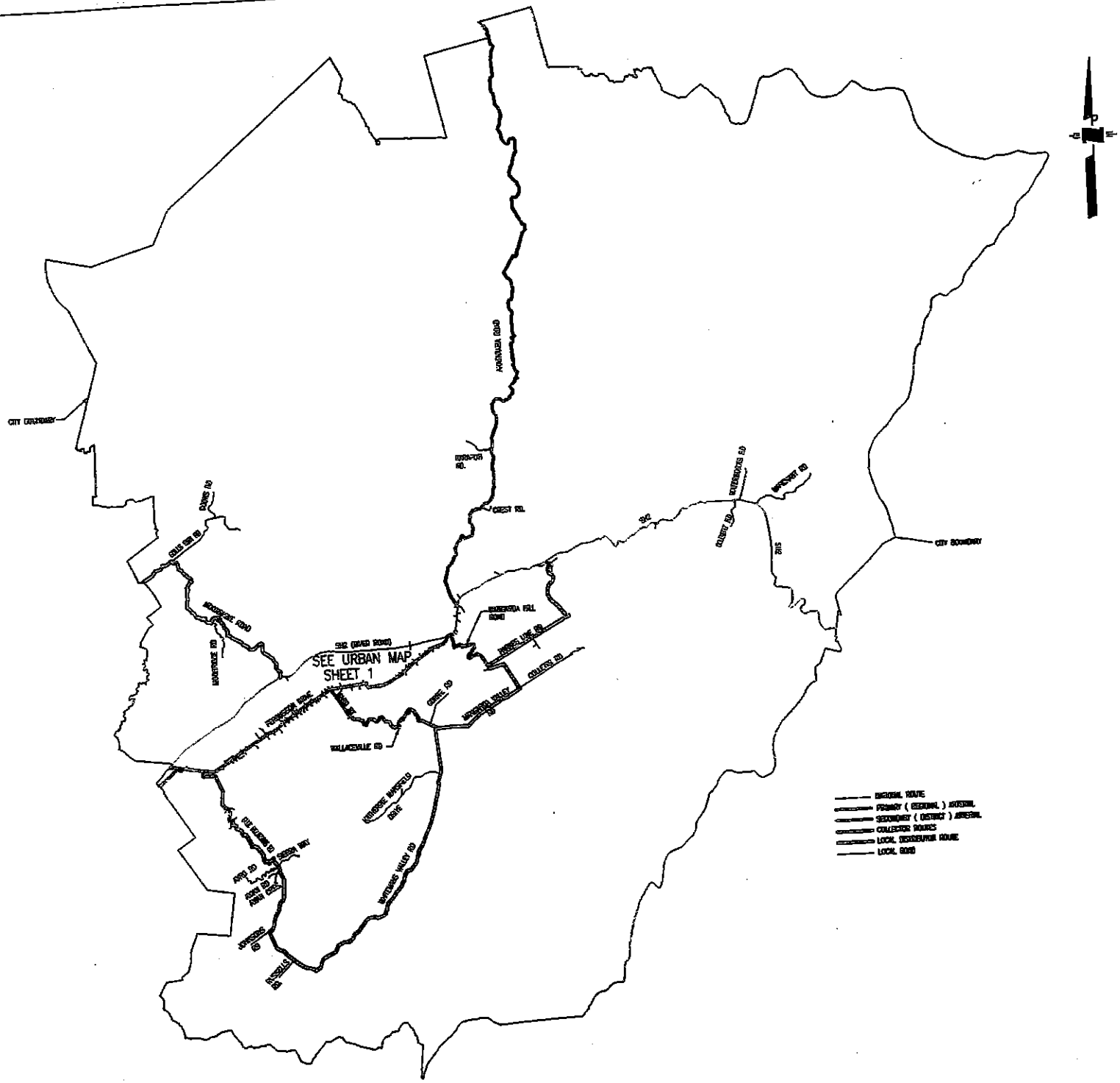
	G. R. CHAMBERLAIN	17/9/96
	G. R. CHAMBERLAIN	17/9/96
		07/98

L. E. BEACH

5781/1 2 B

UPPER HUTT CITY

UPPER HUTT CITY



UPPER HUTT CITY COUNCIL

ROADING HIERARCHY

RURAL AREA

NOT TO SCALE

	NAME	
DESIGNED	G. R. CHAMBERLAIN	14/5/96
DRAWN	G. R. CHAMBERLAIN	14/5/96
CHECKED		24/6/96
SECOND'D		24/6/96
APPROVED		6/96

PLAN No. 5781/2 SHT 2 ISSUE A

APPENDIX B, FIGURE 5

UPPER HUTT CITY COUNCIL CONDITIONS FOR ISSUE OF EASEMENT OVER PUBLIC MAINS

Any easement issued in Upper Hutt City shall be in favour of Upper Hutt City Council and give it or its agents full right to use the easement for access, repair or replacement of services, or laying of new services within the easement.

Easements shall generally be grassed but the following improvements may be constructed over an easement provided surface openings are left at surface level and accessible and normal Council consents are obtained.

i. Gardens and shrubs excluding trees with expected heights in excess of 4 metres.

ii. Paths and drives.

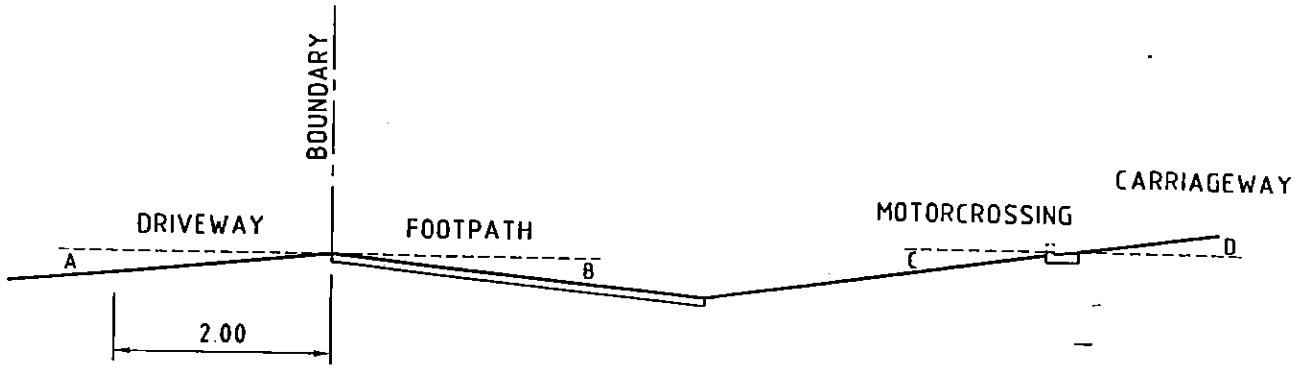
iii. Lightweight fences. This excludes block, concrete or retaining walls.

iv. Single storey, light frame, relocatable non-habitable outbuildings of maximum dimension 6.5m and maximum area 24 m^2.

v. Above ground portable rubber or plastic formed swimming pools of 3.5 metres maximum diameter.

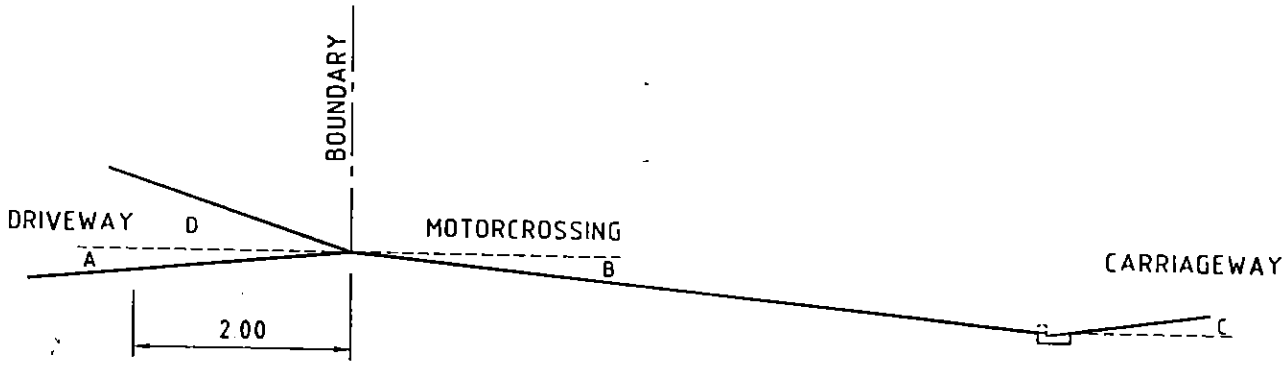
No improvements shall be built over easements formed for access purposes.

Any improvements built on an easement shall be removed by the owner and at the owner's cost when instructed by Council to enable maintenance or replacement of existing services, or construction of new services to be undertaken in the easement. Reimbursement beyond the placing of topsoil and grass seed shall be the responsibility of and at the cost of the owner.



MAXIMUM CHANGE OF GRADE: A + B ≤ 10% (or 5.7°)
C - D ≤ 10% (or 5.7°)
B + C ≤ 17% (or 9.6°)

LOW LEVEL FOOTPATH



MAXIMUM CHANGE OF GRADE: A + B ≤ 10% (or 5.7°)
D - B ≤ 17% (or 9.6°)
B + C ≤ 17% (or 9.6°)

STANDARD FOOTPATH

NOTE: A, B, C, & D REFER TO THE GRADIENTS EXPRESSED EITHER AS A PERCENTAGE OR IN DEGREES.

BASED ON 90 PERCENTILE CAR.

UPPER HUTT CITY COUNCIL

ENGINEERING STANDARDS

No.	Amendments	Date

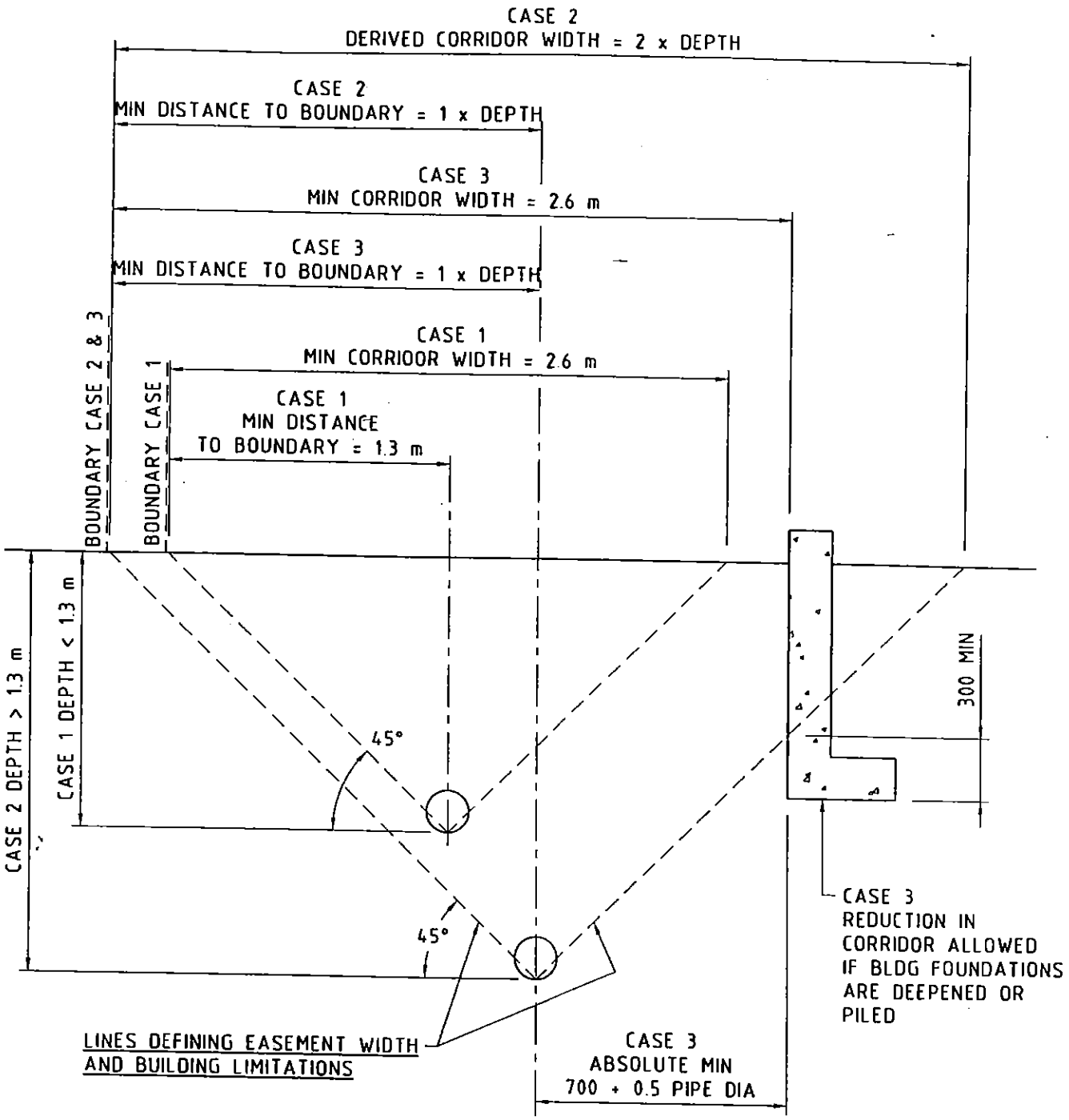
MAXIMUM DESIGN GRADIENTS FOR VEHICULAR ACCESS TO PROPERTY

Drawing Number 5904

Scale | Sheet of

Drawn	Checked	Recommended	Approved Director of Operations	Appendix B	Fig. 6

CW LTD CAD FILE REF:- M:\1524\ACAD\FOOTPATH.DWG



UPPER HUTT CITY COUNCIL

ENGINEERING STANDARDS

No.	Amendments	Date

TRENCHED SERVICES MAINTENANCE CORRIDORS AND BUILDING LIMITATIONS

Drawing Number 5904

Scale 1:20 AT A3

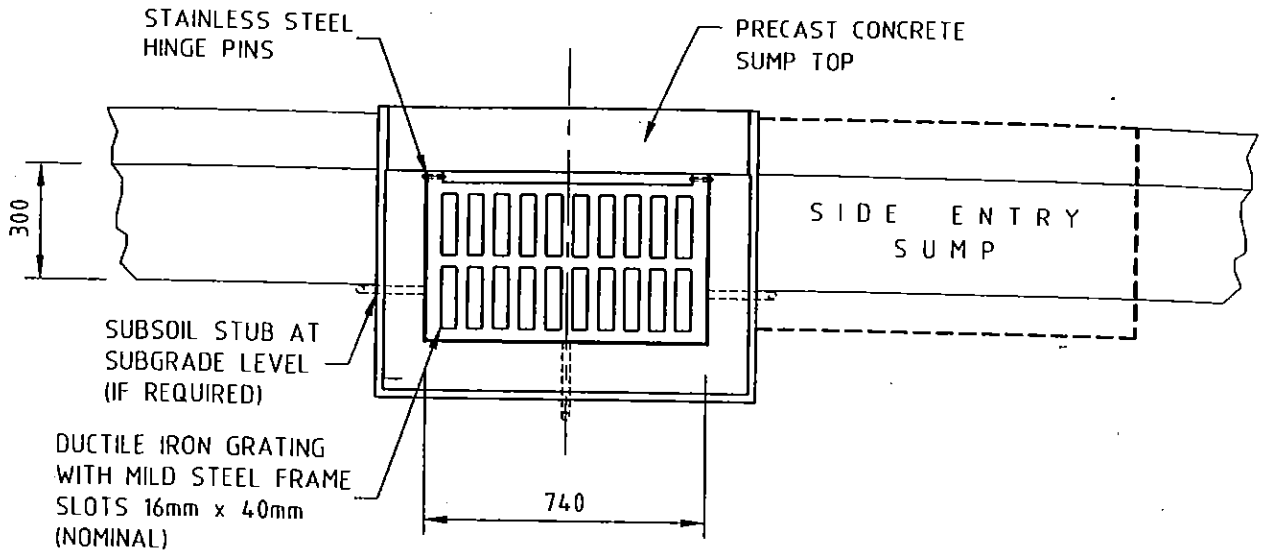
Sheet of

Appendix B

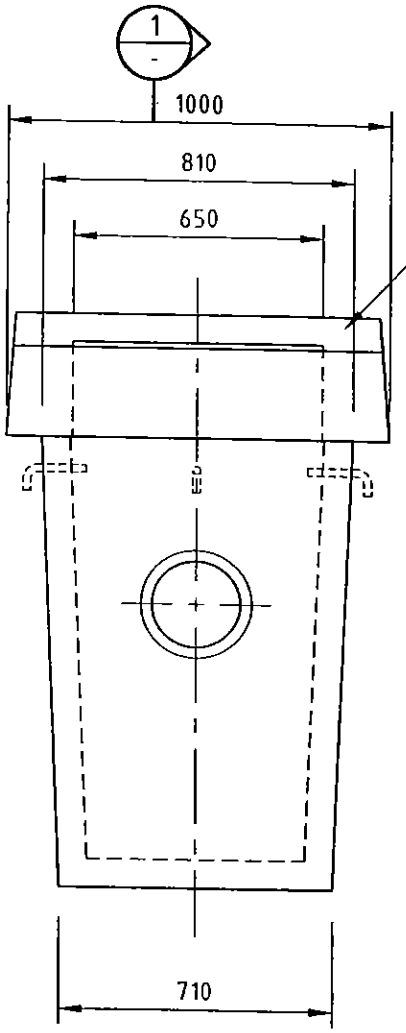
Fig 7

Drawn	Checked	Recommended	Approved Director of Operations
			2/98

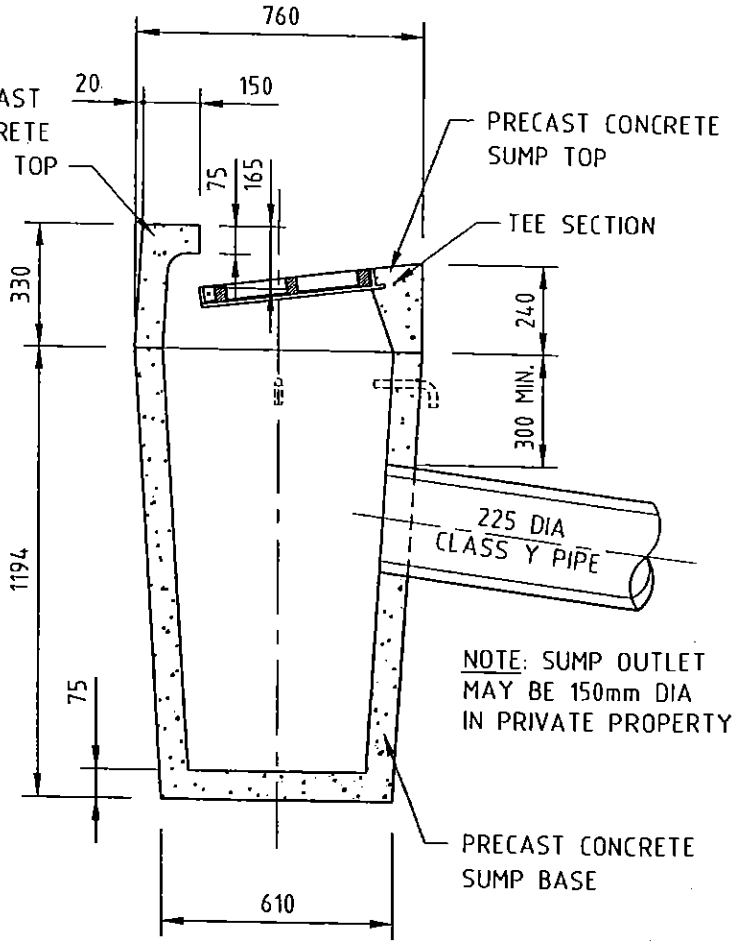
CW LTD CAD FILE REF:- M:\1524\ACAD\CORRIDOR.DWG



PLAN



FRONT ELEVATION



NOTE: SUMP OUTLET MAY BE 150mm DIA IN PRIVATE PROPERTY

SECTION 1

M:\1524\ACAD\SUMPS.DWG

UPPER HUTT CITY COUNCIL

ENGINEERING STANDARDS

No.	Amendments	Date

KERB AND CHANNEL
STORMWATER AND SIDE ENTRY
SUMPS

Drawing Number 5904

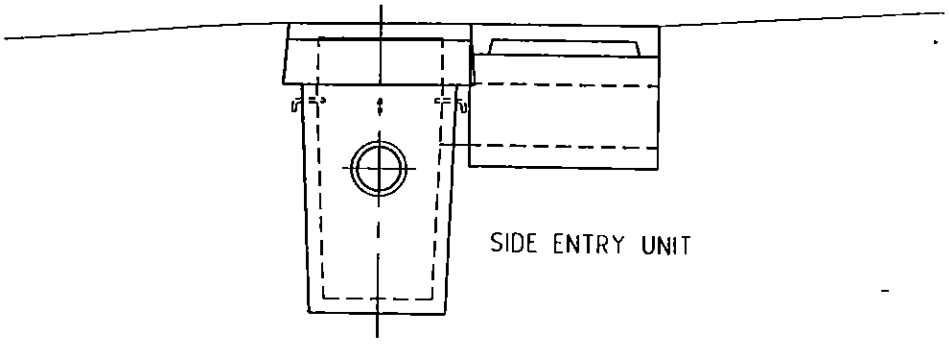
Scale 1:20

Sheet of

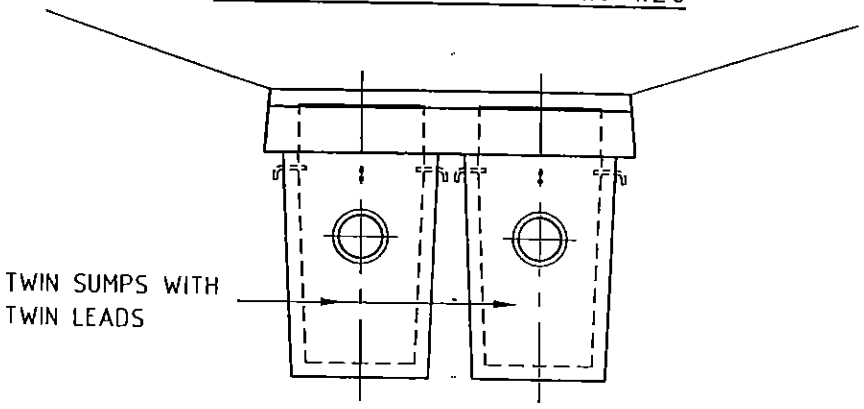
Appendix B

Fig. B (a)

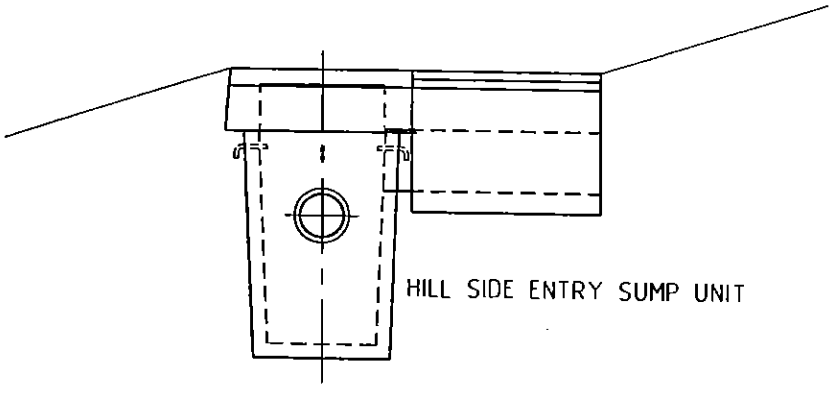
Drawn		Checked		Recommended		Approved Director of Operations



ON GRADES LESS THAN 1:20



AT LOW POINTS



ON GRADES GREATER THAN 1:20

H:\1524\ACAD\SUMPS.DWG

UPPER HUTT CITY COUNCIL

ENGINEERING STANDARDS

No.	Amendments	Date

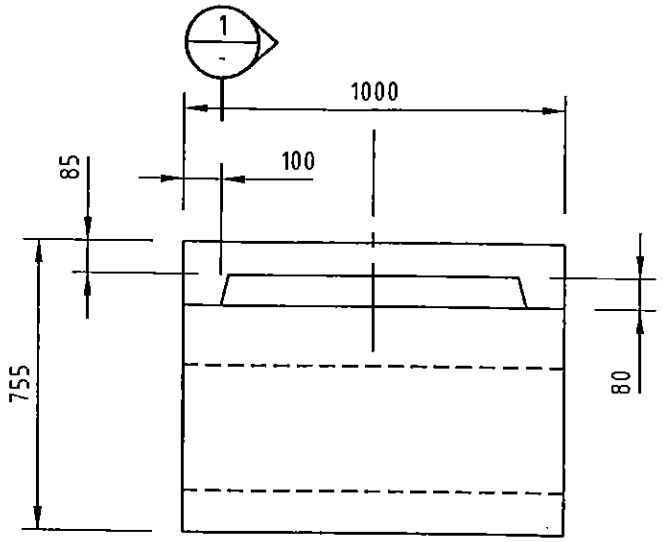
KERB AND CHANNEL
STORMWATER AND SIDE ENTRY
SUMP COMBINATIONS

Drawing Number 5904

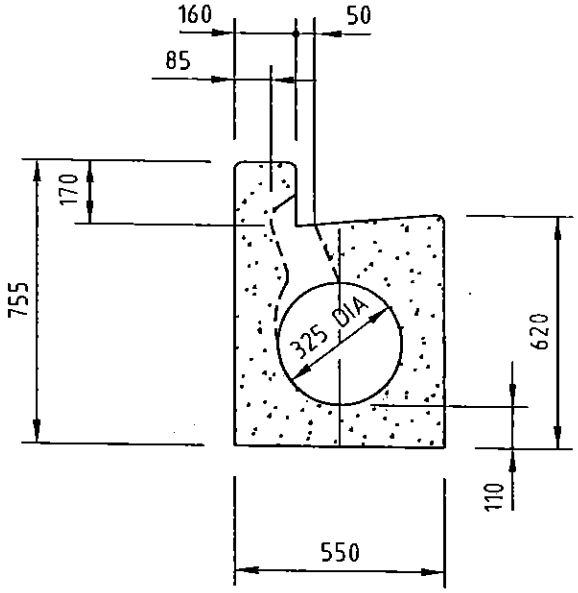
Drawn	Checked	Recommended	Approved Director of Operations

Scale 1:20 | Sheet of

Appendix B | Fig. 8 (b)



FRONT ELEVATION



SECTION 1 / -

H:\1524\ACAD\SUMPS.DWG

UPPER HUTT CITY COUNCIL

ENGINEERING STANDARDS

No.	Amendments	Date

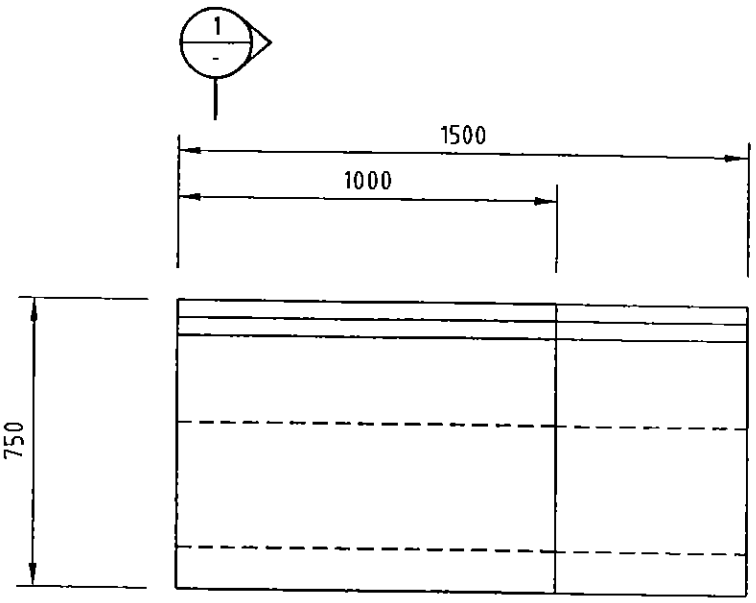
KERB AND CHANNEL
STORMWATER
SIDE ENTRY SUMP

Drawing Number 5904

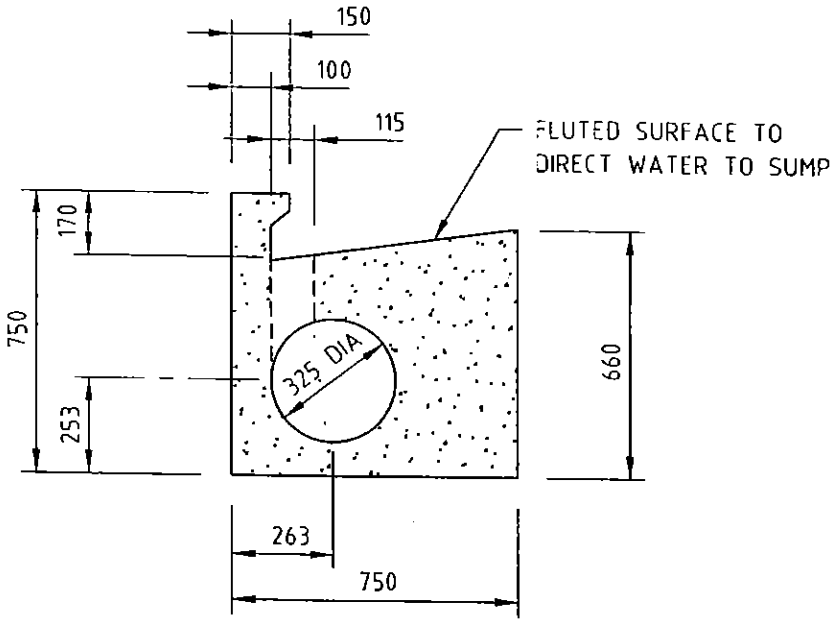
Scale 1:20 | Sheet of

Drawn | Checked | Recommended | Approved Director of Operations 7/88

Appendix B | Fig. 8 (c)



FRONT ELEVATION



SECTION 1

H:\1526\ACAD\SUMPS.DWG

UPPER HUTT CITY COUNCIL

ENGINEERING STANDARDS

No.	Amendments	Date

KERB AND CHANNEL
STORMWATER
HILL SIDE ENTRY SUMP

Drawing Number 5904

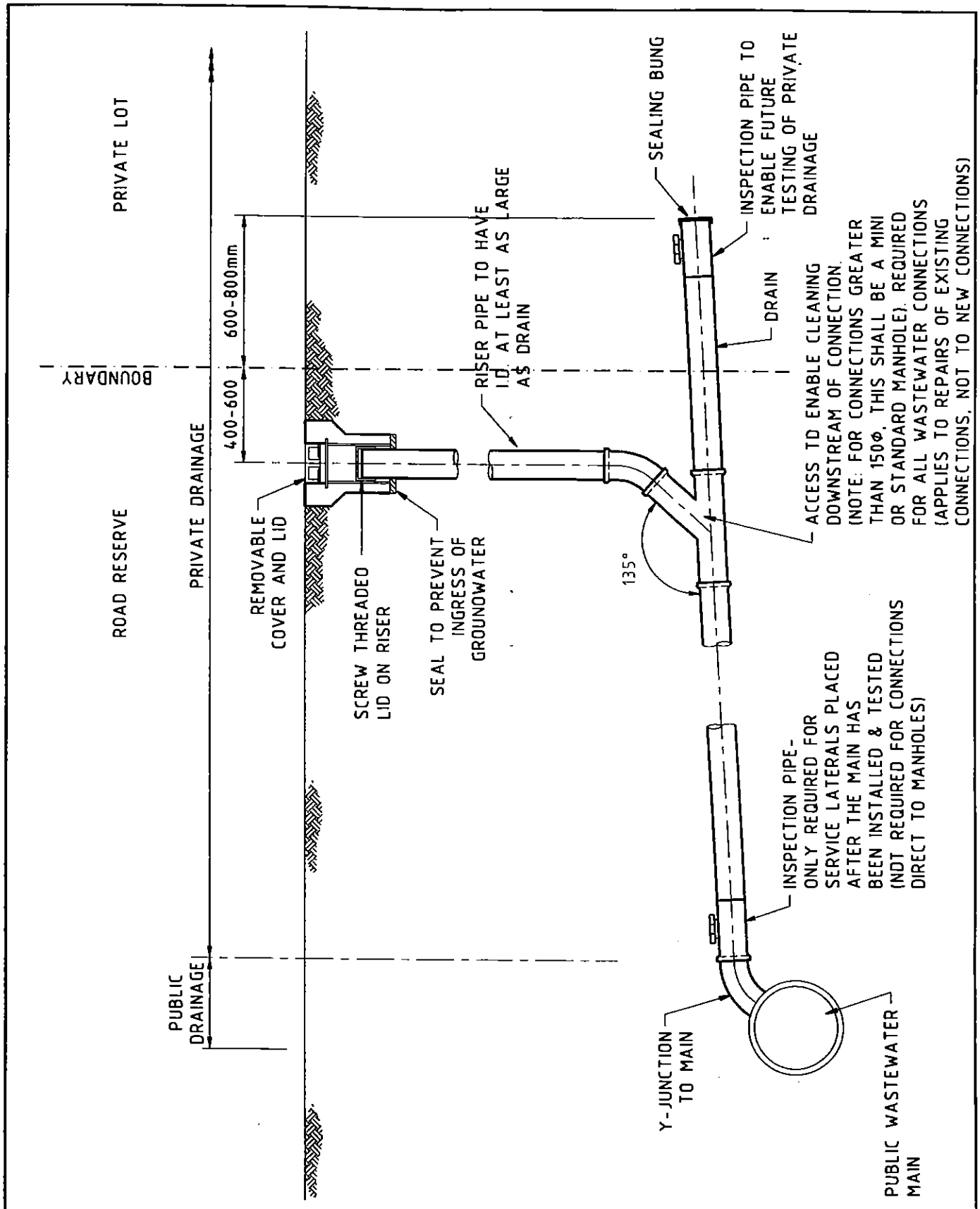
Scale 1:20

Sheet of

Drawn | Checked | Recommended | Approved Director of Operations

Appendix B

Fig. B (d)



UPPER HUTT CITY COUNCIL

ENGINEERING STANDARDS

No	Amendments	Date

MAINTENANCE AND INSPECTION PROVISIONS WASTEWATER CONNECTIONS

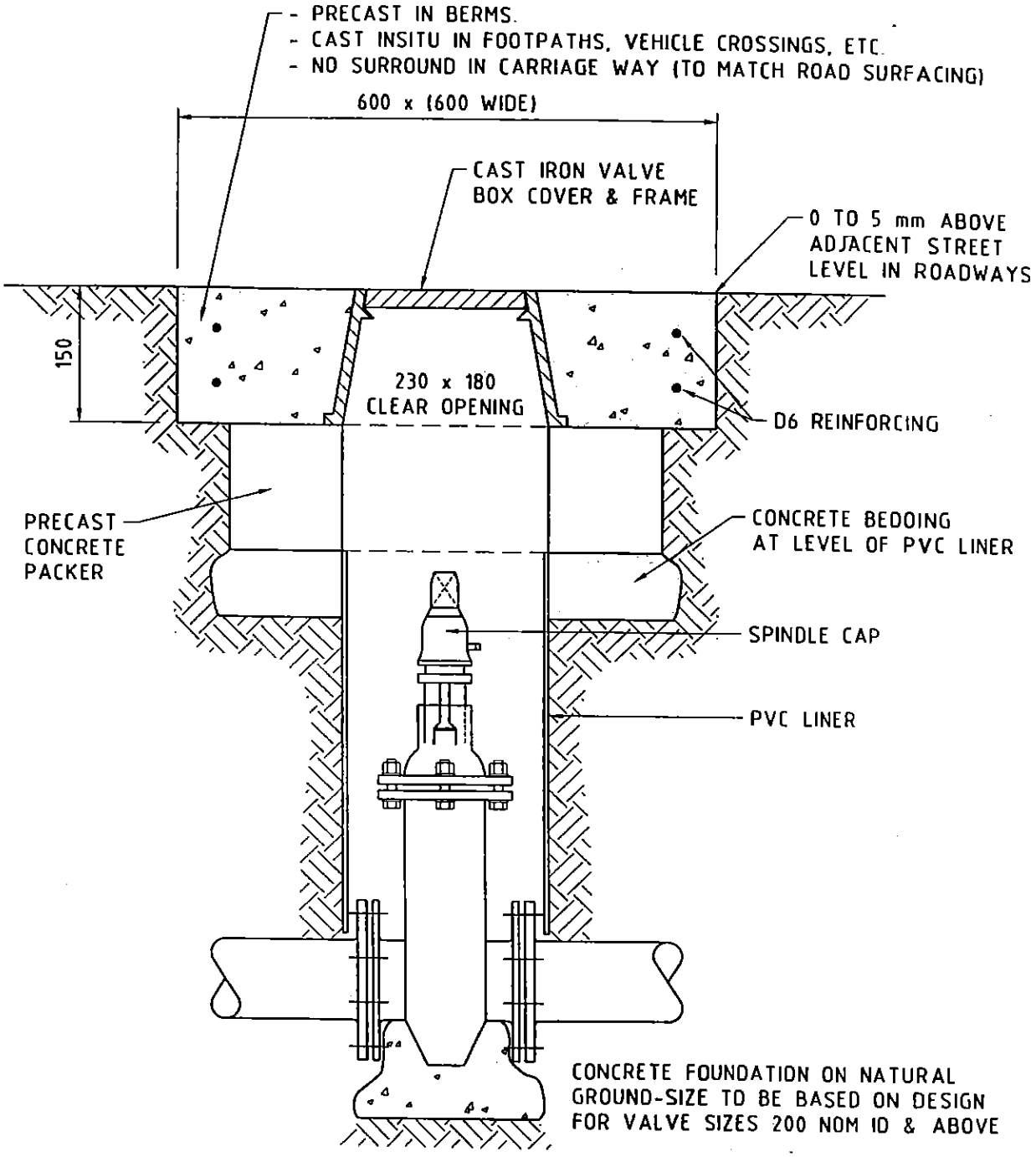
Drawing Number 5904

Scale

Sheet of

Drawn	Checked	Recommended	Approved Director of Operations	Appendix B	Fig. 9

CW LTD CAD FILE REF - M:\1524\ACAD\INSPECT.DWG



UPPER HUTT CITY COUNCIL

ENGINEERING STANDARDS

No.	Amendments	Date

SLUICE VALVE BOX MAINS AND RIDER MAINS

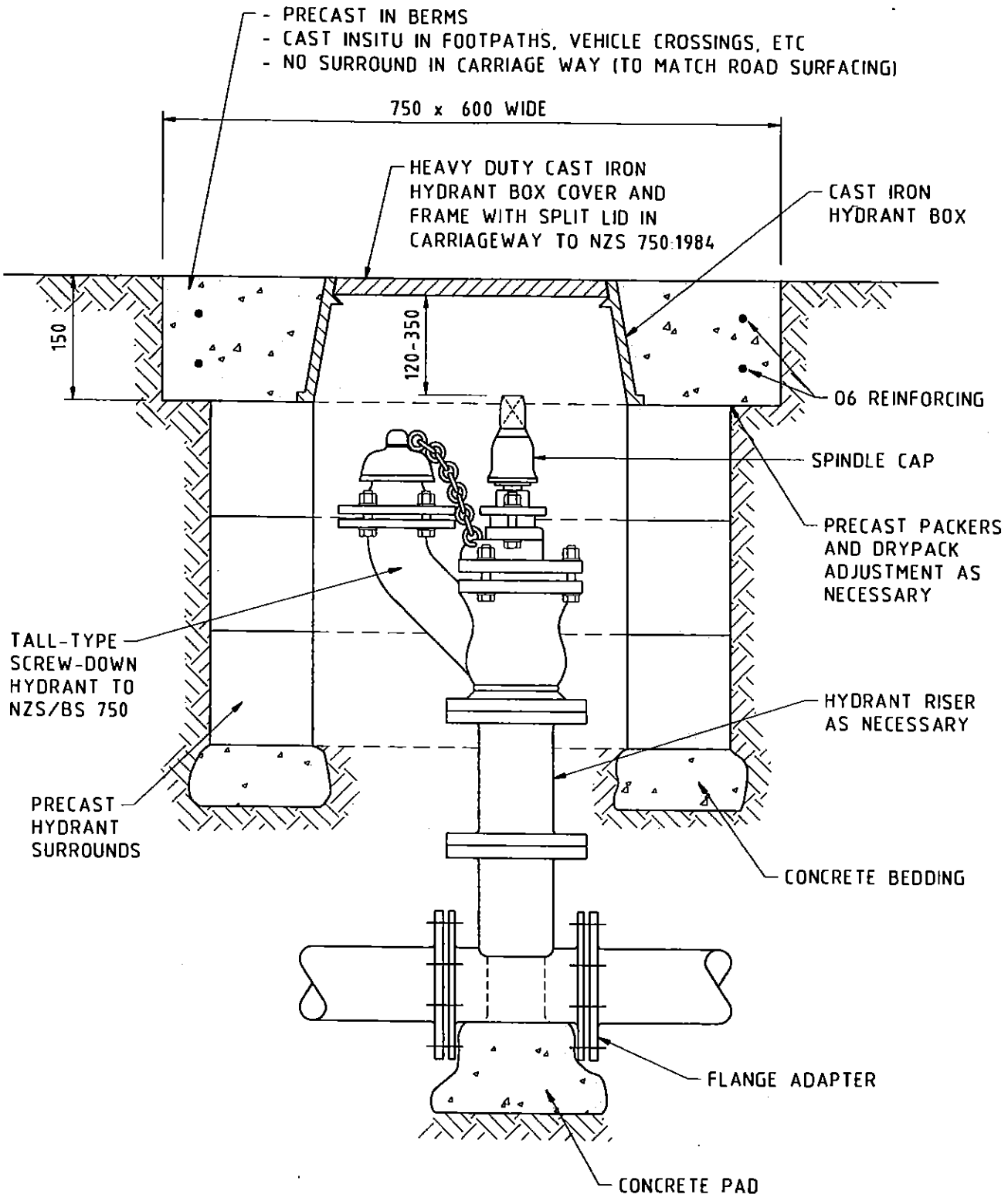
Drawing Number 5904

Scale

Sheet of

Drawn	Checked	Recommended	Approved Director of Operations	Appendix B	Fig 10

CW LTD CAD FILE REF:- M:\1524\ACAD\SLUICE.DWG



UPPER HUTT CITY COUNCIL

ENGINEERING STANDARDS

No.	Amendments	Date

FIRE HYDRANT BOX

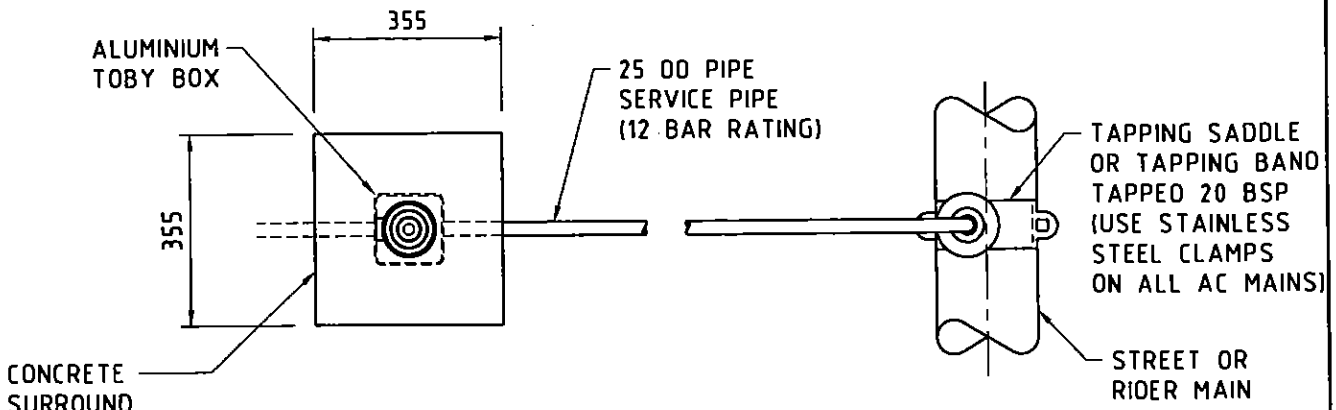
Drawing Number 5904

Scale

Sheet of

Drawn	Checked	Recommended	Approved Director of Operations	Appendix B	Fig. 11

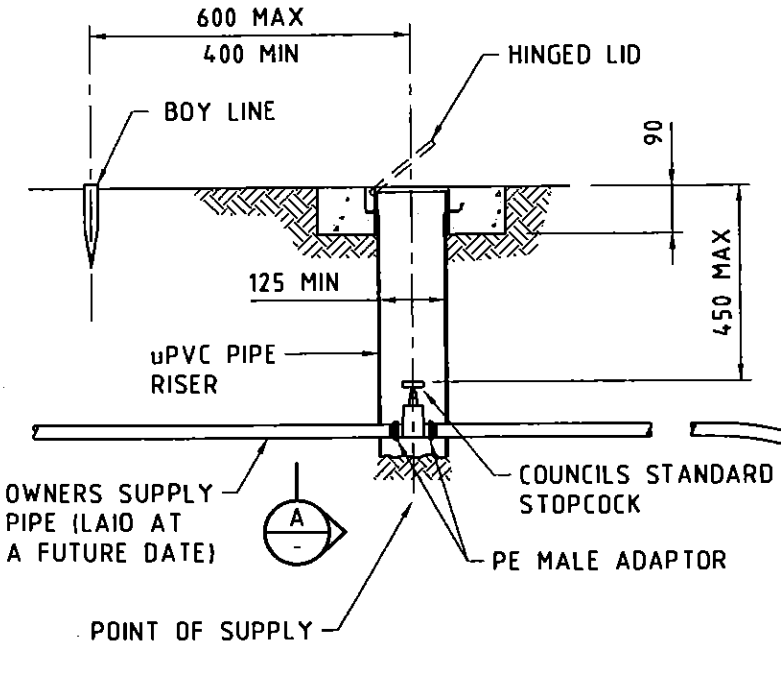
CW LTD CAD FILE REF - M:\1524\ACAD\HYDRANT.DWG



TOBY BOX LID DETAIL

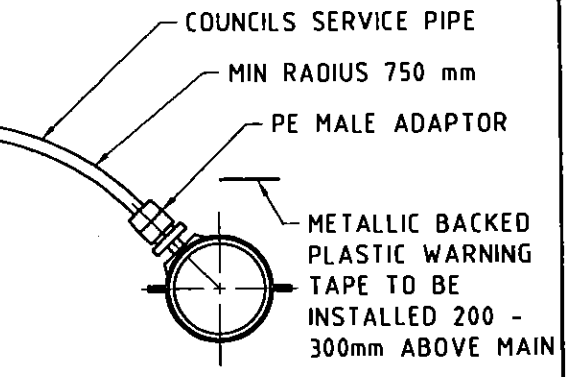
TYPICAL BERM INSTALLATION ONLY

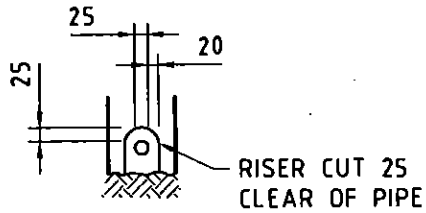
(IN CONCRETE DRIVEWAYS AND FOOTPATHS ALUMINIUM BOX TO BE CAST IN WITH THE ORIVE OR FOOTPATH)



NOTES:

1. SERVICE TO BE LAID AT RIGHT ANGLES TO STREET BOUNDARY.
2. DIMENSIONS ARE IN MILLIMETRES.
3. SERVICE PIPE TO BE INSTALLED WITH A LITTLE SLACK TO ALLOW FOR SOME SETTLEMENT WITHOUT CAUSING STRESS ON PIPE OR ADAPTORS.





SECTION A

PREFERRED SINGLE SERVICE PIPE TO STREET OR RIDER MAIN

UPPER HUTT CITY COUNCIL

ENGINEERING STANDARDS

No.	Amendments	Date

TYPICAL WATER SERVICE PIPE AND TOBY

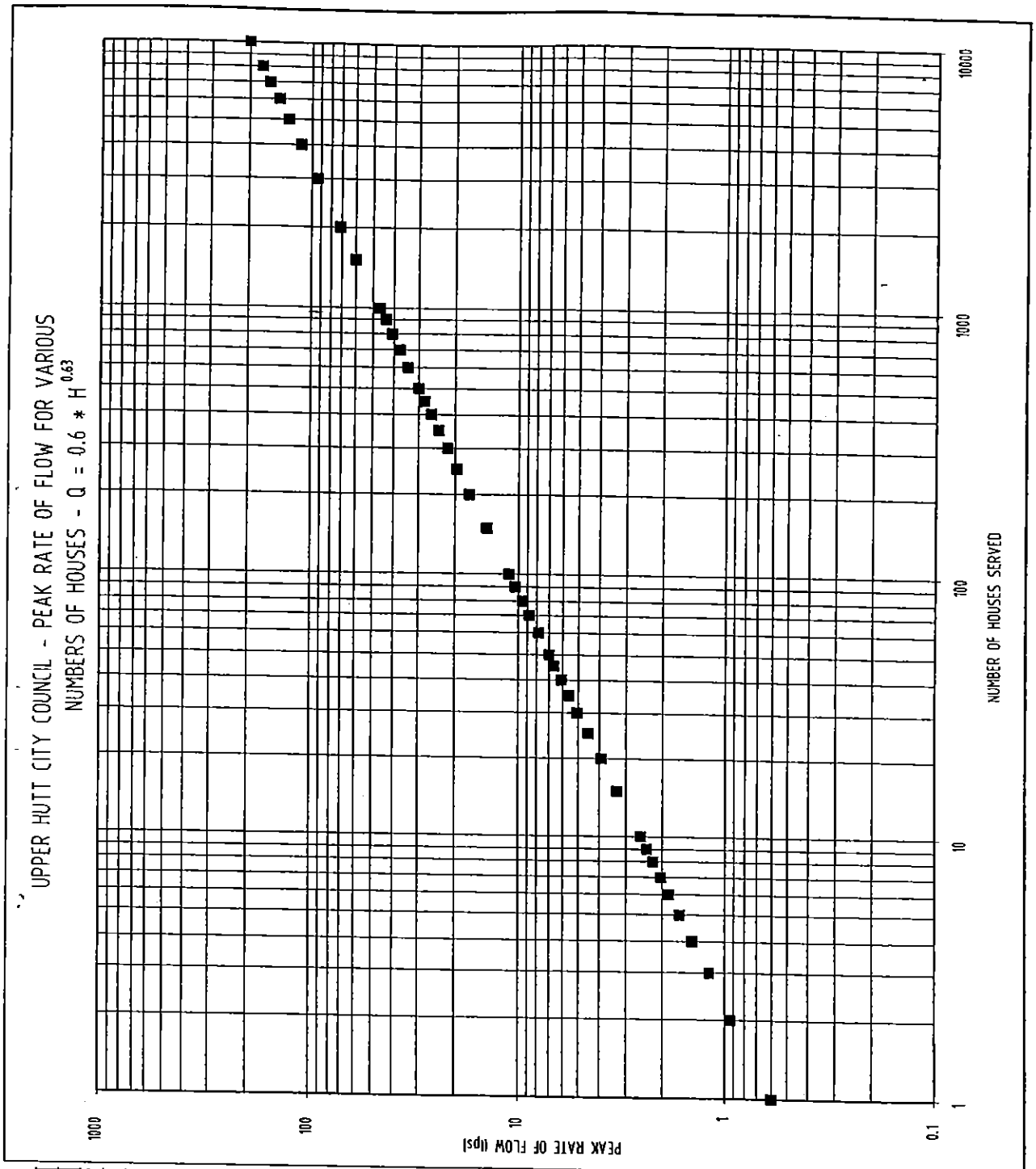
Drawing Number 5904

Scale

Sheet of

Drawn	Checked	Recommended	Approved Director of Operations	Appendix B	Fig. 12

CW LTD CAD FILE REF:- M:\1524\ACAD\TOBY.DWG



Number of Houses (H)	Peak Flow Rate (lps)
1	0.6
2	0.93
3	1.2
4	1.44
5	1.65
6	1.86
7	2.04
8	2.22
9	2.4
10	2.56
15	3.3
20	3.96
25	4.56
30	5.11
35	5.64
40	6.13
45	6.6
50	7.06
60	7.91
70	8.72
80	9.49
90	10.22
100	10.92
150	14.1
200	16.9
250	19.45
300	21.81
350	24.04
400	26.15
450	28.16
500	30.1
600	33.76
700	37.2
800	40.47
900	43.58
1000	46.57
1500	60.13
2000	72.08
3000	93.05
4000	111.54
5000	128.38
6000	144.01
7000	158.69
8000	172.62
10000	198.68

UPPER HUTT CITY COUNCIL

ENGINEERING STANDARDS

No	Ammendments	Date

PEAK RATE OF FLOW FOR VARIOUS NUMBERS OF HOUSES

Drawing Number 5904

Scale

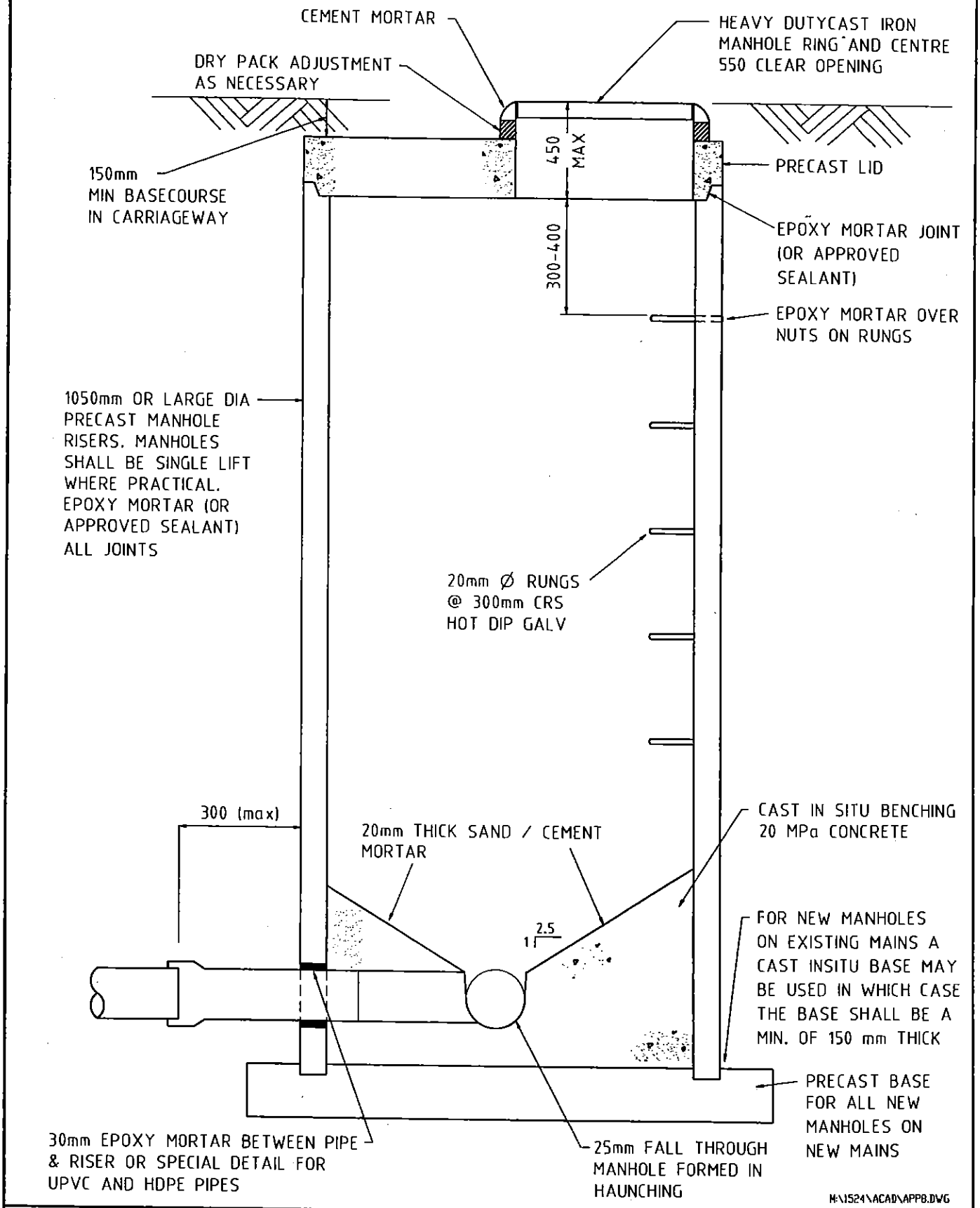
Sheet of

Appendix B

Fig 13

Drawn | Checked | Recommended | Approved Director of Operations 7/98

CW CAD FILE REF M:\1524\ACAD\FIG13.DWG



UPPER HUTT CITY COUNCIL

ENGINEERING STANDARDS

No.	Amendments	Date

PRECAST MANHOLE

Drawing Number 5904.

Scale

Sheet of

Drawn	Checked	Recommended	Approved Director of Operations	Appendix	Fig.
			7/96.	B	14

APPENDIX B, FIGURE 15

MINIMUM REQUIREMENTS FOR PUMP STATIONS AND TELEMETRY

These conditions apply to water, wastewater and stormwater pump stations except where noted as being limited in applicability to certain pump station types. The telemetry requirements also apply to water reservoirs. Refer also to B6.13 and B7.4.

1. Lighting

Pump stations in road reserve shall be located within 10 metres of a street light. If necessary a special street light shall be installed. When located in off road compounds a lighting column and light shall be specially provided. The light shall be switched on to match the normal street lighting except when all night lighting is not allowed by the Resource Consent.

In such cases a column and light shall be installed in the same way but the light shall be switchable by the provision of an on/off switch located in the control cabinet.

The control cabinet shall have a switchable internal light to enable night time reading of meters and cabinet emergency maintenance.

2. Control Cabinets and Controls

i. All electrical equipment, telemetry etc. shall be located above ground level and above the 100 year flood level in a corrosion resistant weather proof cabinet secured against unauthorised entry and seismic movements.

ii. All electrical equipment and cabling shall be safety rated zone 1 class 1 and installed to standards applicable for its location and use.

iii. A 3 pin, single phase plug for portable lighting and equipment shall be provided.

iv. The control panel shall incorporate as a minimum the following controls.

- "Soft" starters which will reduce or eliminate power and pressure surges on pump start and stop (all water supply pumps and all wastewater and stormwater pumps of greater than 2 kW power).
- An ammeter, with switching to enable indication of current in each phase.
- A volt meter, with switching to enable indication of voltage in each phase.
- Motor overload current protection.
- An adjustable pump casing over-temperature sensor with cut-out on temperature rise above 25° - 30°C.
- "No-flow" cut out of pumps.
- Phase failure protection.
- Indicator lights for each of the four above cut-outs all to be manually reset, any one to cause an "alarm" status to be transmitted via the radio telemetry system.
- A delay of not less than 5 minutes on automatic restart when a pump has stopped as a result of fault protection.
- An "hours-run" meter for each pump motor.
- A "number of starts" counter for each pump motor.
- A manual pump duty selector.

- A "reservoir full" signal to stop the pumps even when set on "manual", with indicator light to be on when pumps cut out (for pumps serving reservoirs).

- Ability to isolate the pump control signals to allow for pumps to be run easily for testing purposes. This isolating system should automatically reset after 5-10 minutes.

- Any heater systems required to maintain controls free of moisture.

iv. Pump controls - water supply systems.

For pumps installed "in-line", pump starting shall be achieved via a time clock which will allow for at least two runs per 24 hour periods. The starting time shall be easily adjustable.

For pumps installed adjacent to a reservoir and delivering to a higher level reservoir, pump starting may be achieved via a signal from a "cut-in" float switch or floatless electrode.

Pumps shall stop on a "reservoir full" signal from a float switch or floatless electrode installed at the Reservoir, via a dedicated land line connected between the Reservoir and pumping station.

v. Level controls - stormwater and wastewater.

Pumps shall be supplied with ultrasonic or "Multitrode" level devices to control

- low level stop
- high level start, with additional start levels for pumps 2 and 3 where applicable
- high level alarm

Level devices shall be easily adjustable in setting and accessible.

vi. Other requirements - water supply systems.

a) Pressure gauges

A 100 mm dial liquid filled pressure gauge, with an accuracy of ± 1.6% FSD or better shall be mounted on the pumping station delivery pipework.

For stations piped "in-line" a 100 mm dial LF pressure gauge shall also be mounted on the suction pipework.

All gauges shall have pressure ranges which are appropriate for their duty, and shall read in bar, kPa or metres head (not psi or scale).

Each gauge shall be provided with an isolating valve (either a needle or ball valve).

vii. Flow metering.

Pump flows shall be metered and a pulse output connected to the Telemetry system. The meter selected shall be sized to ensure that the head loss at pump designed flow rate is less than 0.4 metres head.

3. Pump Mounting and Layout

- All pumps shall be isolated with suitable valves and protected by non return valves. Actuated or other form of control valves shall be installed where required to protect the pipework or pump systems.

- Pumps shall be mounted on rubber pads in accordance with the manufacturers recommendation and where appropriate flexible connections shall be installed in the delivery line to reduce vibration and improve seismic security.

- Pump station piping shall be of adequate diameter, friction characteristics and layout to minimise minor losses and ensure discharge velocities are less than 2.0 m/s.

4. Telemetry Standards - pump stations, reservoirs, traffic signals.

All pump stations and reservoirs shall be provided with a radio telemetry system which is fully compatible with the system currently used by Council. The system shall be capable of providing at least the following information:

- "panic" button for pressing by site person in emergency
- high and low level warnings
- pump fault warnings
- duration of pump on/off and pump number
- pump status by number
- door status on control sheds
- status of lockable gates
- hatch security (reservoirs)
- continuous water levels (reservoirs)
- continuous record of inflows and outflows (reservoirs and pump stations on request)
- control and monitoring of the seismic shutoff valves and any other actuated or automated valves to reservoirs.

Traffic signals shall be provided with Telemetry systems providing at least the following information.

- "panic" button.
- fault warning
- signal status at any time

The telemetry system shall be linked to Council's main telemetry computer database and commissioned to ensure it is fault free prior to handover.

5. Other

A metered water supply and tap outlet shall be provided to the immediate vicinity of pumpstations and reservoirs. The supply shall be fitted with an approved reduced pressure backflow preventer when provided at wastewater and stormwater pump stations.

Chamber lids shall provide access openings centrally over each pump and shall be designed to withstand HN HO 72 loadings when at ground level in roads (including paths and berms). A slide across safety grill shall be provided for ground level openings to prevent persons from accidentally falling down the opening when the chamber lid is open. Lids shall be designed to be non-slip, with recessed handles and locks. Lids shall be designed to be easily opened by one person without the need for lifting equipment.

Pump chambers shall be designed to incorporate an adequate factor of safety against flotation when empty.

All below ground metal fittings, bolts etc shall be stainless steel.

All stations shall be designed for automatic control.

APPENDIX B, FIGURE 16

UHCC - MINIMUM CONSTRUCTION INSPECTIONS TO BE UNDERTAKEN BY THE IQP

As the person responsible for looking after Upper Hutt City Council's interest during Civil Engineering Construction, the IQP shall make inspections and enquires of the Supervisor as necessary to satisfy the IQP that standards are being met. Inspections made by the IQP shall include as a minimum:

a) Roading

i. Inspection of all road subgrades after clearing and before placing of any pavement layer.

ii. Inspection of rolled and swept basecourse prior to commencement of surfacing.

b) Stormwater, Wastewater and Water Supply

i. Inspection of trench base prior to commencement of pipelaying.

ii. Inspection after bedding and surround and before pipe backfilling.

iii. Inspection of thrust blocks before covering.

iv. Attendance during pressure testing.

v. Inspection during entering of chlorine for disinfection of water mains and closer pipes.

vi. Inspection of manholes including interior and abutting pipes, after completion.

c) Completion Inspection

i. Receive and review the TV record and ensure any defects have been attended to.

ii. Carry out walkover inspection covering earthworks, road standards, neatness and accuracy of surface openings, standard of landscaping etc. all as necessary to enable the IQP after receiving the required Completion Documentation to forward the necessary Certification to Council.

The above minimum IQP inspections shall be made with the Construction Supervisor who shall in addition make inspections as required to adequately undertake his/her role.

d) Maintenance Bond Release Inspection

i. Walk over the project prior to end of Bond Release/Maintenance period as applicable to enable the IQP to satisfy himself/herself that it is appropriate to forward the Maintenance Certificate to Council.

PART C

DESIGN: A MEANS OF COMPLIANCE

CONTENTS

Appendix C

PART C DESIGN: A MEANS OF COMPLIANCE

C1. Earthworks - Design

C1.1 Introduction

Earthworks shall be designed to the highest engineering standards available at the time of the project so as to ensure stable and environmentally acceptable land forms and safe and stable platforms for buildings and roads. Minimum mandatory design requirements are covered in *Part B* of this Code.

C1.2 Relevant Standards and Guideline Documents

The design of earthworks for all land and infrastructure development shall be based on the requirements of this Code and the most appropriate Codes and Guidelines applicable at the time of the project. NZS 4431 "Code of practice for earth fill for residential development", shall form the basis of design and construction of earthworks for land and infrastructure purposes.

The following is a selection of other currently available and relevant standards and related documents, which shall be used as a applicable. These are not exclusive and other standards and guidelines accepted by the engineering profession at the time may be used where appropriate.

i. NZS 4402 "Methods of testing soil for civil engineering purposes".

ii. NZS 4431: 1989 "code of Practice for Earthfill for Residential Development".

iii. Building Code ASA or BIV.M.4.

iv. NZS 3604 "Code of practice for light timber-frame buildings not requiring specific design".

v. "Guidelines for silt control associated with mass earthworks". The Wellington Regional Council Water Resources Department Revised June 1988.

vi. "Erosion and Sediment Control Guidelines for Earthworks" - Technical Publication No. 9, Auckland Regional Council.

vii. "Slope Stability in Urban Development" produced by the NZ Geomechanics Society and DSIR. DSIR Information Series No. 122 dated January 1977.

C1.3 Geotechnical Site Investigations

Geotechnical site investigations shall be carried out and reports presented covering as a minimum those aspects required by *B2* of this Code.

C1.4 Stormwater Control

The existing natural drainage pattern for any area shall be identified and natural springs or seepage shall be located and catered for in the design.

Where natural drainage paths are to be interfered with by proposed earthworks then sufficient adequate alternative drainage facilities shall be provided to standards required by this Code.

C1.5 Silt and Sediment Control

Measures to stop sediment from the earthworks being transported to adjacent land or waterways shall be designed as part of the earthworks design.

C1.6 Subsoil Drainage

Subsoil drains shall be provided as deemed desirable to intercept groundwater and minimise problems of soil piping, softening and reduction in stability. Drains shall be sized to cope with anticipated flows and superimposed loads to best current standards.

C1.7 Mass Earthworks

The extent of mass earthworks and requirements for construction quality control shall be clearly defined in the design documentation but as a minimum shall include those matters covered in *B2* and *B10* of this Code.

C1.8 Compaction Control of Fills

Compaction control techniques shall be specified based on the recommendations in the geotechnical reports. Techniques shall be selected from those described in NZS 4431 Section 7.4 as being most appropriate to the soil being encountered.

Where the relative compaction technique is used, then the following percentages of maximum dry densities as determined by NZS 4402: Test 4.1.1 shall apply.

- Within the top 0.6 of all fills, the densities shall not be less than 100% of those given by the standard test.
- From 0.6 to 1.2 m (vertical measurement) depth from the finished surface of all fill areas and within 3 metres (horizontal measurement) of all the batter boundaries of unenclosed fills, the densities shall not be less than 98% of that given by the standard test.
- Elsewhere in fills, the densities shall not be less than 95% of that given by the standard test.

C1.9 Cut and Fill Batters

C1.9.1 General

Batters shall generally be designed as detailed below although benches may be dispensed with when the geotechnical report is able to show that conservative batter slopes have been set with factors of safety greater than two, when large scale jointing and faulting is not evident and when alternative methods of maintenance are available.

C1.9.2 Fill Batters

Fill batters shall be sloped to suit the materials encountered and based on the geotechnical report but generally shall be not steeper than 3.0 horizontal to 1 vertical. The top or toe of a fill batter shall be at least 2 metres clear of a private boundary unless the fill batter is laid at flatter than 3 horizontal to 1 vertical in which case the batter may encroach onto the subdivided lots provided a house site is available clear of the batter.

The edge of batters shall also be at least 2 metres from the kerb face or back edge of any path.

C1.9.3 Cut Batters

Slopes for cut batters of 1.5 metres vertical height or greater shall be set after a geotechnical inspection, analysis and the incorporation in the Geotechnical report of recommendations on batter slopes.

Cut batters shall be sloped to suit the materials encountered provided that no cut batters shall steeper than ½ horizontal to 1 vertical (depending on type of country) but generally shall be 1 to 1, or flatter based on the Geotechnical report. Benching of minimum width of 2 metres for every 8 metres of vertical height shall be provided with falls and drainage as provided for fill batters.

The top or toe of a cut batter shall be at least 2 metres from a boundary or building. Buildings and building sites at the top of a cut batter shall be beyond a 45 degree line from the toe of the batter and buildings and building sites at the toe of a cut batter shall be beyond a 45 degree line from the top of the batter or side of the hill unless adequate walling is provided. The toe of a cut batter shall also be at least 1.0 metre from the kerb face or back edge of any footpath but additional allowance may be required to be made for sight distance on a curve or where a high or low level path is required. Generally cut batters shall not be higher than 20 metres.

C1.10 Blending of Batters

Cut and fill batters shall where possible be rounded at the edge abutting natural ground in a manner so as to blend as well as possible with the natural land contours.

Cut batters of 1 to 1 slope or steeper shall be rolled over at the top to blend as well as possible with the natural land contour.

All cut and fill batters shall be protected on completion by grassing, hydroseeding, tree planting or suitable vegetative cover.

C1.11 Minimum Slopes of New Lots

Urban lots formed for new developments shall be generally constructed to provide fall from the rear of lots to the edge of the road berm. Falls shall be adequate to enable house drains to be installed on the lot and connected to the mains or kerb as applicable with drainage standards and falls complying with the Building Code Section E1.

Where it is necessary to develop land in a way that lots are left below the road level they shall be shaped and serviced (eg. by contour drains) in such a way that the drainage requirements of the Building Act can be satisfied.

C1.12 Small Scale Earthworks

For projects involving less than 100 m^3 (insitu measure) of earthworks, cut batters of less than 2 metres and fills of less than 0.5 metre depth which are not to be used for building sites, then the requirements for initial geotechnical reports may be omitted.

However cut and fill standards shall comply with the requirements of this Code and the necessary certification must be provided on completion of construction.

C2. Roads - Design

C2.1 Introduction

Design of roads shall encompass the design and provision of all facilities in a road required to ensure it can cope efficiently with the various traffic form expected in a safe efficient way. Roads shall be capable of carrying all utility services underground and providing an aesthetically acceptable environment. Minimum mandatory design requirements are covered in *Part B* of this Code.

C2.2 Relevant Standards and Guideline Documents

Road designs shall be based on the requirements of the Upper Hutt City Council performance criteria, Upper Hutt City Council typical cross sections and details and the most appropriate Codes and Guidelines applicable at the time of the project. The following is a selection of currently available documents which provide an appropriate basis for road designs in Upper Hutt. These are not exclusive and other standards and guidelines accepted by the engineering profession at the time may be used where appropriate.

i. All Transit New Zealand Standards, Criteria and Guidelines and AUSTROADS Codes and Guides which at any time may be acceptable to Upper Hutt City Council.

ii. All current Transit New Zealand Specifications for road material standards.

iii. Austroads Pavement Design Guide

iv. NZ Institute of Roading Technology "Pavement Design Course" 1993.

v. NRB/TNZ Highway Standards S4 1974 "Pavement Design".

vi. NZS 3116 Interlocking Concrete Block Paving.

vii. NZS 4121 "Code of Practice for Design for Access and use of Buildings and Facilities by Disabled Persons".

viii. NZS 6701: 1983 "Code of Practice for Road Lighting".

ix. Building Code D1.

x. The Street Where You Live - (Streetscape, Traffic Calming) ML Gadd 1995.

C2.3 Classification of Urban Roads

The category in which various Upper Hutt roads fall is defined by the City's roading hierarchy under the following definitions:

C2.3.1 Primary Arterial Roads

Provide interconnections between major sectors of a large area link with external areas and distribute traffic from major intercity links. Access is at grade but may be limited. Traffic volumes are typically 7000 to 10000 vehicles per day with a significant number of heavy vehicles.

C2.3.2 Secondary Arterial Roads

Secondary arterial roads provide access to Primary Arterial Roads. They have a dominant through vehicular movement and carry the major public transport routes. Access to property may be restricted and rear servicing facilities may be required.

C2.3.3 Collector Roads - Area Residential/Industrial/Commercial

Provide circulation between and within local areas and link to primary roads. They may service schools, intermittent or peak hour public transport. Their main feature is to service the local residential or industrial area. Vehicular movements and needs dominate.

C2.3.4 Local Distributor Roads - Residential/Industrial/Commercial

A road which has the primary function of providing access to adjacent residential/industrial/ commercial lots.

C2.3.5 Local Roads (Residential and Industrial) Including Cul-de-Sacs

A road which has the primary function of providing access to abutting properties and through which only traffic having origin or destination there will pass. Low speed vehicle movements, pedestrian and local amenity values predominate.

C2.3.6 Service Lanes

A road which has the primary function of providing rear access, generally in commercial and industrial areas. Heavy or commercial vehicle movements dominate along with low vehicle speeds. Public use may be limited.

C2.4 Classification of Rural Roads

In rural roads berm or road shoulder facilities need to be suitable for pedestrian use and off carriageway emergency parking. Stormwater drainage is generally carried by adjacent open drains. The classification of rural roads in this code is based on the terms defined below.

C2.4.1 Motorways

Motorways have not been included in this Code. They will require specific design standards to be agreed between the Council and designer.

C2.4.2 Arterial Roads (Primary/Secondary)

Provide interconnections between major sectors of a large area and link with external areas and distribute traffic from motorways and major intercity links. Access is at grade but may be limited. Traffic volumes are typically greater than 2500 vpd with a significant number of heavy vehicles. Arterial roads carrying more than 4000 vpd will require specific design standards to be agreed between the Council and Designer.

C2.4.3 Collector Roads

Provide circulation between and within local areas and link to primary roads. They may service schools, intermittent or peak hour public transport. Their main feature is to service the local residential or farming area.

C2.4.4 Local Roads

A road which has the primary function of providing access to adjacent residential/commercial lots.

C2.4.5 Minor Local Roads - Including Cul-de-Sacs

A road which has the primary function of providing access to abutting properties and through which only traffic having origin or destination there will pass. Low speed vehicle movements, pedestrian and local amenity values predominate.

C2.5 Public Transport

Where a plan to demonstrate public transport accessibility is required it shall address at least the following matters.

i. The provision of a continuous through route classified as a Collector road or higher for public transport to use. The gradient shall not be steeper than an average of 1 in 10 with localised maximum grades not exceeding 1 in 8.

ii. High transport intensity land uses (such as schools, tertiary institutions, hospitals, medical facilities, shopping areas, retirement villages and community facilities) should be located with frontages along the public transport route.

iii. Not less than 90% of dwelling sites should be within 400 m of a proposed bus route or 500 m from an existing or planned bus stop.

iv. Pedestrian accessways shall be provided where necessary to assist in compliance with iii. above.

C2.6 Roading Standards

Road standards as defined in *Appendix C, Figure 1 (Urban)* and *Figure 2 (Rural)* road design shall be used as the basis for road design. Traffic calming measures may be used in conjunction with these road dimensions to enhance streetscape and community amenity and control vehicle speeds.

Urban roads shall be provided with kerb and channel and be adequately drained. Subsoil drains under pavement/kerb edges shall be provided in terms of good engineering practice.

Road reserve widths shall be selected to ensure that adequate carriageway, footpaths, berms and batters can be provided to retain amenity values (including landscaping) and enable services to be provided safely and in economically accessible locations. They shall be planned to cope with estimated long term community needs even though construction may be carried out only to shorter term requirements.

Footpaths shall generally be provided on both sides of all urban roads of Local Residential category and above and on not less than one side of the road for Cul-de-sacs. Pedestrian accessways and cycleways shall be provided where necessary to provide continuity of access to specially identified amenities.

In rural roads side drains shall be provided to carry stormwater and keep potential groundwater below structural pavement layers.

Roads may be surfaced with chip seal, asphaltic concrete or concrete pavers subject to them providing acceptable weatherproofing, wearing and friction standards.

C2.6.1 Road Geometric Design

Primary and Collector roads shall be designed to Upper Hutt City Council accepted standards (generally satisfied by the use of Austroads Standards) and shall incorporate horizontal transition curves. Other urban roads may satisfy the geometric standards incorporated in *Appendix C* of this Code or other standards acceptable to Upper Hutt City Council.

Rural roads shall be designed in general compliance with TNZ/1985: "Guide to Geometric standards for Rural Roads" or appropriate Austroads Standards except as modified by the design parameters given in *Appendix C, Figure 1 (Urban)* and *Figure 2 (Rural)* for the applicable road status.

Combination of carriageway widening and offstreet parking shall be used to provide extra and/or safe parking in the vicinity of shopping centres or community facilities (eg. schools, community centres, hospitals etc).

Horizontal and vertical curve design aids suitable for roads without horizontal transition curves are given in *Appendix C, Figures 3 to 6* inclusive.

C2.6.2 Traffic Calming In Residential Streets

Traffic calming where appropriate should be based on relevant current practice but may incorporate such measures as providing horizontal bends of significant deviation (45° or more) at distances of not more than 100 metres between tangent points; provision of speed humps, traffic islands, raised pedestrian crossings, lane deflections, local lane narrowing etc.

C2.6.3 Parking and Traffic Engineering Detailing

Acceptable parking dimensions may be taken from *Appendix C, Figure 7* or the NZ Building Code D1.

TNZ and Austroads Codes and Guides may be used for design of parking and traffic facilities incorporated into any roading or parking area layouts.

C2.6.4 Intersection Design

The preferred angle of intersection is 90° although for secondary roads a minimum angle of 70° may be justified by other constraints. Carriageway alignment may be offset within the street reserve to improve the intersection. Sight lines shall satisfy the minimum standards shown in *Appendix C, Figure 8*.

All residential road intersections of collector/collector status and below shall have a minimum kerb radius at intersections of 10 metres. Such intersections shall also have the lot corners splayed by a minimum of 6 metres along both boundaries.

All road intersections above collector/collector status as well as any intersection within commercial/industrial zoning shall have a minimum kerb radius of 13.5 metres and shall have corner splays of 6 metres. Heavy industrial intersections shall be the subject of special design.

The separation between any two roads intersecting a road of Local Distributor category or higher shall be a minimum distance of 150 metres centreline to centreline. Two local roads intersecting a local road shall be offset at least 40 metres centreline to centreline.

Except for the above minimum specific requirements, intersections shall be detailed to satisfy the appropriate AUSTROADS standards.

C2.6.5 Cul-de-sac Heads

Typical heads are shown in *Appendix C, Figures 9 and 10*. Subject to design a central area may be provided for parking or beautification in a cul-de-sac head. The minimum kerb gradient around cul-de-sac heads shall be 0.5%. Where the head of a cul-de-sac is also a low point it shall be provided with a double sump with individual leads from each sump.

C2.6.6 Bus Bays

Local widening of the road shall may be provided at bus stops on all roads carrying public transport. *Appendix C, Figure 11* shows Council's standard.

C2.6.7 Footpaths, Pedestrian Accessways, Bicycle Tracks

Footpath shall satisfy the minimum requirements of *B3.10* of this Code. Widths shall be as detailed in *Appendix C, Figure 12*. Acceptable fencing detail for urban situations is detailed in *Appendix C, Figure 13(a)*.

Acceptable dimensions for pedestrian accessways are shown in *Appendix C, Figure 13*.

Allowance for cycles shall be made in road design in general compliance with *Appendix C, Figure 1*. Separate bicycle tracks shall be provided where good design requires separation from the carriageway or a different route to be selected.

Acceptable solutions for path surfacing are:

- concrete
- concrete pavers
- asphaltic concrete a minimum of 25 mm compacted thickness.

In all cases the surfacing shall be placed over compacted basecourse which in turn shall be placed over a firm subgrade with all organic soft material removed.

Typical details are shown in *Appendix C, Figure 12*.

C2.6.8 Crossings

C2.6.8.1 Urban

Crossings shall be designed to the standards appropriate to the relevant traffic loading and to the requirements of *Part B* of this Code. *Appendix C, Figures 14 to 16* inclusive show Council's standard and heavy duty vehicle crossings.

Council's standard pram crossing is detailed in *Appendix C, Figure 17*.

C2.6.8.2 Rural

Vehicle crossings may be formed through and to the shape of the adjacent water table where grades and grade changes show that the 90% car can cross clearly and where water table flow occurs only during wet weather.

Where the water table is such that its shape does not suit the above, or water flows occur during dry weather, or wet weather water flows are such as to make the above type of crossing dangerous a culverted crossing shall be used. The pipe culvert shall be sized by the Designer to cope with the expected 10 year return period design flow but in no case shall any culverts be less than 450 mm diameter.

C2.6.9 Berms (Urban)

Berms shall satisfy the minimum requirements of *Part B* of this Code. Berm dimensions shall comply with the details set out in *Appendix C, Figure 1*. Berm cross fall shall where possible be 1 in 25.

Grassed areas for tree planting which are additional to the minimum berm width shall be specifically designed, and in these areas steeper gradients may be permitted to a maximum of 1 in 5 providing the area can be mown.

Where a berm crossfall greater than 1 in 12.5 is proposed, the Designer shall produce a cross-section along suitable individual property access locations to show that the sag or summit curves at crossings can be satisfactorily negotiated by a 90 percentile car.

C2.6.10 Road Shoulders/Berms (Rural)

All roads shall have shoulders and side slopes between the carriageway and side drains/water tables as detailed in *Appendix C, Figure 2*.

Rural berms shall be topsoiled to the same standards as Urban berms.

C2.6.11 Trees

A tree and shrub planting plan and details showing typical topsoil deepening and root guard shall be provided with the design documentation for all urban and rural residential subdivisions as required by *B3.6* of this Code. Acceptable berm trees are listed in *Appendix C, Figure 48*.

C2.6.12 Kerb and Channel, Dished Channel

Concrete kerb and channels shall be provided on both sides of all urban carriageways. Dimensions shall comply with *Appendix C, Figure 18* and gradients shall not be flatter than 1 in 250.

In private ways and access ways where crossfall is such that stormwater control is required on one side only of the carriageway, the kerb and channel may be replaced by a nib kerb on the higher side.

Dished channels, where appropriate shall comply with *Appendix C, Figure 18*.

C2.6.13 Subsurface Drainage

Piped subsurface drainage shall be provided to protect road formations from deterioration or loss of strength caused by high water table.

Piped subsurface drains shall be provided on each side of all urban roads in the flat parts of Upper Hutt City unless it can be shown that the natural subsoils have adequate permeability to enable long term strength of the new pavement to be maintained. They shall be provided on the upslope side of all urban roads in hill areas and on the downslope side also where the downslope side is in cut.

All piped subsurface drains shall discharge by gravity into a suitable component of the public stormwater drainage system.

Subsurface drains shall comply with *Appendix C, Figure 19*.

C2.6.14 Side Drains/Water Tables

All rural roads shall have crossfall to side drains/water tables formed on each side of the carriageway except where the road is on embankment above adjacent land without available channelled drains. In such cases the road may be designed so as to provide for sheet runoff to the adjacent land surface provided natural pre-existing drainage patterns are not altered.

For all situations where side drains are required they shall be sized to suit the flows discharging to them. Side drains shall be intercepted at regular intervals and discharge via ditches or pipes to the nearest available watercourse, gully or natural drainage path. All discharge points shall have outlets protected from scour and shall be located to minimise the risk of slope instability.

Such discharges shall be subject to the approval of affected property owners and be shown to be neither diverting catchments or significantly changing peak flows or flow patterns.

C2.6.15 Sumps

Refer *C3* of the Code, *"Stormwater Drainage - Design"* for detailed requirements for sumps.

Typical cycle friendly sump details are shown in *Appendix B, Figure 8*.

On footpath and accessways, kerb or yard type sumps shall be used as applicable. *Appendix C, Figure 38* shows an acceptable detail for a yard sump.

Trapped sumps shall be used where discharge to a soakpit is permitted. Refer *Appendix C, Figure 39*.

C2.7 Multi Unit Non Public Accesses (Urban and Rural)

Minimum formed and legal widths and other relevant standards shall be as detailed in *Appendix C, Figure 1*.

Except as detailed below geometric standards for accesses shall be the same as for roads.

i. Changes in alignment shall utilise circular curves. Minimum kerb radii shall be

- Residential urban/rural - 8 m or that required for the 99% single unit truck.
- Commercial industrial - set to allow free movement of a B train vehicle.

ii. Corner splays shall be provided along both inner and outer boundaries at changes of alignment. Splays shall be not less than

- Residential urban rural - 3 m
- Commercial industrial - 5.5 m

iii. Where turning heads are required, circular, T, or Y shaped heads are acceptable. Suitable dimensions are shown in *Appendix C, Figure 9 and 10*.

iv. Centreline grades shall be:

- not steeper than 1 in 5 except that grades of 1 in 4.5 may be used on straight lengths of access over distances of up to 20 metres. However the first 5 metres of any access shall be not steeper than 1 in 8. A greater length of transition shall be provided where necessary on industrial/commercial lots.
- Not less than 1 in 250.

v. All accesses shall be shaped with either crown or crossfall of 3%.

vi. Urban residential accesses of longer than 50 metres and less than 4.5 metres wide shall have widening to not less than 5.0 metres at not more than 50 metre spacings to allow cars to pass. Rural accesses may have passing bays at up to 100 metre distances where visibility is available from bay to bay.

vii. All shared urban accesses shall be impermeably surfaced and have their edges defined by concrete edging and shall provide for collection and disposal of stormwater by controlled drainage. *Appendix C, Figure 20* shows an acceptable solution.

viii. Rural accesses shall have a formation width wider than the sealed widths with safe water tables/edge drains along but adequately clear of each side of the access.

ix. All accesses falling towards the road shall drain to sumps (urban) or side drain (rural) on the private side of the public road. For urban residential accesses the sumps shall discharge via a single appropriately sized connection to a stormwater main where available. Where a main is unavailable, disposal options shall be considered in terms of the hierarchy given in *B6.9* of this Code.

x. Rural side drains may discharge directly to the road side drain or where accesses pass over storm ditches they shall be provided with a culvert of size appropriate for the design flow but not less than 450 mm diameter.

xi. Industrial commercial accesses shall drain from their sumps via a lead directly to a public stormwater main.

xii. Private pavements shall be designed as for public roads but no residential or rural pavement shall have less than 150 mm formation thickness.

xiii. Industrial/commercial pavement shall have not less than 300 mm total formation thickness.

xiv. Acceptable surfacing for accessways includes asphaltic concrete, (25 mm minimum thickness), chipseals, insitu concrete or concrete pavers.

C2.8 Lighting

C2.8.1 Design Basis

Lighting of roads, service lanes and pedestrian ways shall be to the standard of illumination recommended in NZS 6701: 1983 "Code of Practice for Road Lighting" and satisfying as a minimum *B3.7* of this Code.

C2.9 Traffic Services and Road Furniture, Survey Benchmarks

The design shall incorporate all road marking including traffic and utility services as appropriate, road traffic and road signs, edge markers and other facilities appropriate to the road type and its position in the road hierarchy.

Design shall satisfy Upper Hutt City Council or Transit New Zealand standards acceptable to Council.

Road name signs and their mounting shall be as detailed in *Appendix C, Figures 21, 22, 22(a), 23*.

C2.10 Road Surfacing

Acceptable road surfacing options include:-

- Hot laid asphaltic concrete of minimum compacted thickness 25 mm, laid over a waterproofing seal coat

- Other asphaltic concrete mixes such as Friction Course or Macadam Wearing Mix laid over a waterproofing coat

- Chip seals of various types, involving not less than 2 bound chip coatings.

- Concrete pavers laid over sand on a waterproof basecourse layer.

To resist scuffing and local load effects the following minimum surfacing standards apply to the named facilities:

Facility	Minimum Surfacing
Residential cul de sac	25 mm asphaltic concrete
Public carparks (excl. parallel parks)	25 mm asphaltic concrete
Industrial commercial cul de sac	50 mm asphaltic concrete
Traffic islands and bus stops	50 mm asphaltic concrete

In the cases of tight traffic islands and bus stops the use of stabilised basecourse is also desirable.

C2.11 Pavement Structural Design

For roads of collector status or above structural design should be undertaken by mechanistic design methods. For other roads, mechanistic or chart based methods may be used. The CBR method outlined below provides an acceptable solution for flexible pavements surfaced with thin surface coatings (chipseal or asphaltic concreting of less than 50 mm thickness). Designs for any other form of pavement shall be fully engineered based on appropriate design codes and guidelines.

C2.11.1 CBR Design Method for Flexible Pavements

The pavement thickness shall be computed from the pavement design curves, reproduced in *Appendix C, Figure 24*. Soaked CBR values of the pavement subgrade shall be used and the pavement designed for the estimated number of EDAs over a 50 year design life.

C2.11.2 CBR Tests

CBR values shall be determined in the laboratory according to Test 18 of NZS 4402: Part 2P and shall be soaked values.

For local roads an alternative method of determining subgrade CBR in non-granular materials by Scala Penetrometer may be acceptable for clay and colluvial materials. *Appendix C, Figures 25 and 26* show a correlation between Scala penetration and CBR values.

The CBR value used in the design shall be the 10 percentile value of the CBR tests taken on the subgrade material. A selection of tests shall be taken at 150, 300 and 450 mm below final subgrade level.

Where CBR values are required for aggregates these shall be based on laboratory tests prepared on the fraction passing the 19 mm sieve but a CBR of more than 30 shall never be used. The use of CBR on metal layers shall only be used in conjunction with consideration of the CBR and stiffness of lower layers.

In areas of extremely poor subgrade, removal or improvement of the subgrade may be required. Such techniques shall be identified and designed on an individual basis.

C2.12 Materials

C2.12.1 Metal Course Aggregates

C2.12.1.1 Transition Layer

A transition layer may be required for traffic loading in excess of 1×10^5 EDA where pavements are placed over silt, clay or weathered greywacke subgrades. The transition layer may be filter metal complying with TNZ Specification F1 or an approved geotextile filter fabric. The transition layer shall be regarded as part of the total depth of the subbase layer.

C2.12.1.2 Subbase

The subbase layer immediately beneath the basecourse shall have a permeability of at least 10^{-4} m/s for a depth of at least 100 mm.

The material used as subbase shall comply with TNZ Specification M/3: 1981. The largest aggregate size shall not be larger than 60% of the depth of the layer or 65 mm. The material shall be sufficiently free draining so as not to be susceptible to undue weakening at highest in-service moisture content.

C2.12.1.3 Basecourse

The thickness of the basecourse layer when used with other metal aggregate layers shall not be less than 100 mm.

Acceptable basecourse specifications are:

TNZ M/4, 1985 (all passing 40 mm - AP40)

A high cost, high quality material. This shall be used for all roads of Collector status and above (refer to *Appendix B, Figures 3 and 4*).

TNZ M5, 1985 MP40 - Wellington variant basecourse

This is a slightly lower quality material than TNZ M/4. It may be used for roads of below Collector status.

TNZ M/4 1964 AP40 - Known in Wellington as TNZ "Standard" Basecourse

It may be used for non industrial/commercial roads of Local status and below and footpaths, kerb crossings, shared accessways etc.

C2.13 Road Surfacing Materials

All materials used in road surfacing shall comply with the appropriate Transit New Zealand Specifications.

The following surfacing options will be acceptable for most subdivisional streets:

C2.13.1 First and Second Coat Chip Seals

For first coat seals the chip size shall generally be Grade 3 on all roads.

For second coat seals the chip size shall be Grade 4. Cycle and/or parking lanes shall be Grade 6.

C2.13.2 Double Wet Lock Coat

First and second seals may be constructed in one operation with asphaltic cutback to TNZ M1 and P3 specifications.

The binder application rate for the seals shall be designed to suit the conditions and chip size.

Acceptable and compatible chip sizes are:

Local roads and below - First Coat: Grade 4, Second Coat: Grade 6

Other roads - First Coat: Grade 3, Second Coat: Grade 5, or 6

C2.13.3 Hot Laid Asphaltic Concrete Surfacing

Hot laid asphaltic concrete surfacing shall comply with TNZ Specification M/10 and use a mix appropriate to the end use and thickness being placed.

A waterproofing seal coat, using asphaltic binder, and Grade 5 chip, with the requirement that the seal coat comprises a minimum of 1.0 L/m^2 per square metre of residual penetration grade bitumen shall be laid prior to surfacing with asphaltic concrete of 50 mm or lesser thickness. No cut back shall be used in such coats as it can cause flushing of the asphalt overlay.

C2.13.4 Other Asphaltic Mixes

For special uses other asphalt based hot mixes may be used such as Friction Course or Macadam Wearing Mix. When used they shall be placed over a waterproof under layer and shall be designed according to current specifications and Guides. In no case shall the laid thickness be less than 25 mm.

C2.13.5 Concrete

All concrete for roads and footpaths shall be Special Grade supplied from an approved Ready Mix plant. Concrete of less than 20 MPa 28 day strength shall not be used for any component of roads or footpaths.

C2.13.6 Concrete Pavers

Concrete pavers may be used for roads or footpaths where agreed with Council as being appropriate.

Design and material standards shall be in compliance with NZS 3116: 1991 "Interlocking Concrete Block Paving". Paver thickness shall be 80 mm appropriate for the loadings expected.

When used in roads the basecourse underlayer shall be given a waterproofing seal coat before the sand and pavers are laid.

When used for bus stops or at raised crossings the basecourse shall be cement stabilised under the raised zone and for at least 3 m on either side of the raised zone.

Pavers shall be laid to 5 mm above lips of channels and other draining features.

C3. Stormwater Drainage - Design

C3.1 Introduction

Stormwater drainage shall be considered as the total system protecting land infrastructure and improvements against flooding. It shall consist of a primary drainage system of pipes and open channels, and a secondary system consisting of open channels, controlled flood plains and flow paths utilised in conjunction with the setting of building levels to ensure that buildings remain free of inundation. Minimum mandatory design requirements are covered in *Part B* of this Code.

C3.2 Relevant Standards and Guideline Documents

The design of stormwater disposal and flood protection systems shall be in accordance with the highest engineering standards current at the time.

The following is a selection of currently available relevant standards and guidelines. The list is not exclusive and other standards and guidelines accepted by the engineering profession at the time may be used where appropriate.

- Resource Management Act 1991 - sets framework of matters to be considered and consents required
- Building Act and Code (Approved document E1 Surface Water)
- "The Frequency of High Intensity Rainfalls in NZ" - A I Tomlinson, NIWA (Kelburn), 1980
- HIRDS - computer rainfall statistics - NIWA 1993.
- "Regional Flood Estimation NZ" - Tech Publication No 20 Hydrology Centre Christchurch, 1989
- "A Guideline & Procedure for Hydrological Design of Urban Stormwater Systems" - NZIE
- "Culvert Manual - Vols I and II" - MWD
- Pipe flow and strength charts provided by various pipe suppliers
- Design guides and charts published by various research and overseas agencies, eg. "Hydraulics of Precast Concrete Conduits" - Cement & Concrete Association of Australia
- "Design Guideline Manual - Stormwater Treatment Devices" - Auckland Regional Council 1992,
- Standards NZ - Standards and Codes covering various pipe types and systems,
- NZS/AS 3725: 1989 "Loads on Buried Concrete Pipes" and Supplement/Commentary to NZS AS 3725,
- ASCE Manual of Engineering Practice No 37 (WPCF Manual of Practice No 9) "Design and Construction of Sanitary and Storm Sewers",
- Concrete Pipe Association of Australia "Concrete Pipe Selection and Installation",
- AS 2366: 1982 "Plastics Pipelaying Design",
- UHCC Flood hazard maps

C3.3 Minimum Design Standards

All stormwater design shall as a minimum satisfy the requirements of *Part B* of this Code.

C3.4 Flood Attenuation

Detention ponds where required for flood flow attenuation, shall be specifically designed to attenuate all peak flows between the 5 year and the 100 year flow. Such ponds shall have spillway provisions for over-design floods and where required the effect of the Probable Maximum Flood shall be considered.

C3.5 Stormwater Quality

An acceptable standard for design of stormwater facilities to minimise the discharge of sediment and pollutants is "Design guideline Manual - Stormwater Treatment Devices, 1992" published by the Auckland Regional Council.

C3.5.1 Peak Flows

Acceptable empirical methods include:

- The Rational Method (most urban catchments of less than 500 Ha)
- The Modified Rational Method (urban and other catchments of greater than 500 Ha)
- Regional Flood Estimation (RFE) technique (rural and semi-rural catchments >500 Ha)

Methods i. and ii. above are described in the Building Code E1 (Surface Water) and the formula and a limited selection of input parameters is covered in *Appendix C, Figures 29 to 34* of this Code.

C3.5.2 Hydrograph Estimation Methods

The use of an accepted hydrograph technique is considered desirable in studying the effects of changes in land use and flood attenuation either within channels or specially designed detention areas.

Where used the input assumptions shall be clearly identified and peak flows derived checked against flows derived from well used empirical methods appropriate to similar catchment types.

C3.6 Rainfall Intensities, Runoff Factors, Times of Concentration

Rainfall intensities relevant to the Upper Hutt City area based on HIRDS 1993 data are shown in *Appendix C, Figures 27 and 28*. This information is also available on the HIRDS computer files available from NIWA. The selection of rainfall intensity for a particular design will depend on the time of concentration of the catchment and the return period being designed for.

Runoff coefficients appropriate to most situations in Upper Hutt City are covered under *Appendix C, Figures 29 and 30* of this Code.

Times of concentration may be derived based on techniques given in *Appendix C, Figures 31 to 33*, NZBC approved document E1 or other suitable reference.

C3.7 Maintenance Corridors, Easements and Reserves

Minimum mandatory requirements are covered in *B1.10* of this Code. The following will generally provide acceptable solutions for the specific situations covered.

i. For buried pipes refer *Appendix B, Figure 7*.

ii. For watercourses, Council will generally require a reserve to be created of width as follows:

A width equal to the width of the primary channel and secondary flood berms, which shall be provided on one or both sides of the primary channel as necessary for hydraulic reasons. In all cases the flood berm width used shall be not less than 4.5 metres to allow for access by Upper Hutt City Council vehicles.

Esplanade reserves may be required on some watercourses and these are set out in the District Plan.

iii. For designed overland flow paths:

- for significant channels as for ii. above,
- for the more usual situation in urban areas of set down paths/accessways or broad swales, the easement width shall be the larger of the designed width required or 3 metres.

C3.8 Design of Piped Drains and Culverts

Piped drains and culverts shall be designed to cope with the flow return periods required under *Part B* of this Code.

The hydraulic design of piped drains should be based on suitably documented and currently accepted methods. Examples of pipe design formulae include:

- Manning's formula
- Colebrook White

The pipe system should be designed to carry the design peak flow.

Concrete or uPVC stormwater pipes may be designed for roughness coefficients as follows:

Pipe Type	Colebrook White k [mm]	Manning n
Spun reinforced concrete	1.5	0.013
uPVC or HDPE	0.9	0.011

All pipe designs shall show the roughness assumptions used and provide supporting evidence for their appropriateness.

Minimum pipe sizes applicable to stormwater drains are given in *Part B* of this Code.

In designing culverts the effects of inlet and tailwater controls shall be considered.

Pipes joined to smaller upstream pipes shall be jointed soffit to soffit and pipes joined to larger upstream pipes shall be joined invert to invert. Subject always to drops through the manhole to satisfy hydraulic needs.

Where the inlet to the stormwater system consists of a pipe and headwall in a watercourse, attention shall be paid to the headwater depth. This shall be done by evaluating the length of pipe to the first manhole separately as a short culvert. In this case, the "tailwater depth" is the depth of water as it enters the next section of the pipeline, which, if flowing just full, is at the soffit of the pipe.

Pipe systems connecting separate catchment intakes shall be designed taking into account the different times of concentration in each catchment.

Pipe velocities shall be set so as to minimise the risk of solids settling in the line.

Energy losses through bends shall be taken into account. *Appendix C, Figure 35* appended, may be used to assess head loss through manholes of 1050 diameter. A drop through manholes (over and above the grade line drop) shall be provided to match the calculated head loss.

Where the velocity of discharge at the outlet of a stormwater pipe is high and likely to cause erosion, an energy dissipating structure shall be constructed. Such structures shall be designed to minimise the collection of debris. Where debris will collect, provision must be made for easy removal.

Where pipe gradients exceed 1 in 10 allowances shall be made for bulking of the flow due to air entrainment. The air to water ratio may be calculated from the formula

$$\left(\frac{air}{water}\right) = \left(\frac{K V^2}{g R}\right)$$

where: V = flow velocity
R = hydraulic radius
K = entrainment coeff = 0.004 for most smooth pipes

Refer also Building Code E1.

Culverts under fills shall be of suitable capacity to cope with the design storm with no surcharge at the inlet. Where the design storm is less than the 100 year flow, design checks shall be carried out under the 100 year flow to assess the extent of the surcharge and to show that it will not risk the stability of the adjacent embankments or cause increased flood risk to upstream properties. If either of these situations apply, the culvert size shall be increased to overcome the problem.

All culverts shall be provided with adequate wingwalls, headwalls, aprons, removable debris traps and/or pits to prevent scouring or blocking. Entry losses shall be taken into account. At culvert entries the socket end of the pipe shall generally be laid upstream.

Typical head loss coefficients at culvert entries are:

Entrance Type	**Coefficient "K_e"**
Headwall with socket end of pipe flush	0.2
Headwall with cut pipe flush or projecting from fill square cut	0.5
Mitred to fill slope	0.7

Where pipes discharge onto land or into a watercourse outlet structures shall be designed to dissipate energy and minimise erosion or land instability.

C3.9 Open Channels

Open channels shall be designed based on currently accepted methods such as Manning's formula or "industry standard" software packages. All design assumptions shall be documented and made available to the IQP for review and to the Council for records.

C3.10 Backflow Prevention

Backflow effects shall be designed for, where applicable. Discharges to existing drains, streams and rivers shall take full recognition of expected river flood levels and shall incorporate backflow prevention as necessary.

C3.11 Manholes

Manholes shall be provided at all changes of direction, gradient and pipe size, at branching lines and terminations and at a distance apart not exceeding 90 metres. They shall be easily accessible and located clear of any boundary. All mains shall terminate with a manhole at the upstream end.

Standard manholes shall be 1050 mm diameter. Flexible joints shall be provided on all pipelines entering and leaving a manhole, within 450 mm of the manhole edge.

Manholes on straight sections of pipelines of 1.2 metre diameter and larger may be constructed using offset intakes which may also be used in conjunction with bends formed using epoxy mortar adhesive.

Drop manholes may be used to drop pipes of 150 mm ID maximum size into deep mains. The dropper shall be within the manhole.

Shallow (Mini) type manholes of 600 mm diameter may be used on pipe lines up to and including 250 mm main diameter and to a maximum depth of 1000 mm from lid level to invert level provided full sized manholes are placed at not more than 90 metre centres and provided deviations do not exceed 35° and no more than two 100 diameter connections enter the manhole.

Minimum requirements for standard manholes are shown in *Appendix B, Figure 14*. Acceptable drop and mini manhole details are given in *Appendix C, Figures 36 and 37*.

When manholes are over uPVC pipes, grit coated "manhole shorts" shall be used through the manhole.

Manholes over 5 metres in depth shall be specifically designed incorporating central landing platform and offset ladder or manhole step irons.

Pipes and culverts of 1200 mm diameter or greater may be laid on bends in the horizontal plane utilising up to 70% of the manufacturer's recommendation for joint deflection. The bends shall be uniform and the alignment accurately located on the "As built" drawing. Manholes at not more than 90 metre centres shall still be placed even though the drain may be laid on a curve.

C3.12 Sumps

The intake capacity of a road sump with grating and rear entry and acceptable ponding at inlet is approximately 28 litres/sec.

All sumps to be taken over by the Upper Hutt City Council shall:

- connect into manholes except when discharging into pipes of 600 mm dia or larger, with manholes within 40 metres, in which cases soffit to soffit connection using a prefabricated junction will be acceptable;
- discharge into an open watercourse where no piped stormwater system is available;
- discharge via sump leads of minimum diameter 225 mm dia for a single sump and for double sumps, each shall have its own lead of not less than 225 mm dia. Where the hydraulic gradient of a sump lead is affected by pipe full conditions in the main drain or drowned outlets specific design calculations to determine sump lead sizes shall be undertaken;
- utilise a rear entry and grating with cycle-friendly grates;

- utilise double sumps and leads at the end of a cul-de-sac, or where channel slopes are steeper than 1 in 20 or at the lowest point of sag in a vertical curve. They shall be located clear of potential accessways;

- be located at all points in a channel where a change in gradient is liable to result in ponding due to changes in flow velocity or on bends where there may be a tendency for water to leave the kerb and channel;

- be located at spacings to suit the design flow but not further apart than 90 metres along any kerb line;

- be located so as to minimise flows across intersections access legs and pram/disabled crossings and be clear of the likely locations of future vehicle crossings. In particular sumps shall not be located fronting across legs to rear lots nor in cul de sac heads unless a location clear of likely future vehicle crossings can be identified.

Sumps in private property which are not to be taken over by Council shall satisfy the requirements of the Building Act whilst also being able to cope with the design inflow.

Standard side entry sumps for use on public roads shall comply with *Appendix B, Figures 8(a) to 8(d)* inclusive. Yard sumps (untrapped and trapped) are shown in *Appendix C, Figures 38 and 39*. Flexible joints on leads shall be provided within 300 mm of the sump.

Where soakpits are permitted water shall first be collected through a trapped yard sump (*Appendix C, Figure 39*).

C3.13 Location of Stormwater Mains

Stormwater mains shall generally be laid in the carriageway. The Upper Hutt City Council standard position for stormwater mains in residential areas is given on *Appendix C, Figure 42*.

C3.14 Structural Design and Bedding, Maximum and Minimum Covers

All pipes laid in soils (as distinct from original rock), whether laid in a narrow trench or not, act as though they were laid under an embankment after a period. Therefore, all pipes shall be designed and founded to resist future loads (weight of fill and traffic loads) as "pipes under an embankment" with a projection ratio of 1.0.

The pipe strength and bedding type shall be selected to meet the requirement of the design loading condition. This may be derived from NZS 4451 or manufacturer's published tables. Pipe bedding shall be selected from the following options.

Granular bedding shall be used with all pipes except in extreme load situations when structural design shows it to be inadequate. Bedding material shall as defined under *C7, "Materials - Drainage and Water Supply Works"* of this Code. Acceptable granular bedding and backfill details are given in *Appendix C, Figure 40*.

Concrete haunching or surround shall be used with rigid walled pipes subject to high loads in firm natural ground. Concrete haunching shall rise beyond

halfway up the pipe. Concrete surround shall extend in one pour from the natural ground not less than 100 mm below the pipe underside, around the pipe by a minimum of 100 mm at any point and to a height not less than 100 mm above the pipe crown. Both concrete haunching and concrete surrounds shall be cleanly broken in the vertical plane at every pipe joint and left with a gap at least 25 mm wide to facilitate seismic movement of pipe joints. The seismic gap shall be filled with neatly cut compressible material such as expanded polystyrene or rubber.

Pipes to be laid in soft flexible soils shall be specifically designed to take into account the conditions.

Where pipe gradients of 1 in 4 or greater occur bedding and backfill shall be specifically designed to ensure long term stability of the pipeline, its surround and the backfill surface.

All pipes and associated structures within road reserve and all other areas likely to receive traffic shall be designed to HN-HO-72 loading as set out in the TNZ "Highway Bridge Design Brief".

Maximum and minimum covers shall be as specified in *Part B* of this Code.

Connections or parts of connections remaining the property of private owners shall satisfy the Building Code with respect to cover.

C3.15 Stormwater Soakpits

May be used in special situations as covered under *Part B* of this Code. They shall be sized based on the site permeability and shall be of the general form as shown in *Appendix C, Figure 41*. Any sumps discharging into a soakpit shall be trapped. Refer *Appendix C, Figure 39*.

C3.16 Stormwater Connections

Connections shall be provided as required be *B5.9* of this Code. Urban lots shall be provided with stormwater connections at such depth at the boundary that a drain is able to be extended from the connection at grades and cover complying with the Building Act, to the furthest point on the lot.

For industrial/commercial lots the capacity of the connections shall be based on the lot size and the minimum requirements for stormwater provisions as defined by the Building Act.

Where connections to main drains are not taken to manholes they shall be made as follows:

- Connections to mains of up to 600 dia shall utilise factory made Y or T fittings.

- Connections to larger mains shall utilise properly manufactured saddles or when to a main of 1200 mm dia or larger it may be made by breaking a hole in the main and placing the connection, trimming it neatly to the shape of the inside of the main so as not to obstruct flow and neatly epoxy mortaring the two together.

- When the connection is 300 mm diameter or larger it shall be connected at a manhole.

Where a connection of 150 mm dia or smaller needs to go deeper than 1.8 metres below ground level for a connection to a large pipe a 45° ramped riser may be constructed to bring the connection to within 1.2 metres of ground level provided the site can be adequately serviced.

Connections shall not be made directly to drains more than 3.0 metres deep to the invert of the pipe. Such situations shall be overcome by the construction of a shallower branch drain which may discharge into the deep drain through a drop manhole.

C3.17 Subsoil Drains

Subsoil drains shall be installed as required to lower ground water levels and pressures, and avoid any potential for future build up of ground water levels and pressures. They shall be specifically designed to cope with estimated flows and superimposed loads.

When being used as drains under roads they shall generally comply with the detail shown on *Appendix C, Figure 19*.

They shall be used under all areas of bulk filling in a pattern set out to intercept likely flows and carry the flow under the fill to the nearest watercourse or drain. When used in this situation they shall be specifically designed to carry estimated flows and withstand the imposed loads.

C3.18 Non-Reticulated Rural and Rural Residential Areas

In such areas suitable stormwater disposal options shall be demonstrated in accordance with *B6.14* of this Code.

C3.19 Materials

Acceptable materials for use in pipelaying works including stormwater drainage are covered under *C7, "Materials - Drainage and Water Supply Works"* of this Code.

C4. Wastewater - Design

C4.1 Introduction

Wastewater drainage systems shall include all collection, treatment and disposal systems as necessary for the safe and hygienic servicing of a development. Minimum mandatory design requirements are covered in *Part B* of this Code.

C4.2 Relevant Standards and Guideline Documents

The design of wastewater reticulation, treatment and disposal systems shall be carried out to the highest engineering standards current at the time.

The following is a selection of currently available relevant standards and guidelines. The list is not exclusive and other standards and guidelines accepted by the engineering profession at the time may be used where appropriate.

- Resource Management Act 1991 - sets the guidelines for assessing environmental effect of discharges to air, water and land,
- Building Act and Code,
- Pipe flow and strength charts provided by various pipe suppliers,
- Design guides and charts published by various research and overseas agencies, eg. "Hydraulics of Precast Concrete Conduits" - Cement & Concrete Association of Australia,
- Standards NZ - Standards and Codes covering various pipe types and systems,
- NZS/AS 3725: 1989 "Loads on Buried Concrete Pipes" and Supplement/Commentary to NZS/AS 3725,
- ASCE Manual of Engineering Practice No 37 (WPCF Manual of Practice No 9) "Design and Construction of Sanitary and Storm Sewers",
- Concrete Pipe Association of Australia "Concrete Pipe Selection and Installation".
- AS 2566: 1982 "Plastics - Pipelaying Design".
- UHCC Tradewaste Bylaw.
- UHCC Wastewater Bylaw.

Pipes shall be sized to cope with peak wet weather flows without surcharge except where special situations make a differing flow appropriate. An example of such a situation could be when an upstream catchment is serviced by a pump station. In such a situation the downstream pipe shall be sized to cope with the known or expected pumping rate but in no case shall this flow be less than the wet weather peak that could be expected under a full gravity system.

Details of minimum design flows are covered in *B7.3* of this Code.

C4.3 Structural Design, Maximum and Minimum Covers

The structural design of wastewater drains shall be as provided under *C3, "Stormwater Drainage - Design"* of this Code. Maximum and minimum covers shall satisfy *B5.14* of this Code.

C4.4 Pipe Suitability and Protection

Pipes shall be selected to resist attack from the fluid being carried. This is particularly the case for tradewaste sewers. This selection shall also recognise the soil material and ground water around them. Where necessary appropriate protective coatings shall be used.

C4.5 Pumping Stations and Pressure Mains

Pumping stations where required shall be designed to incorporate the requirements of *Part B* of this Code and:

- shall be of the wet well variety utilising submersible pumps. Alternatives will only be approved for extremely large or unusual facilities,
- shall utilise pumps compatible with pumps already installed in the Upper Hutt City Council network to facilitate maintenance.
- shall utilise sewage pumps with non clogging impellers capable of handling minimum solid size of 75 mm discharging into 100 mm dia or larger rising mains. If sound technical reasons make the use of 100 mm dia rising mains unreasonable then pumps with a "free ball" passage of 45 mm and a rising main of not less than 75 mm ID may be used. Pumps with 75 mm "free ball" passage shall run at 4 pole speed (1450 rpm). Smaller pumps may run at 2 pole speed (2,900 rpm).
- a system curve shall be developed for the pump station and rising main and pumps selected to operate efficiently at the design flow rate on the system curve.
- rising mains shall be designed to achieve a minimum velocity of 0.7 m/s. Velocities in excess of 2 m/s are to be avoided. The effects of water hammer shall be considered and measures to control the impact incorporated into the design. Options include "soft" starters, variable frequency controllers, control valves, surge facilities, pressure vessels, appropriate pipe strength and material. Pipes used in rising mains shall have a minimum working pressure of 90 metres.
- pumping flow rates shall be set to recognise any flow limits on downstream pipes into which the pumping main will discharge. Variable frequency controllers shall be fitted where pump discharge rate approaches downstream pipe capacity.
- each pump shall be protected by non clogging reflux valves and isolated for maintenance purposes by resilient seated gate valves all in an accessible chamber. A station valve shall be incorporated to enable the whole pump station to be isolated.
- pump chambers shall be of adequate dimension to provide the working storage required, at least part of the emergency storage and to be safely entered for work and repairs. Chambers may be precast or cast insitu. Openings shall allow easy movement of the pumps in and out of the chamber.

- the gravity inlet main shall enter the chamber at not less than 200 mm above the pump start level but shall discharge below the pump start level by means of an internal drop with inspection to enable maintenance of the inlet main.

C4.6 Location of Wastewater Mains

Wastewater mains shall generally be laid in the carriageway. The Upper Hutt City Council standard position for wastewater mains in residential areas is given in *Appendix C, Figure 42*.

C4.7 Connections

All urban lots (residential/commercial/industrial) shall be provided with wastewater connections at such a depth at the boundary that a drain is able to be extended from the connection at grades and cover complying with the Building Act, to the furthest likely wastewater connection point on the lot. Subject to satisfying this criterion the end of the connection shall generally be at a depth to invert of between 600 mm and 1200 mm at the boundary.

An approved plug or cap of appropriate material shall be installed on the last pipe of each lateral connection to stop debris ingress on backfilling.

All connections shall be made to the main by use of factory made Y junctions or direct to manholes.

Where a connection of 150 mm dia or smaller needs to go deeper than 1.8 metres below ground level for a soffit to soffit joint a ramped riser shall be constructed to bring the connection to within 1.2 metres of ground level provided the site can be adequately serviced.

Connections shall not be made directly to drains more than 3.0 metres deep to the invert of the pipe. Such situations shall be overcome by the construction of a shallower branch drain laid from a manhole on the deep drain with the connections made to the shallower drain. The shallow main shall connect to the deeper by the use of either an internal drop manhole or the laying of a short length of steep drain from the deep manhole to the first manhole on the shallow drain.

C4.8 Manholes

Manholes shall be provided at all changes of direction, gradient and pipe size, at branching lines, terminations and at a distance apart, not exceeding 90 metres. They shall be easily accessible located clear of any boundary.

All mains shall terminate with a manhole at the upstream end.

Standard manholes shall be 1050 mm diameter. Flexible joints shall be provided within 300 mm of all manholes. Manhole details are provided in *Appendix B, Figure 14*.

Drop manholes employing internal droppers may be used for wastewater where appropriate. Acceptable details are provided in *Appendix C, Figure 36*.

Shallow (mini) type manholes of 600 mm diameter may be used on mains of up to and including 250 mm diameter an to a maximum depth of 1000 mm from lid level to invert provided full sized manholes are placed at not more than 90 metre centres and provided deviations do not exceed 35° and no more than two 100 mm dia connections enter the manhole. Refer *Appendix C, Figure 37*.

The grade across the invert of a manhole shall not be less than the general grade of the wastewater main line. Additional falls shall be provided to account for bend and manhole losses. Refer *Appendix C, Figure 35*.

Manholes of deeper than 5 metres shall have specific design including provision of landings. Manhole covers and frames shall be cast iron heavy duty to standard Upper Hutt City Council pattern.

C4.9 Pipe Design

Wastewater mains may be designed using Manning's or Colebrook White formulae.

Roughness coefficients, allowing for slime build up and joints are:

Pipe Type	Colebrook White k [mm]	Manning n
Spun reinforced concrete	1.5	0.013
uPVC or HDPE	0.9	0.011

Minimum velocity shall be 0.7 m/s at the peak dry weather flow. Maximum velocity shall be 2.5 m/s unless otherwise agreed with Council.

Normal acceptable minimum grades shall be:

Pipe Internal Diameter [mm]	Gradient Percentage
100	1.00
150	0.40
200	0.30
225	0.25
250	0.20
300	0.17

C4.10 Materials

Acceptable materials for use in pipelaying works, including wastewater works are covered under *C7, "Materials - Drainage and Water Supply Works"* of this Code.

C4.11 Wastewater Disposal - Non Sewered Rural or Rural Residential Lots

Wastewater disposal for non sewered rural or rural residential lots shall be provided by individual household on-lot treatment and disposal systems, to standards set out in *B8* and *C5* of this Code.

C5. On Lot Treatment and Disposal of Household Wastes - Design

C5.1 Introduction

On lot systems remain in the ownership of and the responsibility of the individual property owner and shall satisfy *B8* of this Code and the following requirements.

C5.2 Relevant Standards and Guideline Documents

The design of On-lot Wastewater Treatment and Disposal shall be in accordance with the highest engineering standards current at the time.

A selection of currently available relevant standards and guidelines are:

- NZS 4610: 1982 - Household Septic Tank Systems,
- Handbook on Sewage Treatment and Disposal USEPA 1994,
- Treatment and Disposal of Wastewater from Homes by Soil Infiltration and Evapotranspiration, Dr Alfred P Bernhart, 1973,
- On site wastewater disposal from Households & Institutions - Technical Publication No. 58 Auckland Regional Council 1995,
- AS 1546: 1990 Small Septic Tanks,
- AS 1547: 1994 Disposal Systems for Effluent From Domestic Premises.
- AS/NZS 1547: 1997 On Site Domestic Wastewater Management

These documents need not limit designers references and other recognised standards and guides available at the time of design may be used as appropriate.

C5.3 Design Standards

On lot treatment and disposal shall normally be water based providing treatment in two stages; a primary treatment system which may be a septic tank or home treatment plant, followed by disposal complying with the Wellington Regional Council, "Discharges to Land" plan.

In some situations where potential for environmental contamination is high (eg. poor soil, high water table) tertiary treatment by disinfection or extra filtration may be required.

In special circumstances the use of other than water based sewage systems may be proposed. Such systems shall be designed according to current guidelines and supported by relevant design data. In such cases grey water shall be disposed of to land and adequate soil testing and design shall be provided to support the proposal for grey water disposal.

Existing knowledge of soil conditions and the performance of some on-lot systems in Upper Hutt indicate that conventional soakage trenches are not always viable. Therefore all on-lot systems proposed in Upper Hutt shall be specifically designed by a suitably qualified person.

In the case of preliminary design being done for subdivisions where house sizes are unknown the system sizing shall be based on 5 people permanent occupancy.

Design inputs shall also include:

- testing of site soils,
- obtaining of winter groundwater tables,
- topographical survey of the relevant part of the lot to enable the system to be accurately located in terms of ground contours and features,
- assessment of household water usage which shall be assumed as not less than 180 l/h/day for roof water systems and 240 l/h/day for houses with reticulated water.

It is expected that systems incorporating some of the following features will commonly be required.

i. Primary treatment by:

- improved multi chamber septic tank,
- home treatment plant such as aerated tanks or rotating disc systems.

ii. Secondary treatment incorporating discharge to land such as:

- soakage trenches, commonly dose loaded,
- evapotranspiration and seepage beds or trenches,
- mounded evapotranspiration and seepage beds,
- land irrigation by low pressure spray or drip system.

iii. Tertiary treatment incorporating options such as chemical or ultraviolet treatment where discharge to waterways is proposed. All discharges to waterways will require specific Resource Consent to be obtained.

C5.4 Minimum Clear Distances

Unless sound analysis can be provided to the contrary and Resource Consents obtained from the Wellington Regional Council, the following minimum requirements for land discharge systems shall apply:

- effluent fields shall be located not closer than 15 metres from gully floors, storm drains or downslope boundaries,
- the lowest level of the disposal system to be not less than 600 mm above the winter water table. In free draining materials this clearance maybe inadequate to control groundwater contamination.
- located in an area which is free of inundation in the 20% AEP flood event.

- a reserve area of equivalent size to the disposal area designed shall be set aside on the lot satisfying the above criteria.

C6. Water Supply

C6.1 Introduction

Water supply facilities include water uptake, storage, treatment and distribution via limited access trunk mains and multiple access local networks, along with all appurtenances necessary for a secure supply and adequate fire provision. Minimum mandatory design requirements are covered in *Part B* of this Code.

C6.2 Relevant Standards and Guideline Documents

The design of water supply facilities shall be carried out to the best standards current at the time of the project and supported by full calculations and information on features incorporated.

The following is a list of currently available relevant standards and guidelines. The list is not exclusive and other standards and guidelines accepted by the engineering profession at the time may be used where appropriate.

- Ministry of Health Drinking Water Standards for New Zealand, 1995,
- NZ Fire Service "Code of Practice for Fire Fighting Water Supplies" 1992, (NZ Fire Services Code)
- NZS relevant to the various materials used in water supply systems,
- Design guides and charts for pipe capacities supplied by various pipe manufacturers,
- NZS 3106: 1986 Code of Practice for Concrete Structures for the Storage of Liquids,
- NZS 4501: 1972 Code of practice for Location, Marking of Fire Hydrants,
- UHCC Water Bylaw.

C6.3 Water Quality

Water delivered at the point of consumption shall be of quality complying with the appropriate Ministry of Health Standards at the time.

The water supply system shall be designed to avoid contamination and minimise pressure variations in the reticulation.

C6.4 Design Flows, Maximum and Minimum Pressures

Design flows and maximum and minimum pressures shall be based on the requirements of *B9.2.4* of this Code.

C6.5 Reservoir Levels

The following information on Upper Hutt City Council reservoirs may be used as a basis for hydraulic calculations associated with pipe designs.

Reservoir Name	Year Completed	Depth [m]	Storage [m^3]	TWL (AMSL)
Chatsworth	1967	1.98	136	145
Cruickshank 1	1954	4.98	2270	119
Cruickshank 2	1975	7.45	9100	121
Emerald Hill	1965	4.52	1140	162
Maidstone	1977	3.05	225	185
Pinehaven 1	1953	5.03	727	159
Pinehaven 2	1995	4.59	1000	159
Plateau	1973	4.60	450	162
Timberlea	1989	6.10	6100	169
Trentham 1	1948	5.05	2270	119
Trentham 2	1984	7.53	9100	121
Craigs Flat	1995	4.17	500	138.6

C6.6 Main Sizing

Pipes shall be sized using the Colebrook White or Hazen Williams formulae or design charts derived from these formulae. The Colebrook roughness "K", or Hazen Williams constant "C" shall be based on pipe manufacturer's recommendations adapted for the 15 year "wear" condition. In analysing existing mains the actual age of the main shall be taken into account in setting the "K" or "C" values. Pipes shall be designed based on actual internal diameter.

The pressure rating of pipes and fittings shall be not less than 120 metres.

C6.7 Reticulation Layout and Standard Sizes

C6.7.1 Principal Mains

Principal mains of not less than 100 mm nominal diameter fitted with fire hydrants shall be laid on one side of all through streets and on one side of every cul-de-sac. Mains shall be laid to not more than 65 metres from the end of any cul-de-sac, subject to the requirements of the NZ Fire Service Code regarding hydrant spacing. Potential building sites shall also satisfy the NZ Fire Service Code with respect to proximity from fire hydrants.

For rural residential lots serviced by a municipal water supply a principal main with fire hydrant shall be provided to within 65 metres of the boundary of every lot.

Layout of reticulation mains shall provide a closed loop system. This shall be achieved by using public land, where possible, otherwise by easement through private property. The short term use of dead ends on a staged development may be acceptable provided the overall development utilises looped systems.

Water mains shall be laid parallel with road reserve boundaries. *Appendix C, Figure 42* shows the preferred installation locations.

In roads which may be extended in future mains shall be laid to within 4 metres of the end of the legal road. Mains shall extend across the full frontage of all Industrial/Commercial lots.

Where demand requires a 300 mm diameter or larger principal main it shall be considered as a trunk main and shall not be used for direct tapping of service connections. In such situations rider mains shall be used to service connections.

C6.7.2 Rider Mains

A rider main shall be laid parallel with the road frontage of lots on the side of the road remote from the principal main so that service connections do not cross the carriageway. Rider mains shall be continuous between intersections and have sufficient cross feeds to provide for the number of dwelling units served.

Where, in a cul-de-sac the installation of a through main is impracticable, the dead-end main shall terminate in a ring rider main. All rider mains on dead end mains shall be connected from upstream of the terminal hydrant.

All rider mains shall be provided with a scour valve installed near the lowest section of the rider main. Refer *Appendix C, Figures 43 to 44* inclusive for typical details. Rider mains from dead end mains shall be connected from upstream of the terminal hydrant.

C6.7.3 House Service Connections

Refer also *B5.9.5* to *B5.9.8*.

Service connections sizes shall be not less than 20 mm ID. All services from dead end mains shall be connected from upstream of the terminal hydrant.

There shall be a stopcock with toby box located 400 to 600 mm on the public side of the boundary and no supply pipe shall be laid beyond the toby box.

Where the potential land use is such that a large diameter connection is required the toby box shall be replaced with an appropriately sized valve and meter in an easily accessible box.

C6.8 Thrust Blocks

Thrust blocks shall be designed for all locations where out of balance forces occur such as bends, tees, valves, tapers etc. Design shall be based on the bearing value of the soil at the particular location except that the maximum bearing value used shall be 100 kPa. Thrust blocks shall bear on firm natural ground and shall leave joints and bolts accessible.

Thrusts for 10 metres head of water for a selection of pipe inside diameters are given in *Appendix C, Figure 45* and typical thrust block details are shown in *Appendix C, Figure 46*.

C6.9 Hydrants and Valves

Hydrants shall be located to enable scouring and fire protection as required by *B9* of this code.

Sluice and rider main gate valves shall enable isolation of mains and branches and shall be located as required by *B9* of this Code. Gate valves with hand wheels shall be used for all pipes of 50 mm ID and less.

Air valves shall be located as required by *B9* of this Code.

Material standards shall comply with the requirements of *C7, "Materials - Drainage and Water Supply Works"* of this Code.

C6.10 Air Valves

Air valves shall be provided at high points in all mains and at high points and other locations required by good engineering practice on trunk mains with limited off-takes. Locations shall be identified and air valves sized as part of the specific design. Air valves shall be installed with a gate valve on the main offtake to enable removal of the air valve for maintenance. All air valves shall be located in a chamber to give air movement and allow maintenance access. The air valve chamber shall be drained to the nearest stormwater system and the air valve shall be installed at such an elevation that it remains above any possible surcharging from the stormwater systems.

Air valves shall be designed to expel air automatically under working conditions and shall have sufficient capacity to admit air on draining the line, at such a rate that negative pressures of greater than -40 kPa do not occur.

C6.11 Pumps and Reservoirs

Shall be designed to satisfy the requirements of *Part B* of this Code.

C7. Materials - Drainage and Water Supply Works

C7.1 Introduction

This section of the Code covers acceptable materials for pipelines and associated appurtenances for stormwater, wastewater and water supply works. It shall be read along with *Part B* of this Code which sets down minimum mandatory requirements.

All materials used shall be new, clean in as new condition and of suitable standard for their purpose.

C7.2 Pipe Materials

Whilst the following pipe materials provide acceptable solutions for certain uses not all materials will be accepted for general use. The Designer should discuss preferred pipe types with the IQP prior to completion of design drawings and specification. Pipes shall comply with the industry accepted standard applicable at the time. Pipe selection shall recognise the soil material and groundwater around the pipe and the liquid being conveyed. All pipes shall utilise flexible joints of a type recommended by the manufacturer.

C7.2.1 Concrete Pipes (Wastewater and Stormwater)

Concrete pipes shall be reinforced concrete rubber ring jointed and shall comply with NZS 3107: 1978 - "Specification for precast concrete drainage and pressure pipes". They must be marked with the date of manufacture, and cured for at least ten days before delivery.

Flush jointed pipes above 1200 mm diameter are acceptable for stormwater provided they are used with external jointing sleeves.

The minimum strength class of pipe shall be Class X.

Unreinforced concrete pipes are <u>not</u> acceptable in Upper Hutt City.

C7.2.2 Spiral Welded Steel Pipes (Wastewater, Stormwater, Water Supply)

Steel pipes shall meet the requirements of NZS 4442: 1988 - "Welded steel pipes and fittings for water, sewage and medium pressure gas". Steel pipes shall be lined internally with mortar and buried pipes shall be coated externally with an approved tape wrapping system as required by NZS 4442. When used for above ground situations special external protective coatings will be required to best suit the location. These may include tape wrapping, hot dip galvanising or paint/epoxy coating systems.

CLS pipes are only acceptable for wastewater and stormwater use when required for exposed or other special situations, eg. stream or gully crossings.

C7.2.3 Ductile Iron Pipes (Water Supply)

Ductile Iron pipes shall be manufactured to meet the requirements of AS 2280 or BS 4772: 1988. Ductile iron pipes shall be internally lined with mortar, coated externally with bituminous paint and laid inside a polythene jacket unless an alternative corrosion protection system is approved by Council. Proprietary rubber ring joints such as "Tyton" shall be used.

C7.2.4 Unplasticised PVC Pipes (Water, Wastewater, Stormwater)

Unplasticised PVC pipes for the use with potable water shall comply with NZS 7648: 1987 and shall have a minimum working pressure rating of 120 metres.

PVC pipes for stormwater and sewer shall comply with AS/NZS 1260: 1996 "PVC Pipes and Fittings for Drain Waste and Vent Applications". Pipe class for both sewers and stormwater drains shall be SH or SEH as required.

Only rubber ring flexible joining systems shall be used. Solvent jointing of uPVC will not be accepted except for fixing of stub flanges or pipe specials. Gibault joints shall be used at junctions with cast iron and concrete lined steel fittings except where cast iron fitting with formed rubber ring sockets are used.

Special manhole shorts shall be used at manholes on gravity pipes.

C7.2.5 High Density Polyethylene (Wastewater, Stormwater and Water Supply)

HDPE pipes used for gravity sewer or stormwater shall comply with NZS 7604: 1981.

Pipe SDR for 160 to 355 mm OD pipes shall be not less than 26 for depths to invert of between 0.9 metre and 4.0 metres. Other depths will require specific design and extra wall thickness.

Note $$SDR = \frac{OD}{Wall\ Thickness} 1$$

HDPE pipes may only be used for water supply with the specific approval of Council and then only for mains of 200 diameter or less. Pipes shall comply with NZS 7601: 1978 and NZS 7602: 1977 for cold water pressure main use.

Joints for all HDPE pipes shall be electro-fusion welded or flanged. No jointing system that does not leave a clean unimpeded internal bore will be accepted.

Where used for water mains the pipes and jointing method shall be rated to a 120 metre working head.

C7.2.6 ABS Pipes (Wastewater, Stormwater and Water Supply)

ABS pipes are <u>preferred</u> for pump stations and valve chambers when appropriate diameters are available. ABS pipe and fittings of appropriate pressure ratings shall comply with one or more of the following Codes:

Pipes	-	BS 5391: 1976 or NZS 7609 Part 1, 1990
Fittings	-	BS 5392: 1976 or NZS 7609 Part 2, 1990 (NZS 7609 = AS 3518)

Threads shall not be cut into ABS pipes.

Pipes used shall be of pressure rating suitable for the purpose but pipe used in water mains shall be rated to at least 120 metres.

C7.2.7 Corrugated Steel or Aluminium Pipe (Stormwater only)

Corrugated galvanised steel or aluminium pipes may be used for drains and culverts of 900 mm diameter or greater, subject to specific City Council approval. They shall comply with NZS 4405: 1986 and systems shall be designed and laid in accordance with NZS 4406: 1986. Corrugated multi-plate culverts may be used.

C7.2.8 Medium Density Polyethylene Pipes

Medium density polyethylene pipes of up to 160 mm OD for use in cold potable water services, shall comply with NZS 7610: 1991 (BS 6572: 1985). Pushlok, Plasson or equivalent couplings may be used. Pressure rating shall be not less than Class 12 (120 metres working head).

C7.2.9 Galvanised Steel Pipe (Limited Stormwater Locations)

Galvanised steel pipes are required for shallow stormwater laterals under berms and footpaths to kerb. Pipes shall be medium wall hot dipped galvanised.

Jointing systems shall be as recommended by the manufacturer and approved by Upper Hutt City Council.

C7.3 Acceptable Jointing Systems, Pressure Mains

The following jointing systems are acceptable for pressure mains.

C7.3.1 Gibault Type Joints

All gibault joints shall have an elongated central register.

Gibault type joints shall be cast from first quality grey iron of an approved type. Joints shall be factory coated with an approved corrosion protection system and supplied with compatible factory corrosion protected nuts and bolts. Generally hot dip galvanising is the minimum level of protection acceptable. In all cases the completed joint shall be wrapped with the full "Denso" system (primer, mastic, petrolatum tape and MP/HD overwrapping tape).

Tapped elongated gibault joints with approved coating may be used for connections up to 40 mm nominal bore. Where elongated gibault joints are tapped, the central register shall be factory coated with an approved corrosion protection system.

For pipes of over 400 mm dia all joints shall be specifically detailed to be capable of resisting seismic movement. Gibault joints without designed joint ties will generally not satisfy the seismic needs.

C7.3.2 Viking Johnson Couplings

Shall generally be used for all high pressure pipes of over 400 mm dia.

C7.3.3 Flanges

Shall comply with NZS/BS 4504: 1989, BS 10: 1962 or ANSI B16.2 as applicable.

Flanges going into existing lines may be drilled to BS 10: 1962, Table D or E as required to achieve pressure ratings but flanges in all new pipelines shall be drilled to metric patterns (NZS 4504: 1988) except where fittings and appurtenances drilled to other patterns are to be used.

Flange size and thickness, bolt size and pattern shall be appropriate to the relevant standard and the test pressure applicable at the site but never less than 120 metre working pressure. Flange gaskets shall be 3 mm or thicker nylon reinforced rubber.

C7.3.4 Humes Speedsteel Couplings

May be used for jointing steel pipes subject to joints being capable of withstanding the test pressure. Joints shall be rated for not less than 120 metre working pressure.

C7.3.5 Welded Joints

Welded jointing is acceptable for use in steel pipelines and welded specials are acceptable for use in ductile iron or PVC pipelines. Welding shall be to NZS 4442: 1988.

C7.3.6 Rubber Ring Joints

Patent rubber ring systems are acceptable in ductile iron and steel pipes provided all components are rated to a minimum working pressure of 120 metres.

C7.4 Specials and Fittings - Water Supply Works

C7.4.1 Steel

Spiral welded steel pipe fittings and special shall comply with NZS 4442: 1988 and shall be mortar lined and coated externally to prevent corrosion of the steel surface. All welded joints shall be cleaned internally and externally after fabrication and repaired internally and externally to the same condition as the unaffected parts of the pipe. Where used above ground they shall be specially coated externally to suit the environment. Where special external coatings are provided the pipe exterior shall be sand blasted to Swedish Standard 055900 Sa2.5 after fabrication and prior to application of the coating. Where hot dip galvanising is used it shall comply with NZS/AS 1650: 1989. Epoxy or similar coatings shall be shop applied to the paint manufacturer's standards.

Where specials are fabricated from spiral welded steel and used below ground all slag shall be removed from weld lines, heated areas wire brushed clean and the exterior protective coating made good to the manufacturer's instructions. The whole fitting shall then be wrapped in Denso tape. Interior lining shall be made good with epoxy mortar.

C7.4.2 Cast or Ductile Iron

Cast or ductile iron pipe fittings shall be cast from best quality iron and shall comply with AS 2280 or AS 1830. All fittings shall be mortar lined internally and externally coated with a factory applied corrosion protection system, eg. Levasint, Plascoat, Rilson Nylon II or bonded epoxy to BS 6920.

Ductile iron fittings shall be used only with ductile iron pipe.

C7.4.3 Threaded Pipe Fittings (20 mm to 50 mm ID

Threaded pipe fittings shall be of a dezincification resistant material (LG2 gunmetal or similar) compliance with BS 1400: 1985 and shall be threaded to BS 21: 1985.

Threads shall not be cut into PVC, Polyethylene or ABS pipes. All threaded connections to these pipes shall be achieved using approved purpose made fittings.

C7.4.4 Tapping Bands

Shall be manufactured from LG2 gunmetal, complying with BS 1400 LG2 and shall fully encircle the pipe. The pipe must not be deformed by more than 1%. Direct tapping of pipes is not permitted. The diameters of holes cut in PVC mains shall not exceed:

Pipe Diameter [DN-mm]	Largest Hole Cut in Pipe [mm]
100	20
150	25
200	32
225	40
300	0

The hole cut in the pipe wall for the tapping band shall be neatly cut with a single drilling of the appropriate size or with the use of a hole saw.

C7.4.5 Nuts and Bolts

Items such as nuts and bolts, washers and similar shall be provided with factory applied corrosion protection systems acceptable to Council. Generally the minimum protection standard will be hot dip galvanised steel with an average minimum zinc coating mass of 305 grams/m^2. All fixings shall be wrapped in the full Denso protection system.

C7.4.6 Polyethylene Fittings

Polyethylene pipe fittings shall only be used with polyethylene pipe and shall meet the requirements of the Water Research Centre Water Industry Specification 4.32.11. Only Pushlok fittings may be used without specific approval of Council.

C7.4.7 Fire Hydrants

Hydrants shall conform to NZS/BS 750: 1984 with the following modifications:

- Hydrants shall be cast iron, tall pattern clockwise closing, with cast iron dolly cap fitted to the hydrant stem.
- The hydrant shall be coated with a factory applied corrosion protection system and all exposed bolts shall be 316 stainless steel.
- The inlet from the flange to the valve seat shall be protected against internal corrosion with an approved factory applied coating.
- Seals shall be long life polyurethane/ester and glands shall be packed with pure PTFE valve packing.
- Frost plug drains shall not be fitted or alternatively the plug shall not be free draining. If the hydrant is supplied with a frost plug drain it shall be plugged with non ferrous tapered metal plugs.

The preferred hydrant is Blakeborough Figure 2686 pattern.

C7.4.8 Valves

C7.4.8.1 Sluice Valves

Sluice valves shall comply with NZS/BS 5163: 1986 "Sluice Valves for Waterworks Purposes". They shall be cast iron heavy pattern, with non rising spindles and anti-clockwise closing. They shall be of "Grade A" construction and suitable for gland packing under mains pressure. Glands shall have 2 "O" ring seals or the valves shall be provided complete with PTFE packing. They shall be supplied with a factory applied corrosion protection system and have resilient seating. Any exposed bolts shall be 316 stainless steel. They shall be rated to not less than 16 bar working pressure.

C7.4.8.2 Gate Valves for Rider Mains

Valves shall be clockwise closing.

Gate valves shall comply with the relevant sections of BS 5154: 1989 except where modified below. They shall be of the inside screw, non-rising stem, solid wedge type. Pressure rating shall be at least Class 1600 kPa.

Valve bodies, gates and stems shall be of dezincification resistant copper alloy, stainless steel or other suitable copper alloy containing less than 10 percent zinc. Brass or high zinc content alloys shall not be used in these components. Handwheels shall be nylon or stainless steel and retaining nuts shall be of corrosion resistant material suitable for burial underground.

Acceptable gate valves include Methven GV125, Pegler 1070, Kitazawa series B Class 200.

C7.4.8.3 Toby Valves

Shall be manufactured of a dezincification resistant copper alloy and incorporate a device for backflow prevention.

Where applicable, they shall comply with NZS 784.

Acceptable toby valves are: Petronelli CP20 Globe valve
Barclay Engineering BEL stopcock

C7.4.8.4 Air Valves

Air valves shall be sized to cope with the appropriate air movements. They shall be of corrosion resistant material and shall always be installed in association with an isolation valve. Minimum pressure rating shall be 12 Bar. Acceptable brands are:

ARI BARAK Model D-040 (50 BSP) up to 150 mm diameter main
ARI SECEV Model S-030 (25 BSP) up to 100 mm diameter main
BERMAD Double Purpose (50 BSP) up to 200 mm diameter main

C7.5 Connections

C7.5.1 Rider Main Connections

Rider mains shall be connected to the principal main with either a tapped 316 stainless steel tapping band or an elongated gibault joint, each with a female threaded branch.

C7.5.2 Service Connections

Medium density polyethylene pipe complying with NZS 7610: 1991 shall be used for connections of up to and including 50 mm ID. Each service connection shall be connected to the watermain from the top portion of the main. Refer *Appendix B, Figure 12*. Fittings shall be threaded to BS 21: 1985.

C7.6 Water Meters

Water meters shall be compatible with the pipeline in which they are placed and the rate of flows which they are expected to measure. Meters shall be Class C with a calibration certificate provided to the IQP.

C7.7 Pipe Bedding Materials

Bedding materials for all pipes shall be crushed or river run sand or gravel, free from silts, clays or organic matter.

Bedding materials may be well graded or poorly graded but particle sizes shall not exceed the following:

i. 100% passing 10 mm for any pipe type or size.

ii. 100% passing 20 mm acceptable for rigid pipes of 225 mm dia or larger.

C7.8 Surface Boxes

C7.8.1 Hydrant, Sluice Valves, Rider Main Valves and Toby Boxes

These boxes shall comply with *Appendix B, Figures 10, 11 and 12*.

C7.8.2 Water Meter Boxes

Water meter boxes shall be suited to the particular application, shall be vandal resistant and able to take anticipated imposed loads. For smaller size meters an Upper Hutt City Council standard pattern moulded plastic or cast iron or aluminium shall be used. A range of purpose made covers may be required for larger size meters depending on where and how they are

mounted and whether they are in conjunction with other fittings such as a back-flow preventer.

C7.9 Drainage Appurtenances

C7.9.1 Standard Manholes, Drop Manholes, Shallow (mini) Manholes

Precast concrete manholes shall comply with the requirements of NZS 3107: 1978 and have an internal diameter of not less than 1050 mm. Standard manholes shall comply with details shown in *Appendix B, Figure 14*.

Drop manholes shall comply with *Appendix C, Figure 36*.

For pipes of 750 mm diameter or larger with any side connections or main deviations of greater than 20° then manhole risers shall be of diameter large enough to enclose all incoming pipes and allow streamlined bends through the manhole.

Shallow (mini) manholes shall utilise 600 mm dia sump barrels with an Upper Hutt City Council cast iron frame and cover. Refer *Appendix C, Figure 37*.

All manholes when used in roads, road reserve and accessways shall be capable of withstanding HN HO 72 loadings.

Manholes of over 1.0 metre depth to invert shall be provided with hot dip galvanised steel step irons. Step irons shall be of the "dropper" or "safety" type such that a foot will not slide off and shall be spaced as shown in *Appendix C, Figure 36*. Step iron holes in the riser shall be epoxied after placing of the step iron to ensure the manhole is watertight.

Manhole covers and frames shall be 550 mm internal diameter of heavy duty cast iron of circular pattern. Manhole covers shall not rock in place.

Pipes in manholes shall have their inverts neatly lined with cement render to NZS 3114, concrete surface finish U3. All inverts shall be carried vertically to the soffit of the pipe before haunching back to the manhole walls.

C7.10 Concrete and Mortar Materials

The following NZ Standards shall be used as a means of compliance with this specification.

NZS 3104: 1991	Concrete Production - High Grade and Special Grade
NZS 3108: 1991	Concrete Production - Ordinary Grade
NZS 3109: 1987	Concrete Construction
NZS 3114: 1987	Concrete Surface Finish

Concrete for thrust blocks, surround and general requirements in water main works shall be Grade 20 high grade concrete. Concrete for drainage works shall not be less than Grade 20 high grade.

Concrete strength for special water supply or drainage structures shall be based on specific design.

Mortar and its components shall comply with NZS 3103: 1993.

APPENDIX C

CONTENTS

APPENDIX C

CONTENTS

APPENDIX C, FIGURE 1
ROAD DESIGN STANDARDS - URBAN (50 km/hr LEGAL SPEED)

Class	Type	Area Served	Traffic Vols	Design Speed		Road Reserve Width	Rec Carriageway Width				Footpaths	Berm	Max/Min Grade	Normal Camber	Max Super	Notes
				Flat or Rolling	Hilly		Parking	Traffic	Cycles	Total						
LOCAL ROADS	Private Way	1-3 lots 1-6 du	NA	NA	NA	3.6 (2)	-	1x2.75	-	2.75(2)	-	0.5+0.35	16% max 0.4% min	3%	NA	Not public street (2)
	Private Way	4-6 lots 7-12 du (1)	NA	NA	NA	6.0 (2)	-	1x5.0	-	5.0(2)	-	2x0.5	16% max 0.4% min	3%	NA	
	Cul-de-sac	up to 20 du	NA	NA	NA	11.0	1x2.5	1x3.5	-	6.0	1.4	0.5+3.1	12.5% max 0.4% min	3%	6%	No stopping one side
	Residential	21-150 du	up to 750 vpd (1)	30.0	30.0	20.0	2x2.5	2x3.0	-	11.0	2x1.4	2x3.1	12.5% max 0.4% min	3%	6%	(3)
	Industrial street	up to 20 units	>300 vpd	30.0	30.0	15.5	1x2.5	2x3.5	-	9.5	2x3.0	-	10% max 0.4% min	3%	6%	No stopping one side
	Ind/Comm service lane	-	NA	NA	NA	8.0	-	2x3.5	-	7.0	-	2x0.5	10% max 0.4% min	3%	NA	(4)
	Commercial (park precinct)	-	<2000 vpd	30.0	30.0	(5)	(5)	2x3.5	-	-5.0	2x3.0	-	10% max 0.4% min	2%	NA	(5)
LOCAL DISTRIBUTOR ROUTE	Residential	<150 du	200-1000 vpd	40.0	40.0	21.0	2x2.5	2x3.5		12.0	2x1.4	2x3.1	12.5% max 0.4% min	3%	8%	-
	Industrial/ Commercial	20-40 units	300-1000 vpd	40.0	40.0	18.0	2x2.5	2x3.5		12.0	2x3.0	-	10% max 0.4% min	3%	6%	(5)
COLLECTOR ROUTE	Residential	150-450 du	1000-3000 vpd	50.0	40.0	21.0	2x3.0	2x3.5	7.0	13.0	2x1.4	2x3.1	10% max 0.4% min	3%	8%	
	Industrial/ Commercial	>40 units	>1000 vpd	50.0	40.0	18.0	2x3.0	2x3.5	7.0	13.0	2x3.0	-	10% max 0.4% min	3%	6%	(5)
SECONDARY (DISTRICT) ARTERIAL		>450 du	3000-7000 vpd	50.0	50.0	24.0	2x2.5	2x3.5	2x1.5	15.0	2x1.4	2x3.1	10% max 0.4% min	3%	8%	
PRIMARY (REGIONAL) ARTERIAL			7000-10000 vpd	70.0	60.0	26.0	2x2.5	x3.51x2.0	2x1.5	17.0	2x1.4	2x3.1	10% max 0.4% min	3%	8%	Painted median occup. 2.0m traffic lane

Notes:

1. du = dwelling units, vpd = vehicles per day
2. Where a private way adjoins a Local Distributor or above, it shall have a 5 metre traffic width and 6 metre road reserve width for a minimum of 6 metres from Road Boundary.
3. Parking bays set into berm footpath zones.
4. No parking both sides but must provide for steeping of service vehicles.
5. Width dictated by parking provisions. Parking (incl. angle parking) shall be provided on both sides of street and maximised taking into account traffic considerations.
6. Where Council gives approval to delete cycle lanes each traffic lane shall be increased to 4.0 m.
7. Parking lane width allows for combined parking/cycle lane.

M:\1524\ACAD\C-02.DWG

UPPER HUTT CITY COUNCIL

ENGINEERING STANDARDS

ROAD STANDARDS – RURAL

No.	Amendments	Date

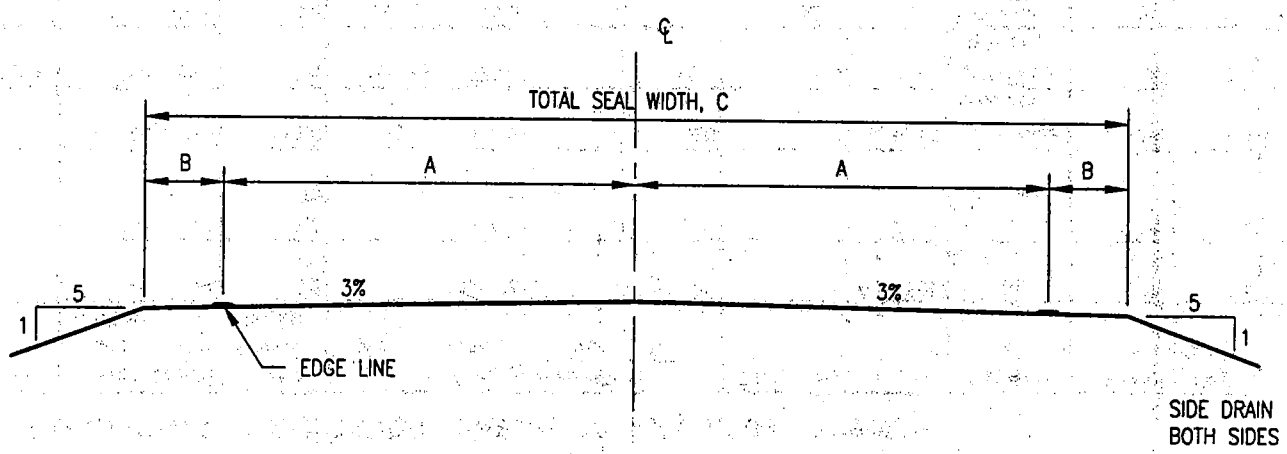
Drawn | Checked | Recommended | Approved | Director of Operations

Appendix C | Fig. 2 | Scale | Drawing Number 5904 | Sheet of

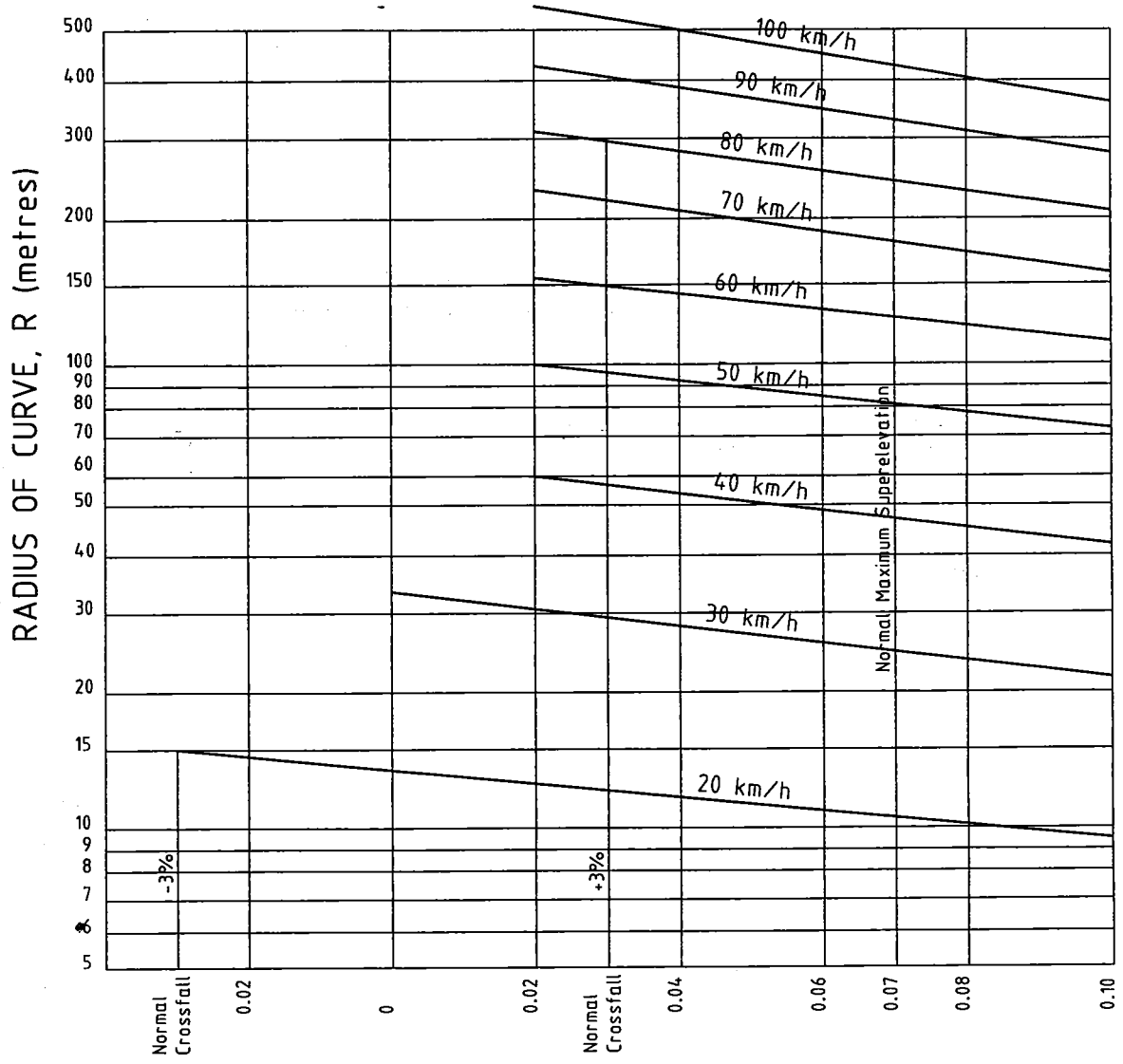
Road Standards - Rural

Classification	Traffic Volume Vehicles per Day	Lane Width (m) A	Shoulder Width (m) B	Total Seal Width (m) C	Design Speed		Maximum Minimum Grade	Minimum Road Reserve. (m) *	Normal Camber
					Flat or Rolling	Hilly			
Minor Local	0–300	2.5	0.5	6.0	40	30	12.5% 0.4%	12.0	3%
Subcollector	300–700	3.0	0.5	7.0	50	40	12.5% 0.4%	14.5	3%
Minor Collector	700–1000	3.25	0.75	8.0	50	40	10% 0.4%	15.0	3%
Major Collector	1000–2500	3.25	1.0	8.5	60	50	10% 0.4%	17.0	3%
Arterial	> 2500	3.5	1.5	10.0	70	60	10% 0.4%	17.0	3%

*ROAD RESERVE TO BE OF ADEQUATE WIDTH TO CONTAIN BERMS OF AT LEAST 2m WIDE ON EACH SIDE CLEAR OF SIDE DRAINS.



TYPICAL CROSS SECTION



Radius of Curve, $R = \frac{V^2}{127(e + f)}$

Where: R = radius of curve (m)
V = speed (km/h)
e = superelevation
f = friction factor (Dimensionless)

Negative crossfall should not be used where this is avoidable.

For circular curves used without transitions:
Use 66% of the maximum superelevation at the tangent points, 90% of the maximum superelevation at the 1/4 and 3/4 points, and the maximum superelevation at the 1/2 point.

Speed, V (km/h)	Friction factor
10	0.26
20	0.24
30	0.22
40	0.20
50	0.18
60	0.16
70	0.15
80	0.14
90	0.13
100	0.12

UPPER HUTT CITY COUNCIL

ENGINEERING STANDARDS

No.	Amendments	Date

SAFE SPEEDS ON HORIZONTAL CURVES

Drawing Number 5904

Scale

Sheet of

Drawn	Checked	Recommended	Approved	Director of Operations

Appendix C

Fig. 3

M:\1524\ACAD\C-03.DWG

Runoff Length, $L = \frac{100\ We}{G}$ metres

Where: L = runoff length (m)
W = pavement width (m)
e = superelevation rate (m/m)
G = percentage difference in longitudinal grade between the pavement deges.

Speed km/h	20	30	40	50	60	70	80
Suitable Values of G%	1.95	1.80	1.65	1.50	1.35	1.20	1.10

FOR PAVEMENT WIDTH W = 7m

SUPERELEVATION RATE em/m	MINIMUM RUNOFF LENGTH, L metres FOR SPEED km/h OF						
	20	30	40	50	60	70	80
.06	22	23	25	28	31	35	38
.07	25	27	30	33	36	41	45
.08	29	31	34	37	42	47	51
.09	32	35	38	42	47	53	57
.10	36	39	42	47	52	58	64
.12	43	47	51	56	62	70	76
ABSOLUTE MINIMUM	20	20	25	25	30	30	35

FOR PAVEMENT WIDTHS UP TO 7m USE THE ABOVE RUNOFF LENGTHS.
FOR PAVEMENT WIDTHS 7m TO 10m MULTIPLY THE ABOVE RUNOFF LENGTHS BY 1.2.
FOR PAVEMENT WIDTHS 10m TO 14m MULTIPLY THE ABOVE RUNOFF LENGTHS BY 1.5.

UPPER HUTT CITY COUNCIL

ENGINEERING STANDARDS

No.	Amendments	Date

SUPERELEVATION RUNOFF

Drawing Number 5904

Scale

Sheet of

Drawn	Checked	Recommended	Approved Director of Operations	Appendix	Fig.
				C	4

H:\1524\ACAD\C-04.DWG

The amount of widening required on curves depends on the lane width, the radius of curvature, the dimensions of the design vehicle and the design speed. THe values in the following table are suitable for use in urban areas at all normal speeds.

A). PRIMARY, COLLECTOR AND SUB-COLLECTOR STREETS OF UP TO 60 km/h DESIGN SPEED.

WIDENING ON HORIZONTAL CURVES						
Radius (metres)	Two lane carriageway width (metres)					
	6.0	6.5	7.0	7.5	8.0	8.5
	Metres Widening					
Up to 40	1.75	1.50	1.25	1.00	0.75	0.50
40 to 50	1.50	1.25	1.00	0.75	0.50	-
50 to 80	1.25	1.00	0.75	0.50	-	-
80 to 150	1.00	0.75	0.50	-	-	-
150 to 250	0.75	0.50	-	-	-	-

B). FOR LOCAL ROADS DESIGNED FOR 40 km/h OR LESSER DESIGN SPEED.

WIDENING ON HORIZONTAL CURVES	
Radius (metres)	Two lane carriageway width (metres)
	5.5 to 6.5
	Metres Widening
15 - 20	2.00
20 - 25	1.60
25 - 30	1.30
30 - 40	1.10
40 - 50	0.80
50 - 60	0.70
60 - 80	0.60
80 - 100	0.40
100 - 200	0.20

UPPER HUTT CITY COUNCIL

ENGINEERING STANDARDS

No.	Amendments	Date

WIDENING OF CURVES

Drawing Number 5904

Scale 1:20

Sheet of

Drawn | Checked | Recommended | Approved Director of Operations 8/98

Appendix C

Fig. 5

H:\1524\ACAD\C-05.DWG

For urban roads where lighting provides illumination and topography is such that full vertical curve length is difficult to attain, comfort and appearance of sag vertical curves are more relevant features in urban roads than that of safe stopping distance by vehicle headlights.

To ensure reasonable standards of comfort and appearance and to secure approriate visibility, vertical curves shall not be shorter than:

Curve length L = K x A where L = the curve length in metres but not less than 0.815 x V metres where V is the Design speed in km/h.
A = the algebraic difference in grade (expressed as percentage)
K = value not less than in the table below.

Design Speed V (km/h)	Standard K values		Minimum K for stopping and comfort	Minimum K for over-taking	Absolute minimum curve length, L (m)	Safe stopping distance (m)
	Crest curve	Sag curve				
30	4	6	3	28	25	25
40	7	9	5	41	30	40
50	10	12	7	57	40	60
60	14	15	9	(i)	45	75
70	18	18	11	(i)	50	95
80	23	21	13	(i)	60	120
90	28	24	15	(i)	70	140
100	33	27	18	(i)	80	170

NOTES:

(i) Not appropriate for urban two-lane roads.

(ii) Where K values over 40 are used, gradients at summits and valleys will be flatter than 4% for more than 30 metres and surface water drainage may require special attention. Storm drainage in sag curves should be specifically controlled by local steepening of the channel gradient to 1% at the sump.

(iii) Where the consequences of ponding or scour are serious, or where the potential catchment area may become large due to blocking of adjacent sumps then consideration should be given to provision of double sumps within sag vertical curves.

UPPER HUTT CITY COUNCIL

ENGINEERING STANDARDS

No.	Amendments	Date

VERTICAL CURVE LENGTHS

Drawing Number 5904

Scale

Sheet of

Drawn	Checked	Recommended	Approved Director of Operations

Appendix C

Fig. 6

H:\1524\ACAD\C-06.DWG

NOTES

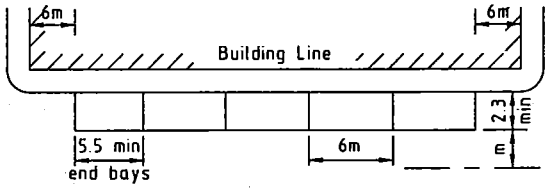
WHEN VEHICLES OVERHANG THE END OF THE BAY (EG. OVER THE FOOTPATH) D MAY BE REDUCED TO Dx

TAIL-IN PARKING BAYS SLOPE IN OPPOSITE DIRECTION

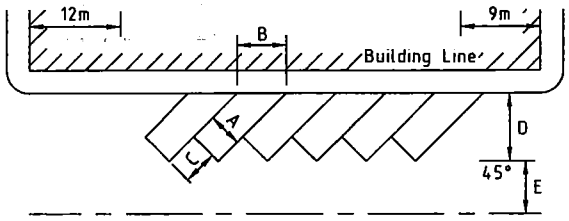
E = MIN AISLE WIDTH FOR REGULAR USERS

E1 = MIN AISLE WIDTH FOR CASUAL USERS

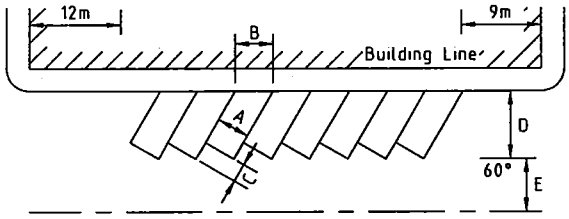
NZ BUILDING CODE D1/AS1 ALSO PROVIDES ACCEPTABLE SOLUTION



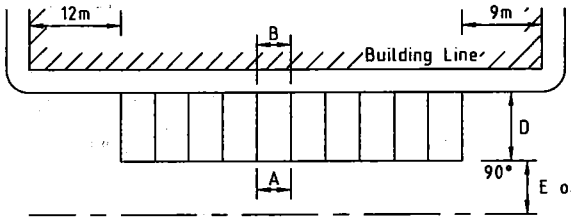
E = 3.5 ONE WAY AISLE
= 5.5 TWO WAY AISLE



A	B	C	D	Dx	E	E1
2.4	3.4	2.4	5.5	5.0	4.0	
2.5	3.5	2.5	5.6	5.1	3.8	
2.6	3.7	2.6	5.65	5.15	3.5	
2.7	3.8	2.7	5.75	5.25	3.5	



A	B	C	D	Dx	E	E1
2.4	2.75	1.4	5.9	5.25	4.8	
2.5	2.9	1.45	5.95	5.3	4.5	
2.6	3.0	1.5	5.95	5.35	4.3	
2.7	3.1	1.55	6.0	5.4	4.0	



	A	B	C	D	Dx	E	E1
	2.4	2.4	-	5.4	5.0	7.5	
	2.5	2.5	-	5.4	5.0	7.0	8.0
	2.6	2.6	-	5.4	5.0	6.6	7.0
	2.7	2.7	-	5.4	5.0	6.2	6.0
DISABILITY PARK	3.6	3.6	-	5.4	5.0	8.0	8.0

UPPER HUTT CITY COUNCIL

ENGINEERING STANDARDS

No.	Amendments	Date

CAR PARKING DIMENSIONS

Drawing Number 5904

Scale NTS

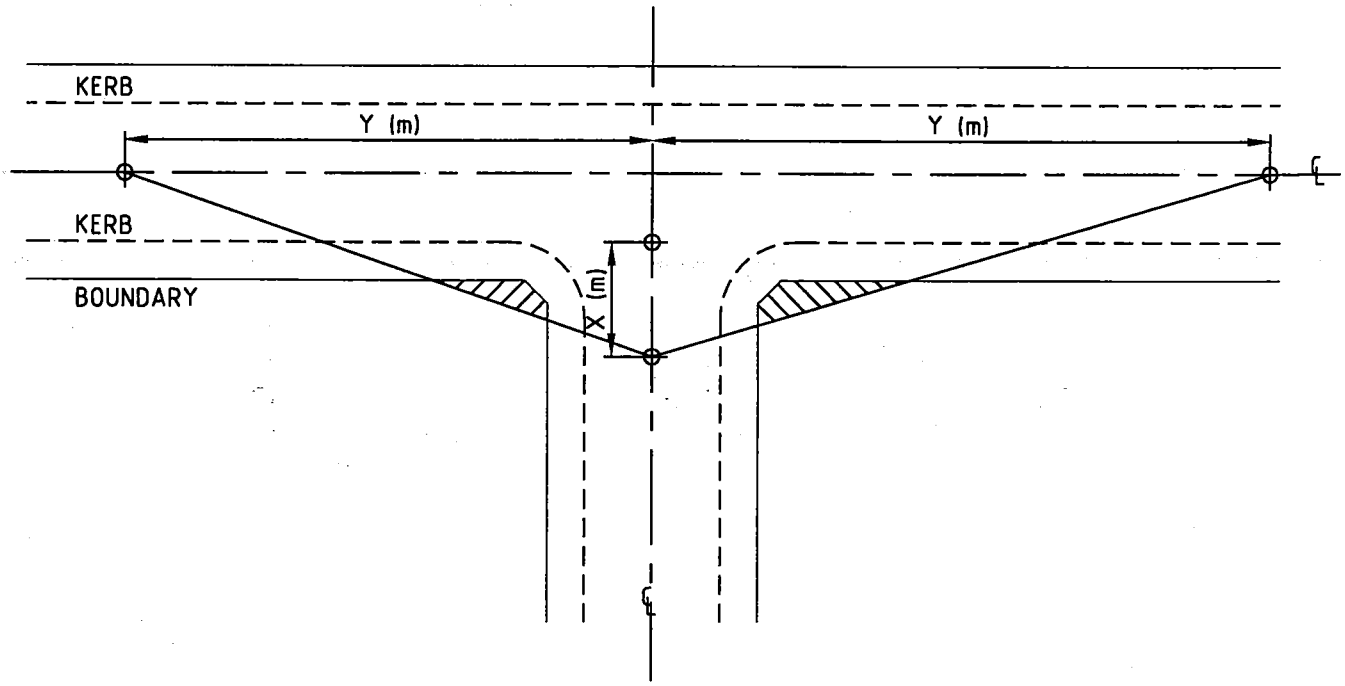
Sheet of

Drawn	Checked	Recommended	Approved Director of Operations

Appendix C

Fig 7

H:\1524\ACAD\C-07.DWG



Major Road		Side road distance X (m)		
Design Speed (km/h)	Distance Y (m)	Principal to sub-collector road	Local road Cul-de-sac Major private-way	Service lane Minor private-way
100	170	8	5	3
70	95	8	5	3
50	60	8	5	3
40	40	8	5	3
30	25	8	5	3
20	16	8	5	3

NOTE:

Within the areas represented by the visibility splays, full visibility will be needed above a level of one metre above the level of the adjacent carriageway. For one-way roads and dual carriageways visibility will only be required in the direction of approaching traffic.

UPPER HUTT CITY COUNCIL

ENGINEERING STANDARDS

No.	Amendments	Date

TRAFFIC SIGHT LINES AT NON-SIGNALISED INTERSECTIONS

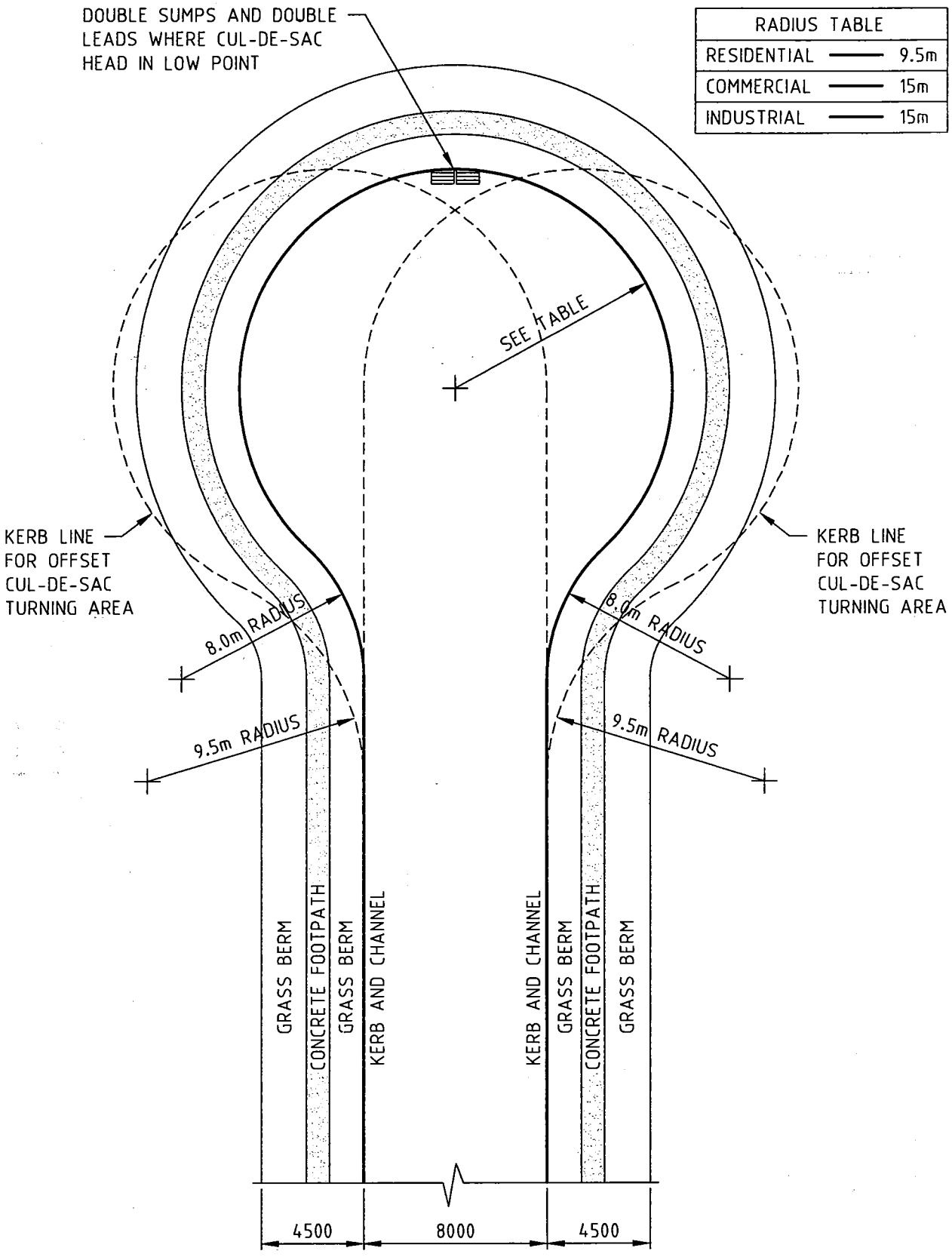
Drawing Number 5904

Scale 1:20

Sheet of

Drawn	Checked	Recommended	Approved Director of Operations	Appendix	Fig.
			8/98	C	8

H:\1524\ACAD\C-08.DWG



UPPER HUTT CITY COUNCIL

ENGINEERING STANDARDS

No.	Amendments	Date

DIMENSIONS OF CUL-DE-SAC TURNING AREA

Drawing Number 5904

Scale 1:250

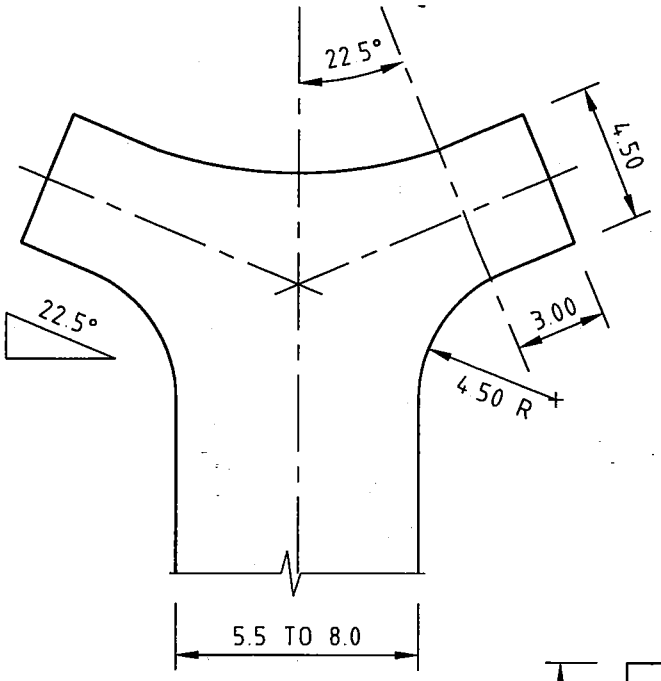
Sheet of

Drawn	Checked	Recommended	Approved	Director of Operations

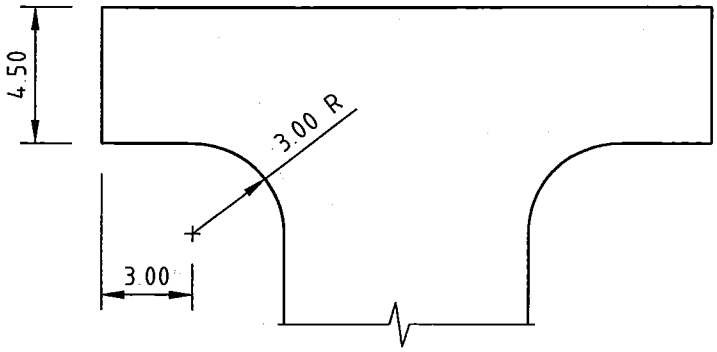
Appendix C

Fig. 9

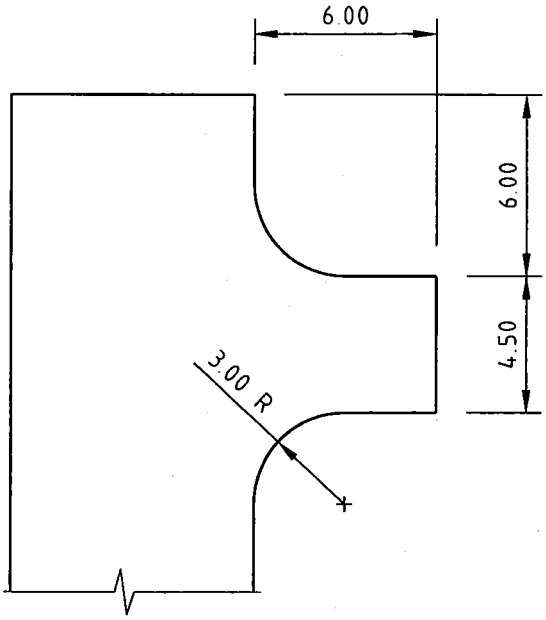
M:\1524\ACAD\C-09.DWG



Y TURNING



T TURNING



L TURNING

ONLY FOR USE WHERE THE STANDARD CIRCULAR HEAD IS UNSUITABLE

UPPER HUTT CITY COUNCIL

ENGINEERING STANDARDS

No.	Amendments	Date

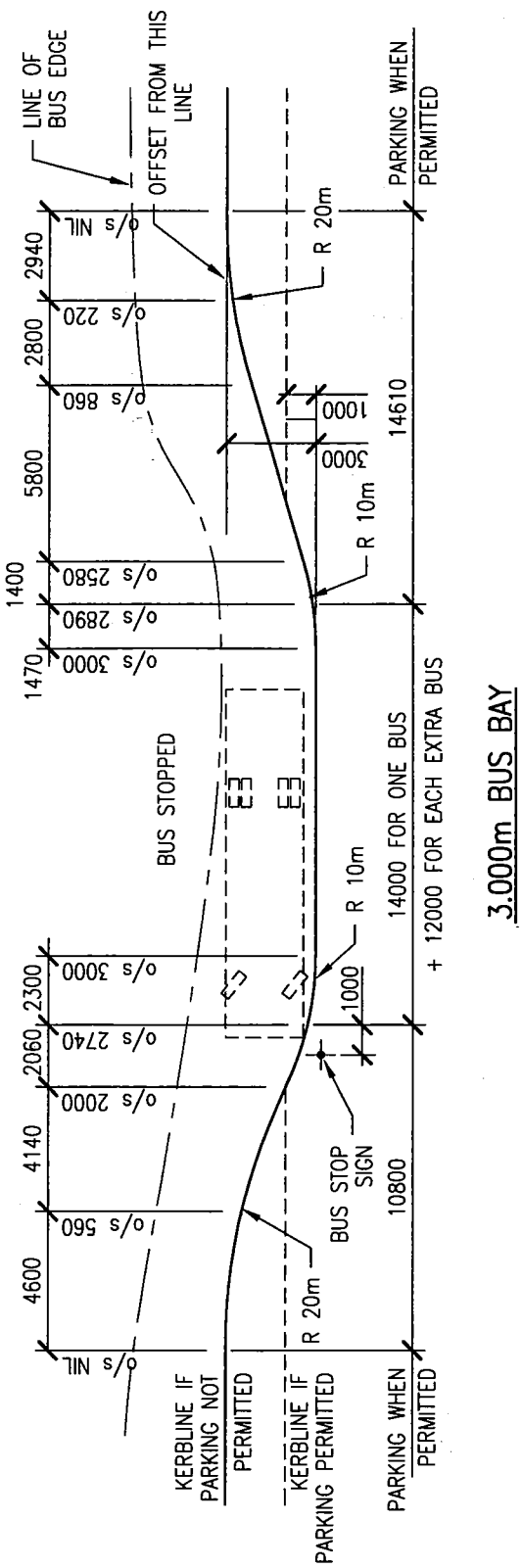
TURNING AREAS FOR CUL DE SACS

Drawing Number 5904

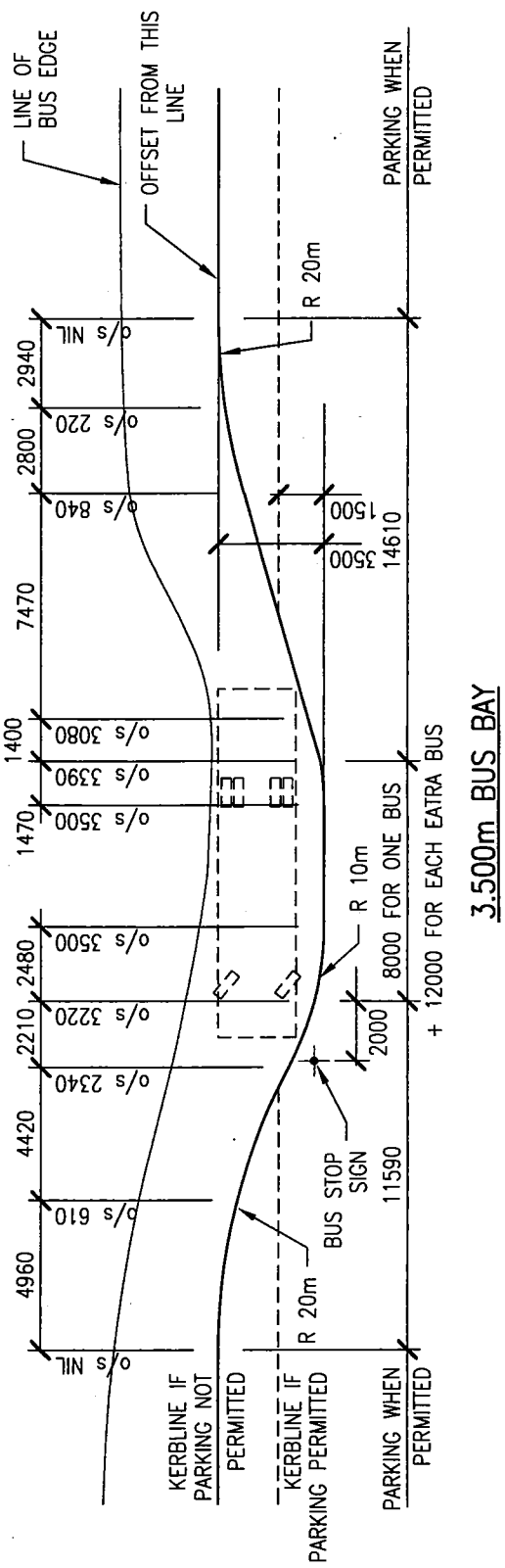
Scale NTS | Sheet of

Drawn	Checked	Recommended	Approved Director of Operations	Appendix	Fig.
				C	10

H:\1524\ACAD\C-10.DWG



3.000m BUS BAY



3.500m BUS BAY

UPPER HUTT CITY COUNCIL

ENGINEERING STANDARDS

No.	Amendments	Date

3.000m & 3.500m BUS BAYS

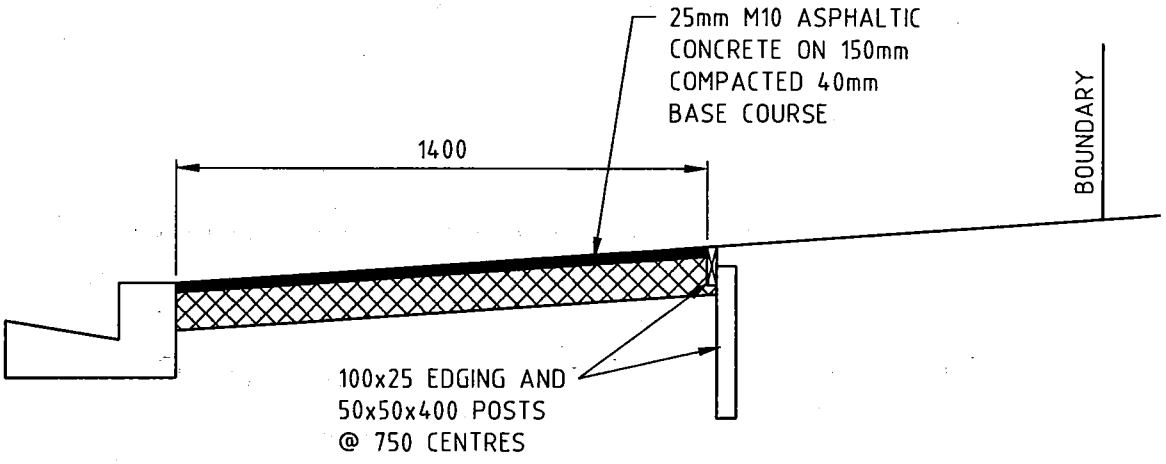
Drawing Number 5904

Scale

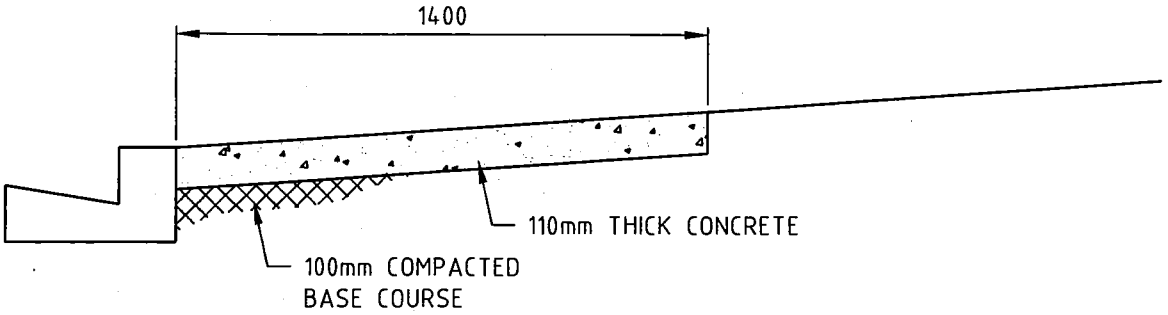
Sheet of

Drawn	Checked	Recommended	Approved Director of Operations	Appendix	Fig.
			8/98	C	11

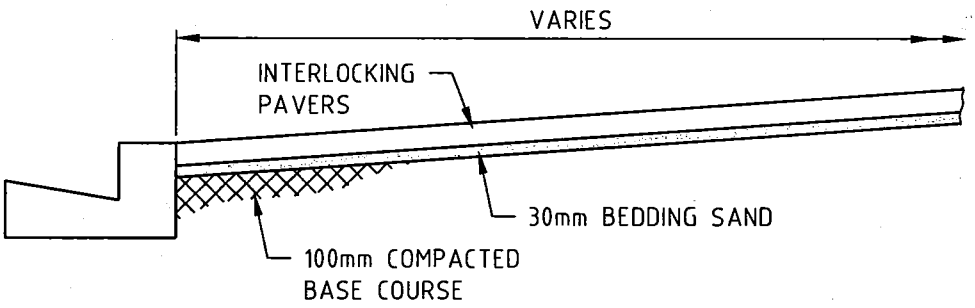
M:\1524\ACAD\C-11.DWG



ASPHALT



CONCRETE



INTERLOCKING PAVERS

UPPER HUTT CITY COUNCIL

ENGINEERING STANDARDS

No.	Amendments	Date

FOOTPATH CONSTRUCTION TYPICAL SECTIONS

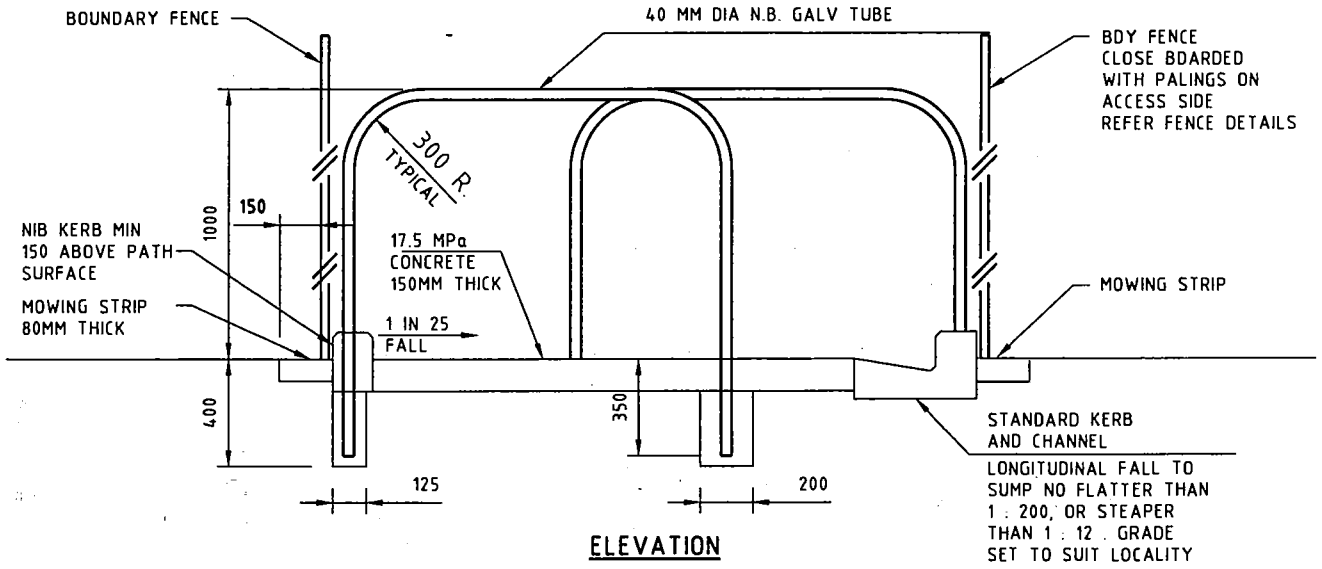
Drawing Number 5904

Scale

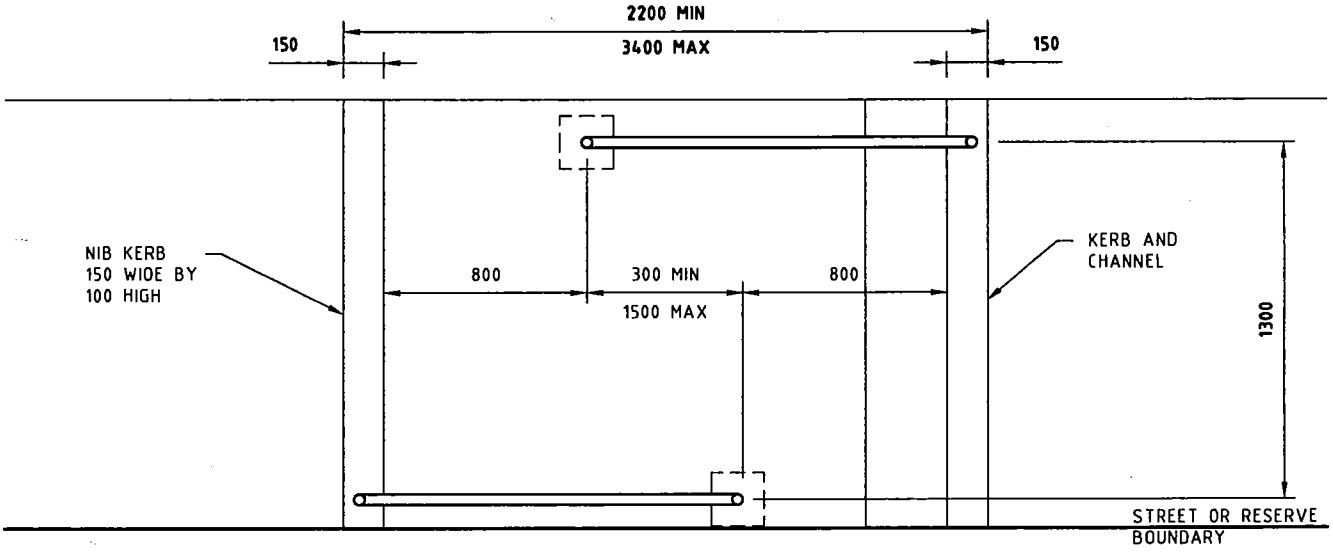
Sheet of

Drawn	Checked	Recommended	Approved Director of Operations	Appendix	Fig.
				C	12

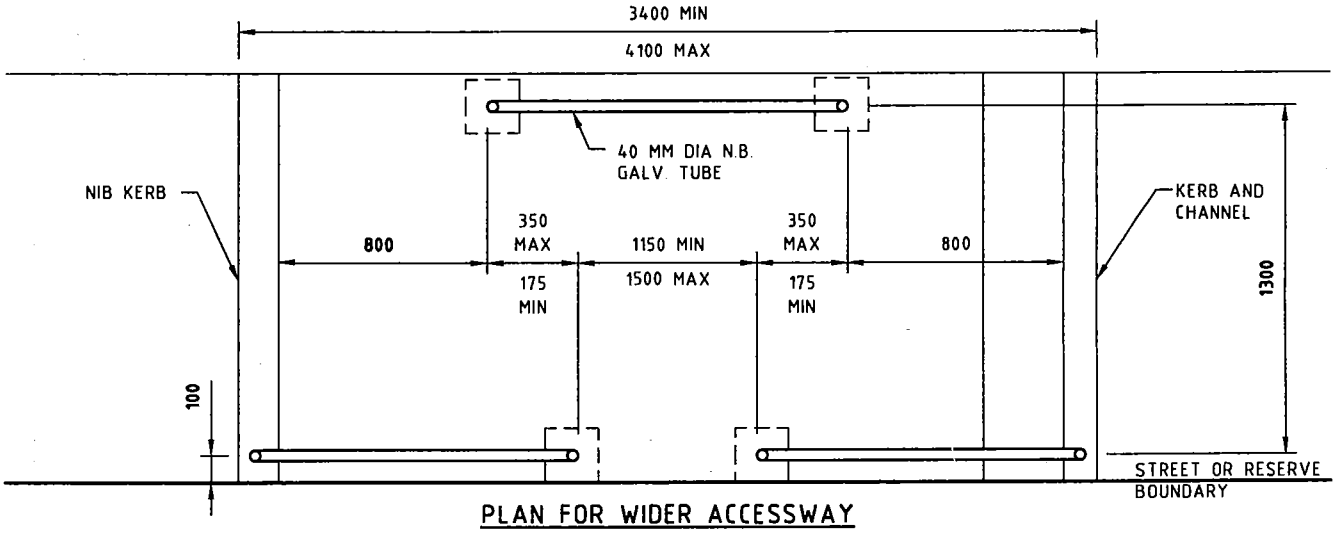
H:\1524\ACAD\C-12.DWG



ELEVATION



PLAN



PLAN FOR WIDER ACCESSWAY

UPPER HUTT CITY COUNCIL

ENGINEERING STANDARDS

No.	Amendments	Date

PEDESTRIAN ACCESS WAY AND CYCLE BARRIERS

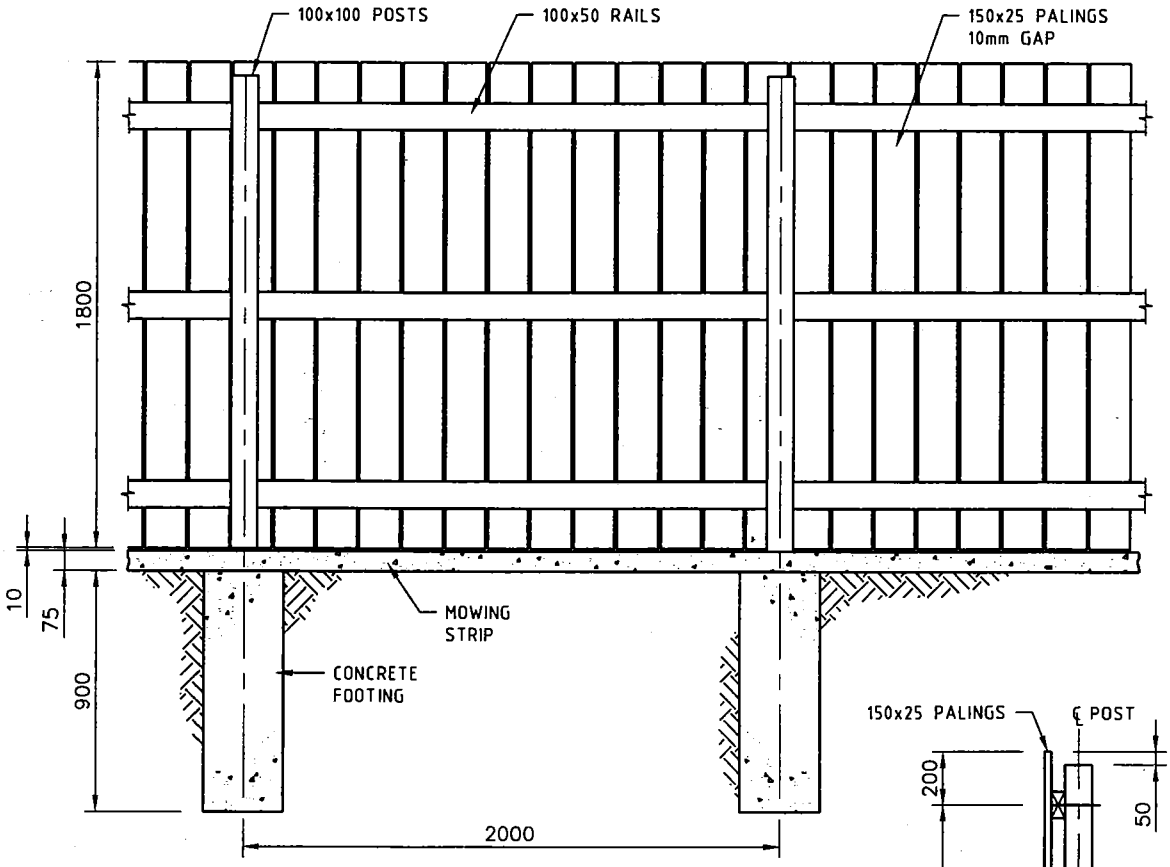
Drawing Number 5904

Scale

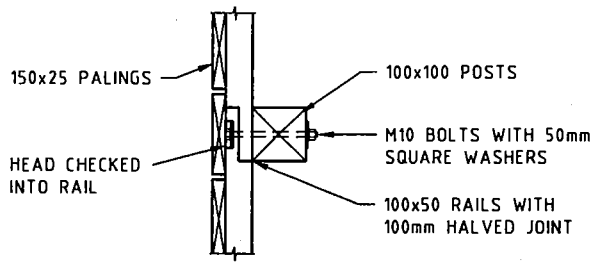
Sheet of

Drawn	Checked	Recommended	Approved Director of Operations	Appendix	Fig.
				C	13

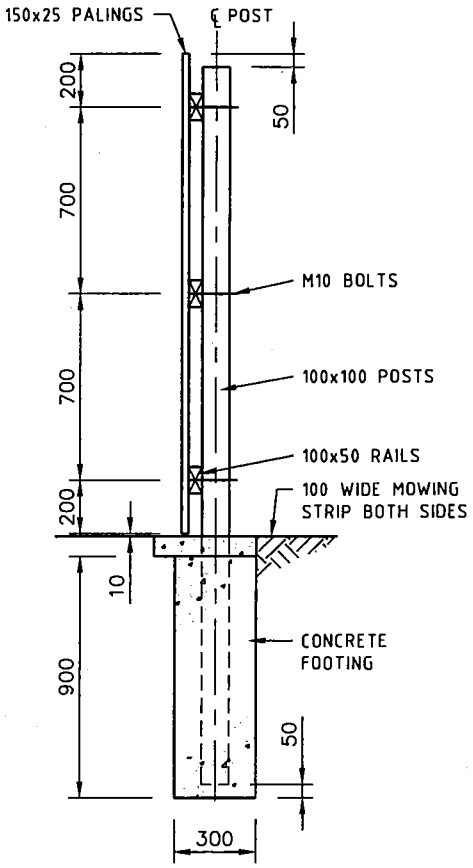
H:\1524\ACAD\C-13.DWG



ELEVATION
SCALE 1:20



RAIL FIXING DETAIL
SCALE 1:10



SECTION
SCALE 1:20

NOTES:

1. PALINGS TO BE ON PUBLIC ACCESS SIDE OF FENCE.
2. ALL NUTS, BOLTS, NAILS AND WASHERS TO BE GALVANISED.
3. ALL TIMBER PALINGS AND RAILS TO BE H3 TREATED AND POSTS TO BE H4 TREATED.
4. ALL CONCRETE TO BE 20MPa.

UPPER HUTT CITY COUNCIL

ENGINEERING STANDARDS

No.	Amendments	Date

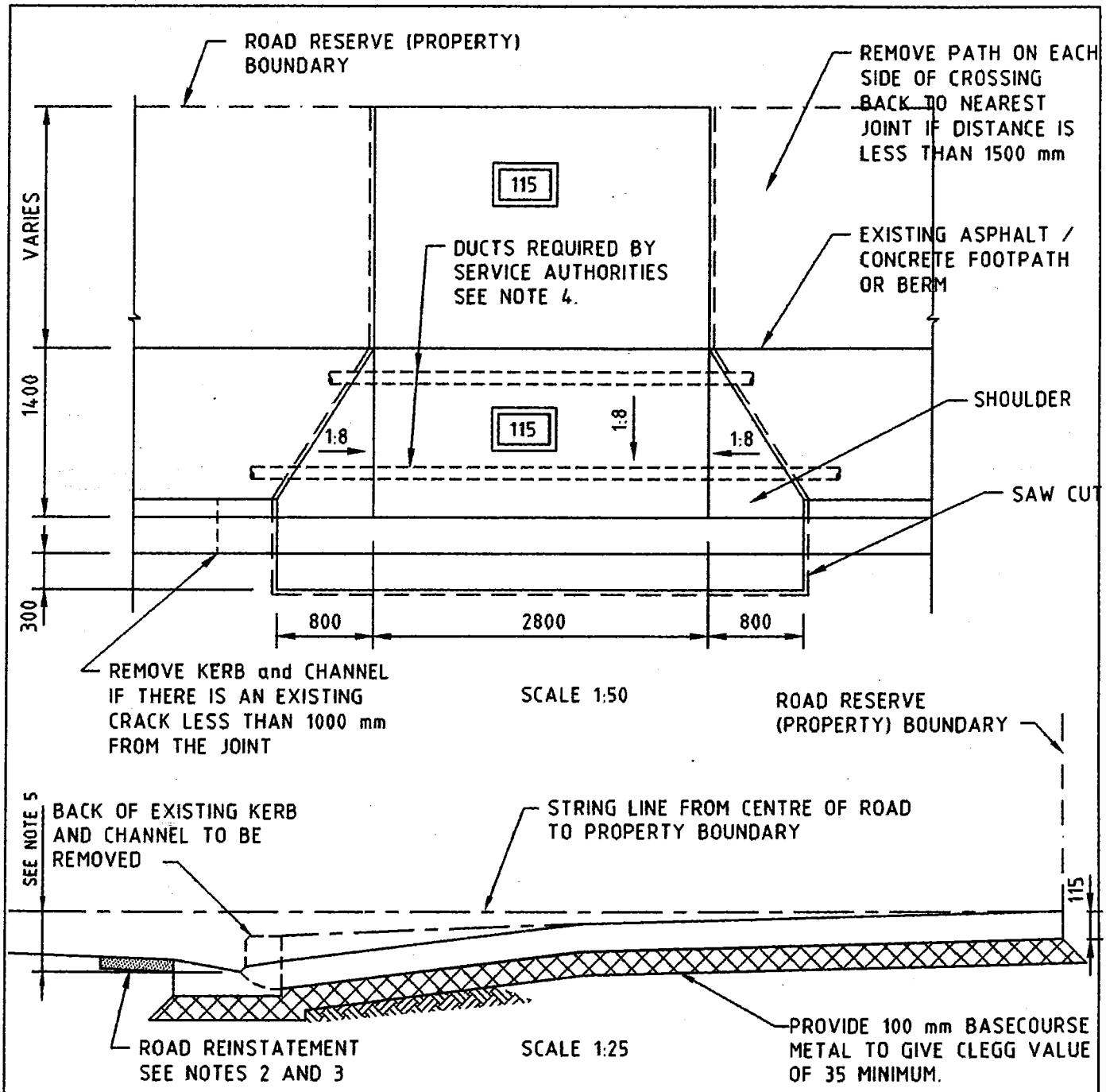
CLOSE BOARDED TIMBER FENCE

Drawing Number 5904

Scale AS SHOWN | Sheet of

Drawn	Checked	Recommended	Approved Director of Operations	Appendix	Fig
				C	13 (a)

M:\1524\ACAD\ C-13a.DWG



NOTES

1. All concrete shall comply in all respects with NZS 3109, and to be 20MPa crushing strength after 28 days minimum.
   All surfaces to have a broom finish.
2. A full bitumen coat completely covering the surface and extending up the sides of the reinstatement, is to be applied prior to the laying of the M10 asphaltic concrete.
3. The surface shall be sealed with 50 mm depth M20 asphaltic concrete, 300 mm in front of kerb and channel.
4. For duct details, refer Appendix C Figure 16
5. Height from channel invert to string line to be between 150 mm and 250 mm.

UPPER HUTT CITY COUNCIL

ENGINEERING STANDARDS

No.	Amendments	Date
A	Conc strength altered	2/99

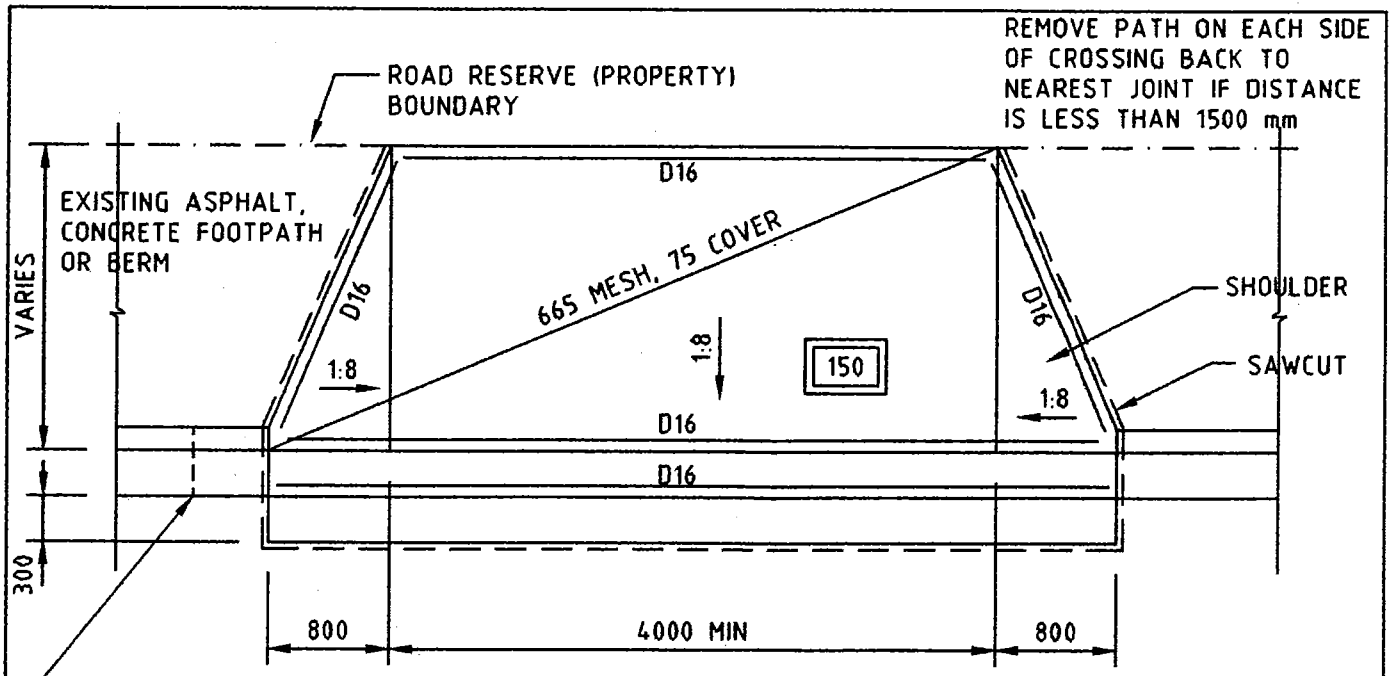
STANDARD CONCRETE VEHICLE CROSSING

Drawing Number

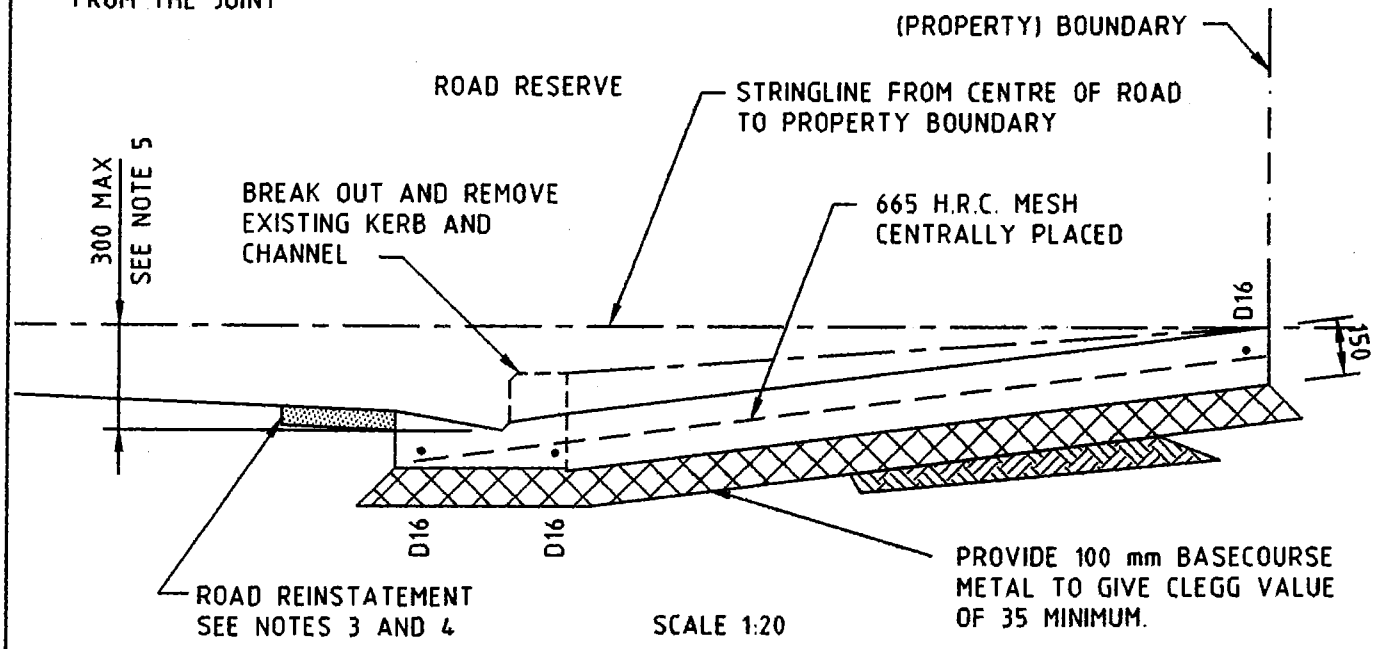
Scale AS SHOWN | Sheet of

Drawn	Checked	Recommended	Approved Director of Operations	Appendix	Fig.
	A.Khan		2/99	C	14

E:\1524\ACAD\C-14.DWG



SCALE 1:50



SCALE 1:20

NOTES

1. All concrete shall comply in all respects with NZS 3109, and to be 30MPa crushing strength after 28 days minimum.
All surfaces to have a broom finish.
2. A full bitumen coat completely covering the surface and extending up the sides of the reinstatement, is to be applied prior to the laying of the M10 asphaltic concrete.
3. The surface shall be sealed with 50 mm depth mix 20 asphaltic concrete, 300 mm in front of kerb and channel. (A)
4. For duct details, refer Appendix C Figure 16
5. Height from channel invert to string line to be between 150 mm and 250 mm.

UPPER HUTT CITY COUNCIL

ENGINEERING STANDARDS

No.	Amendments	Date
A	AC mix altered	2/99

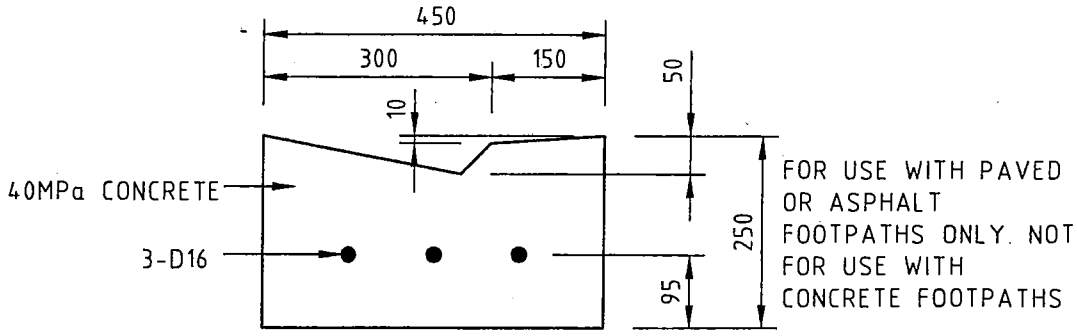
HEAVY DUTY VEHICLE CROSSING

Drawing Number

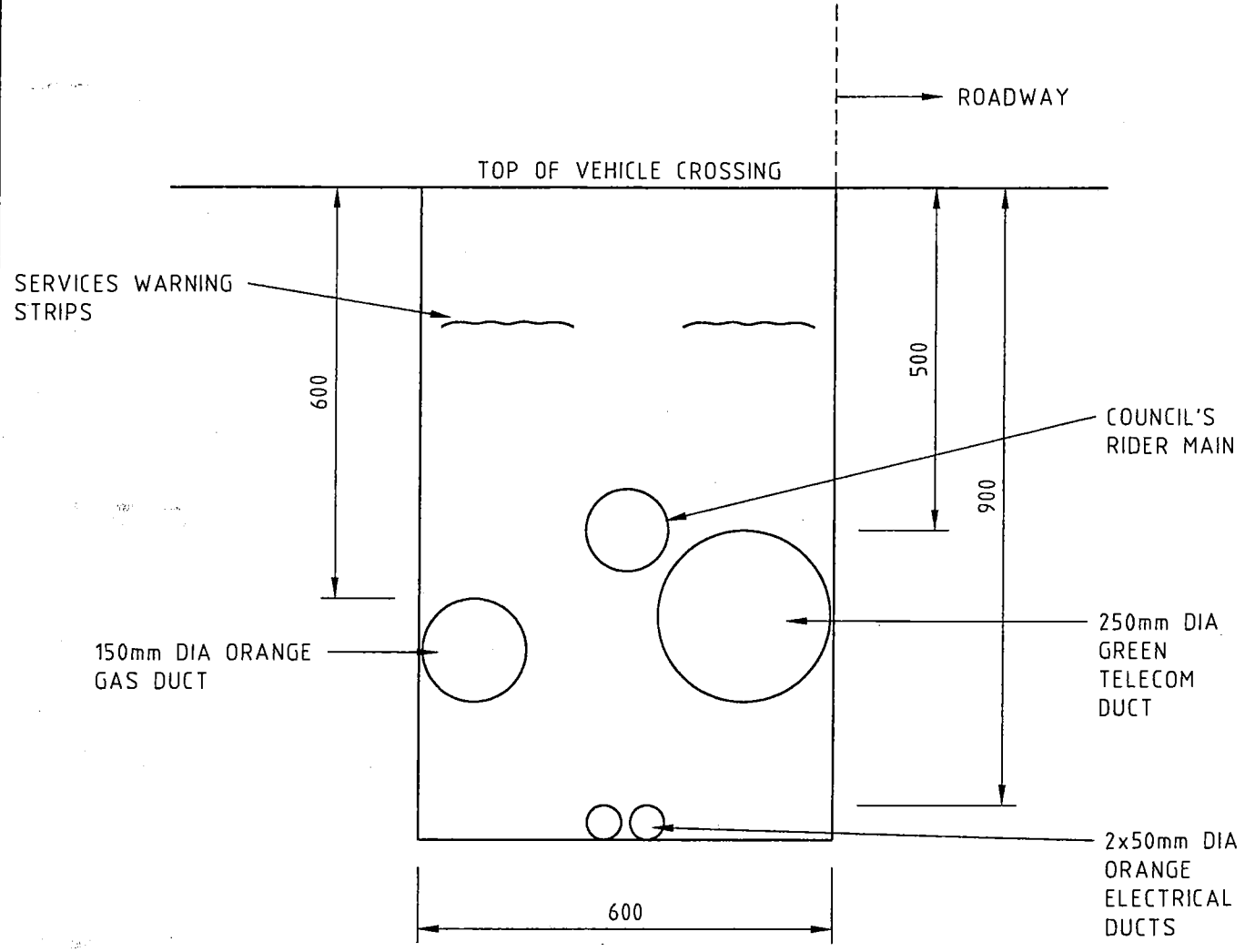
Scale AS SHOWN | Sheet of

Drawn	Checked	Recommended	Approved Director of Operations	Appendix	Fig.
SAL				C	15

H:\BZC\ACAD\C-15.DWG



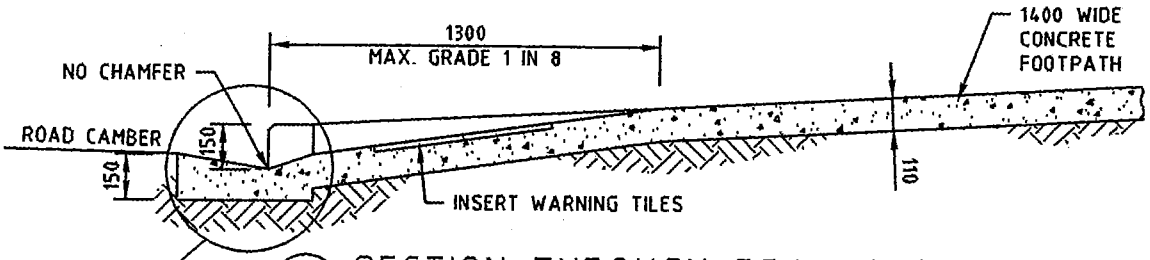
HEAVY DUTY VEHICLE CROSSING
KERB AND CHANNEL



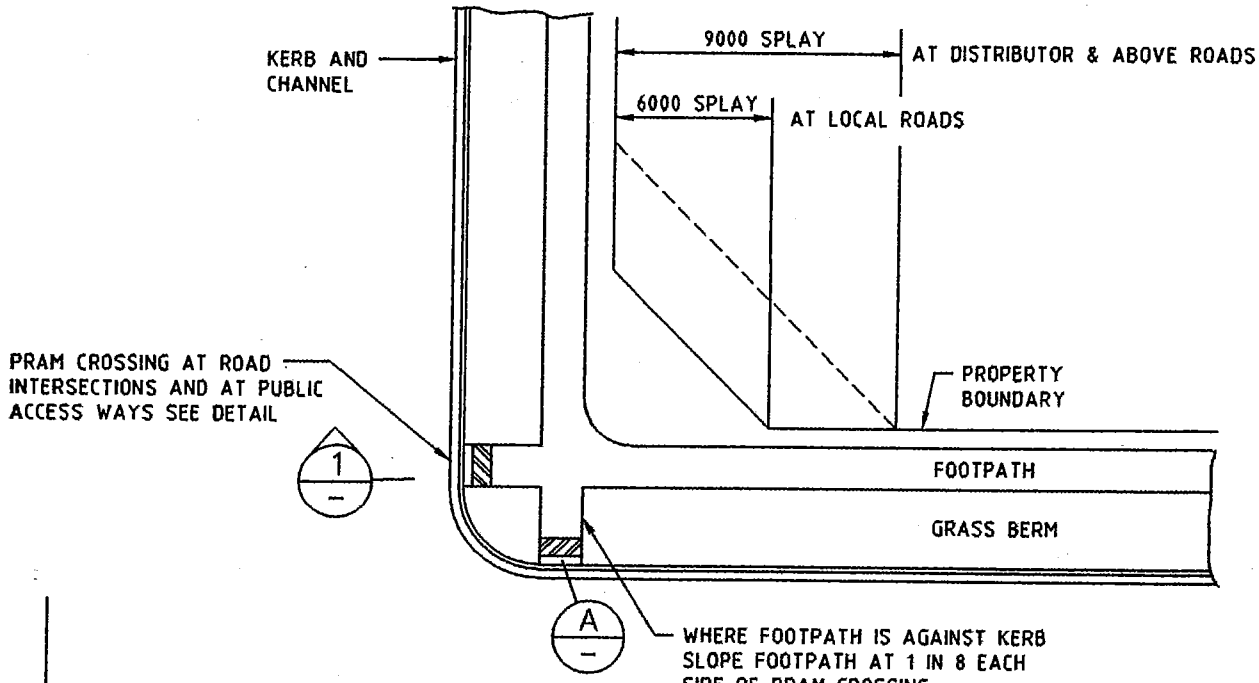
SERVICE TRENCH

UPPER HUTT CITY COUNCIL				ENGINEERING STANDARDS	
No.	Amendments	Date	HEAVY DUTY VEHICLE CROSSING KERB DETAILS AND SERVICE TRENCH	Drawing Number 5904	
				Scale	Sheet of
Drawn	Checked	Recommended	Approved Director of Operations	Appendix C	Fig. 16

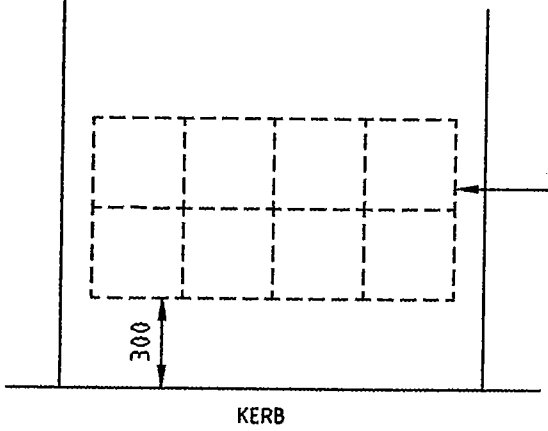
M:\1524\ACAD\C-16.DWG



1 – SECTION THROUGH PRAM CROSSING



STREET INTERSECTION CORNER



A – PRAM CROSSING DETAIL

ALL PRAM CROSSINGS SHALL COMPLY TO THE DISABLED PERSONS ACT NZS4121.1988 AND SHALL HAVE 300x300 TYPE 'B' TACTILE WARNING TILES, COLOURED YELLOW AND INSTALLED TO AID THE VISUALLY IMPAIRED.

UPPER HUTT CITY COUNCIL

ENGINEERING STANDARDS

No.	Amendments	Date
1	Tactile tile position	2/01

PRAM CROSSING AND BOUNDARY SPLAYS AT INTERSECTION

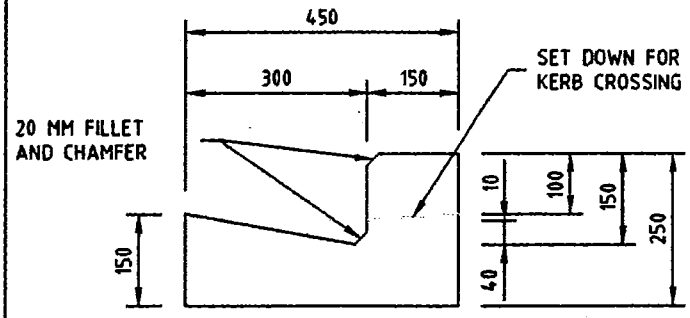
Drawing Number

Scale NTS

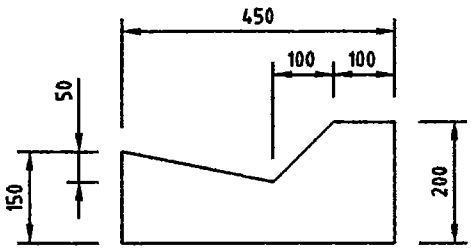
Sheet of

Drawn	Checked	Recommended	Approved Director of Operations	Appendix	Fig.
			26/2/01	C	17

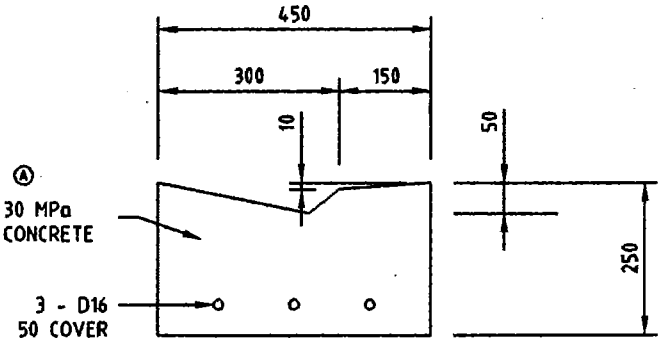
M:\1524\ACAD\17.DWG



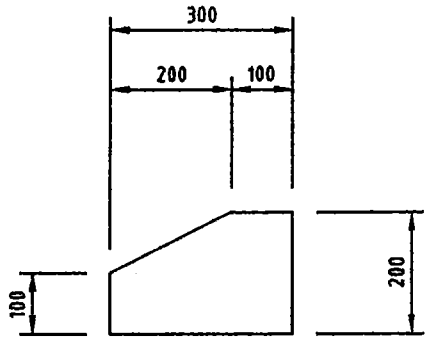
STANDARD KERB AND CHANNEL



MOUNTABLE KERB AND CHANNEL

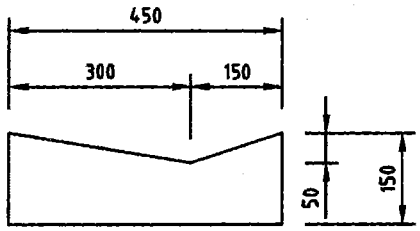


HEAVY DUTY VEHICLE CROSSING
KERB AND CHANNEL

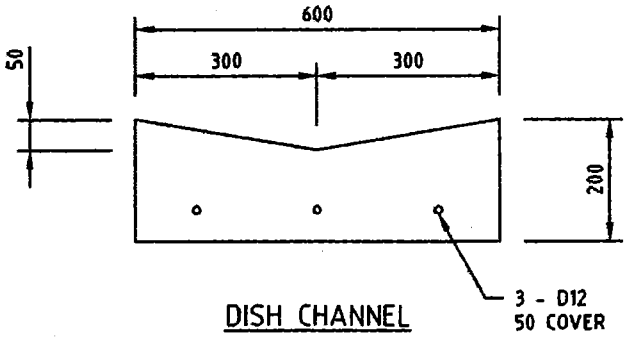


FOR USE WITH PAVED
OR ASPHALT FOOTPATHS
ONLY . NOT FOR USE
WITH CONCRETE FOOTPATHS

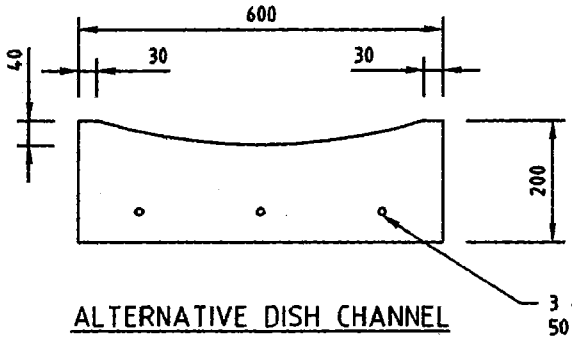
MOUNTABLE NIB KERB



PRAM CROSSING
KERB AND CHANNEL



DISH CHANNEL



ALTERNATIVE DISH CHANNEL

UPPER HUTT CITY COUNCIL

ENGINEERING STANDARDS

No.	Amendments	Date
A	Conc strength altered	2/99

KERB DETAILS

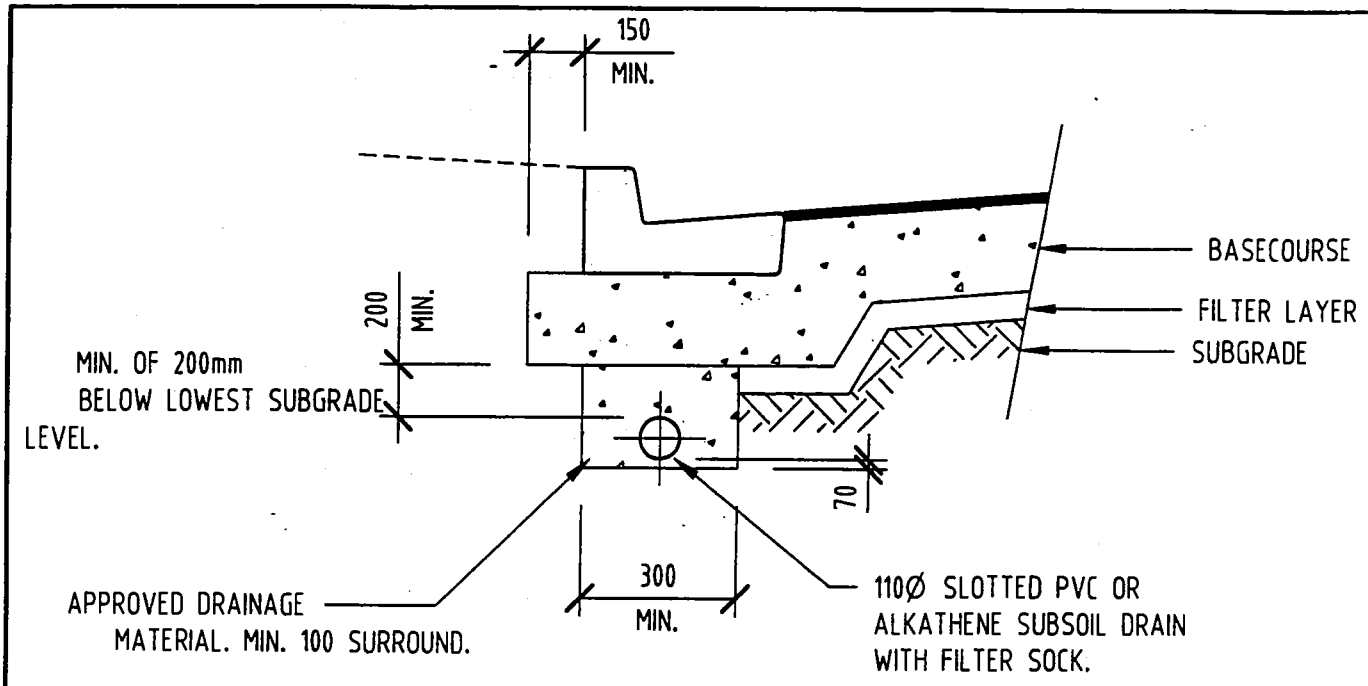
Drawing Number

Scale

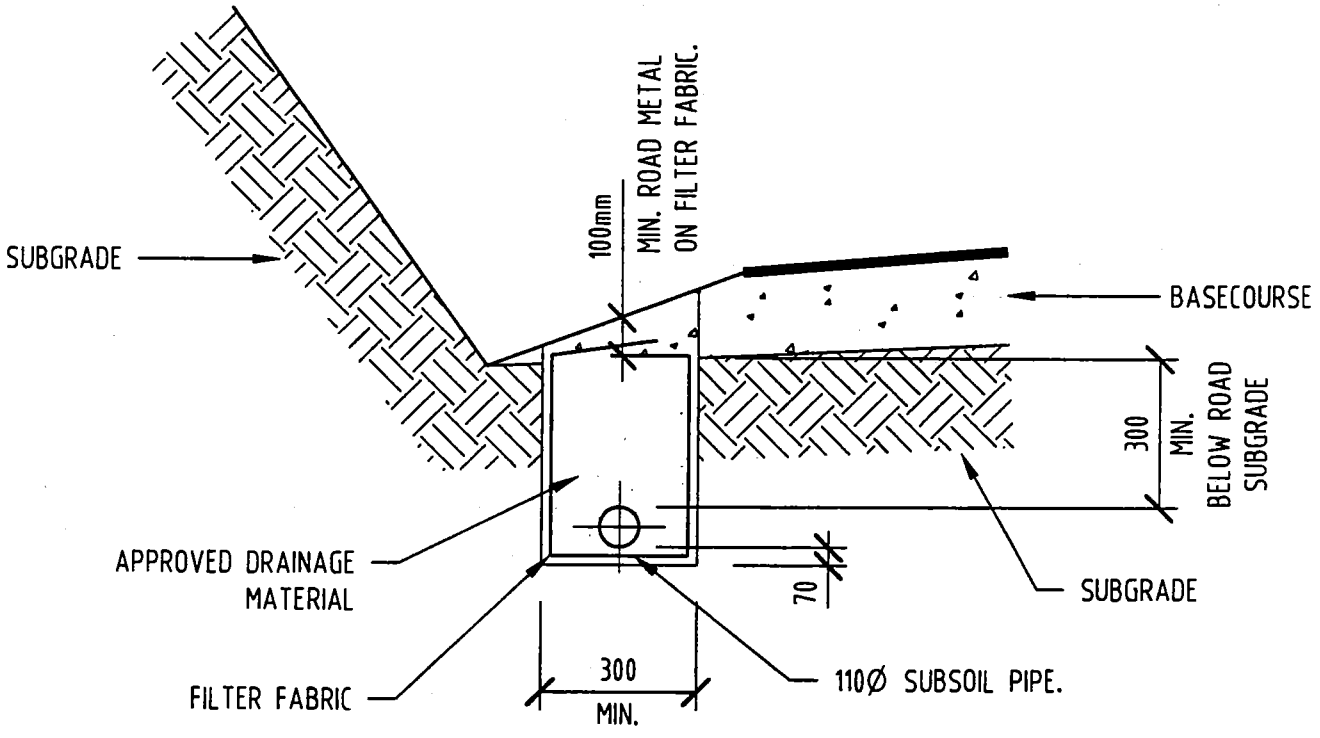
Sheet of

Drawn	Checked	Recommended	Approved Director of Operations	Appendix	Fig.
				C	18

H:\1526\ACAD\C-18.DWG



UNDER KERB DRAINAGE



RURAL SUBSOIL DRAINAGE

UPPER HUTT CITY COUNCIL

ENGINEERING STANDARDS

No	Amendments	Date

UNDER KERB DRAINAGE AND RURAL SUBSOIL DRAINAGE

Drawing Number 5904

Scale

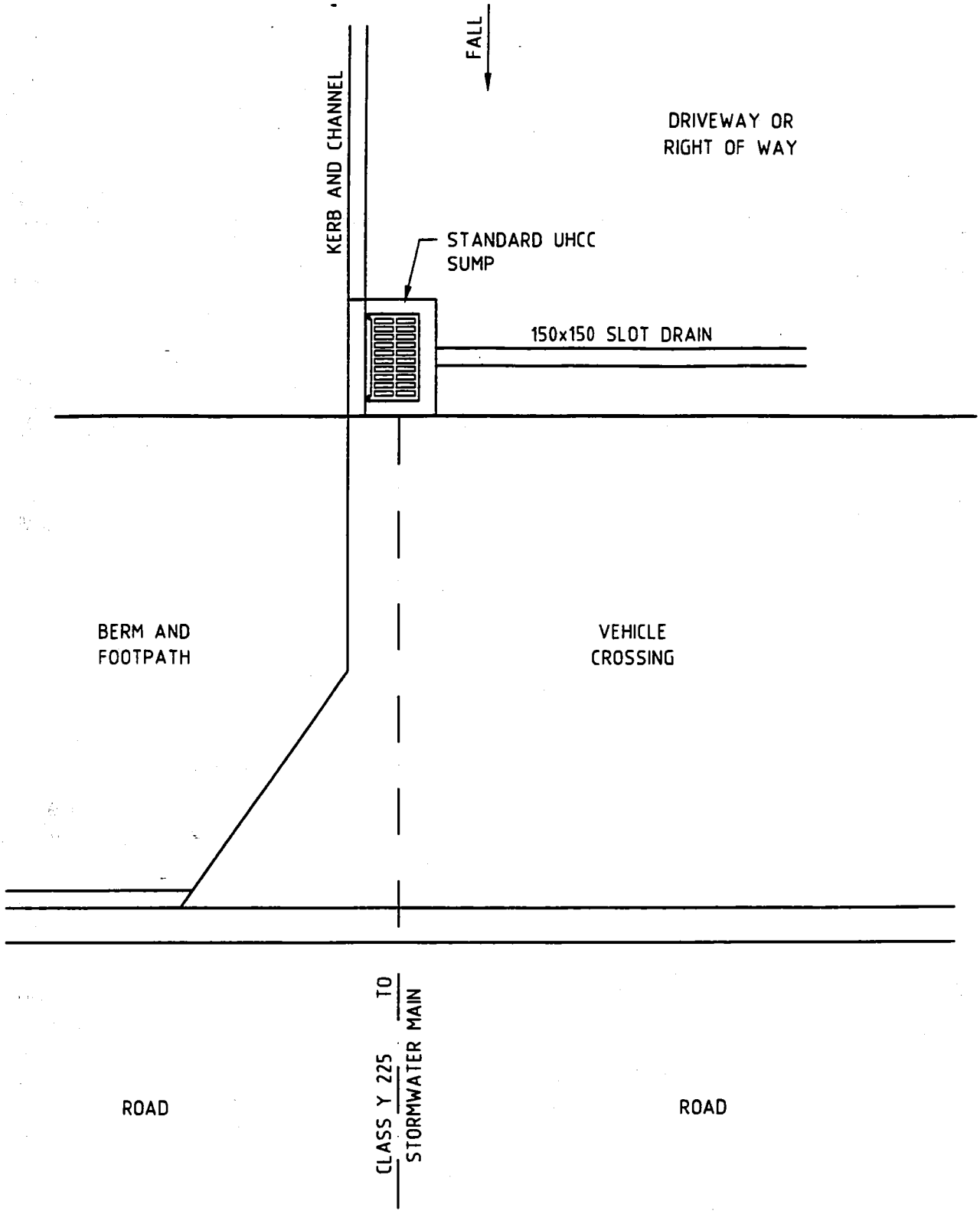
Sheet of

Drawn	Checked	Recommended	Approved Director of Operations

Appendix C

Fig. 19

M:\1524\ACAD\C-19.DWG



UPPER HUTT CITY COUNCIL

ENGINEERING STANDARDS

No.	Amendments	Date

TYPICAL STORM DRAINAGE AT ACCESS OR RIGHT OF WAY SLOPING DOWN TO ROAD

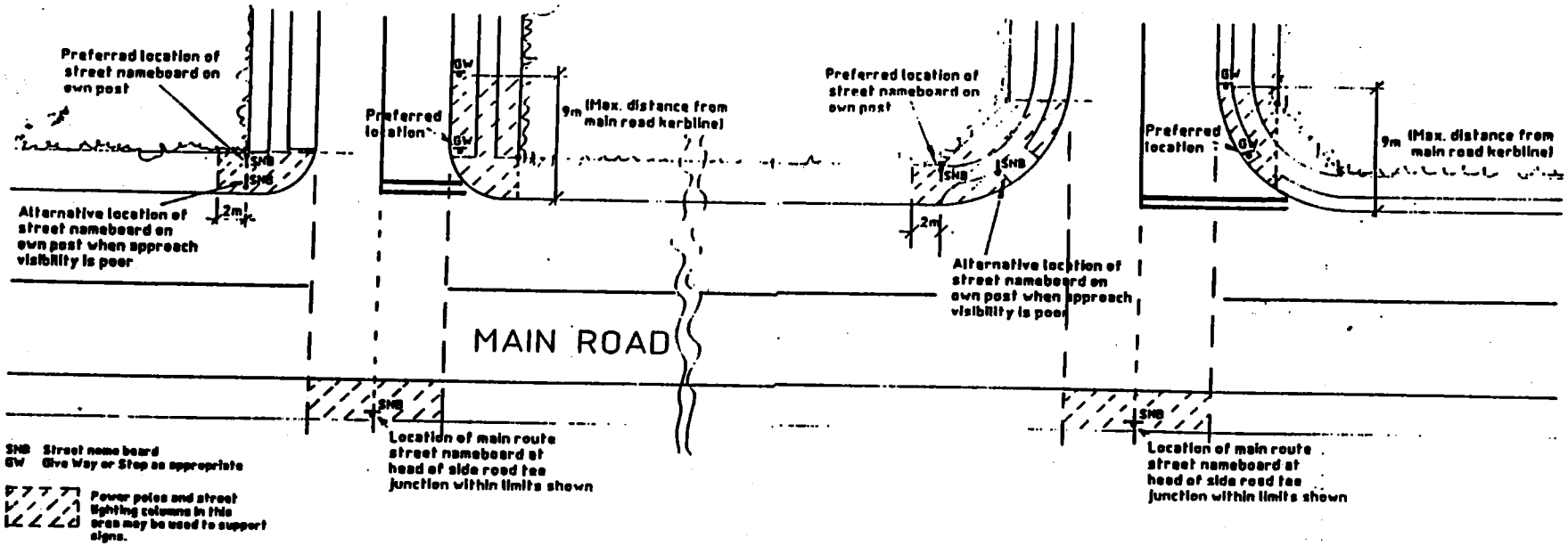
Drawing Number 5904

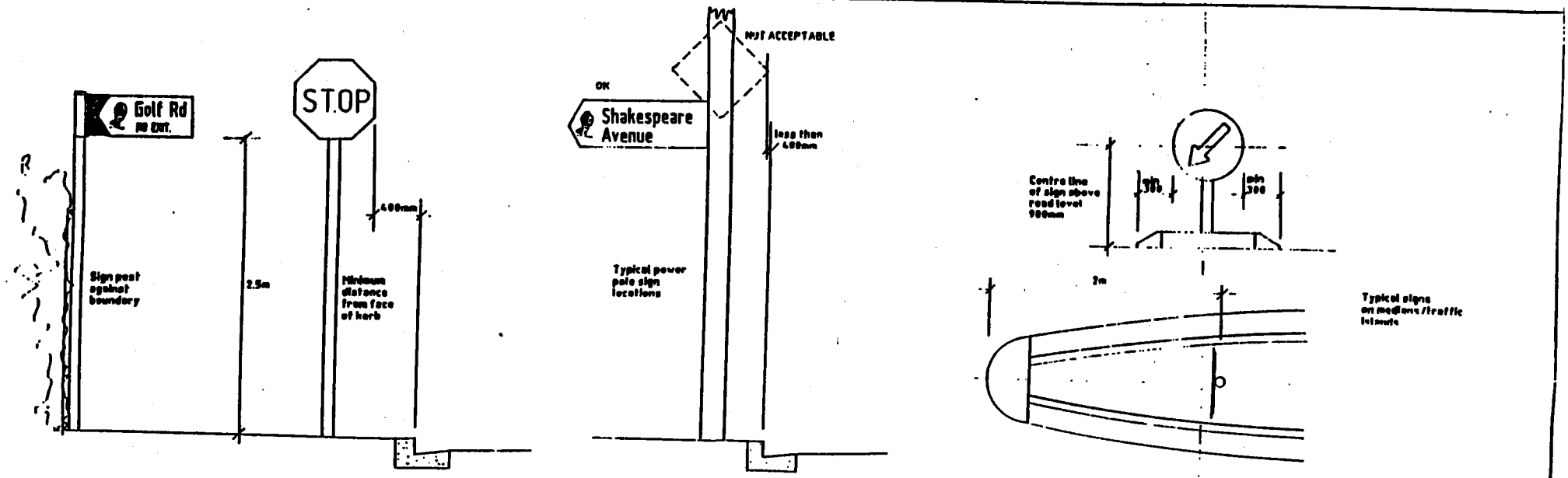
Scale

Sheet of

Drawn	Checked	Recommended	Approved Director of Operations	Appendix	Fig.
				C	20

M:\1524\ACAD\C-20.DWG





ISSUE	AMENDMENTS	DATE	INITIAL

THE UPPER HUTT CITY COUNCIL

APPROVED
DATE 11/95

	NAME	DATE
DESIGNED	J M NEVILLE	11/95
DRAWN	J M NEVILLE	11/95
CHECKED		
RECOMMENDED		
SCALE	nts	

SIGNS

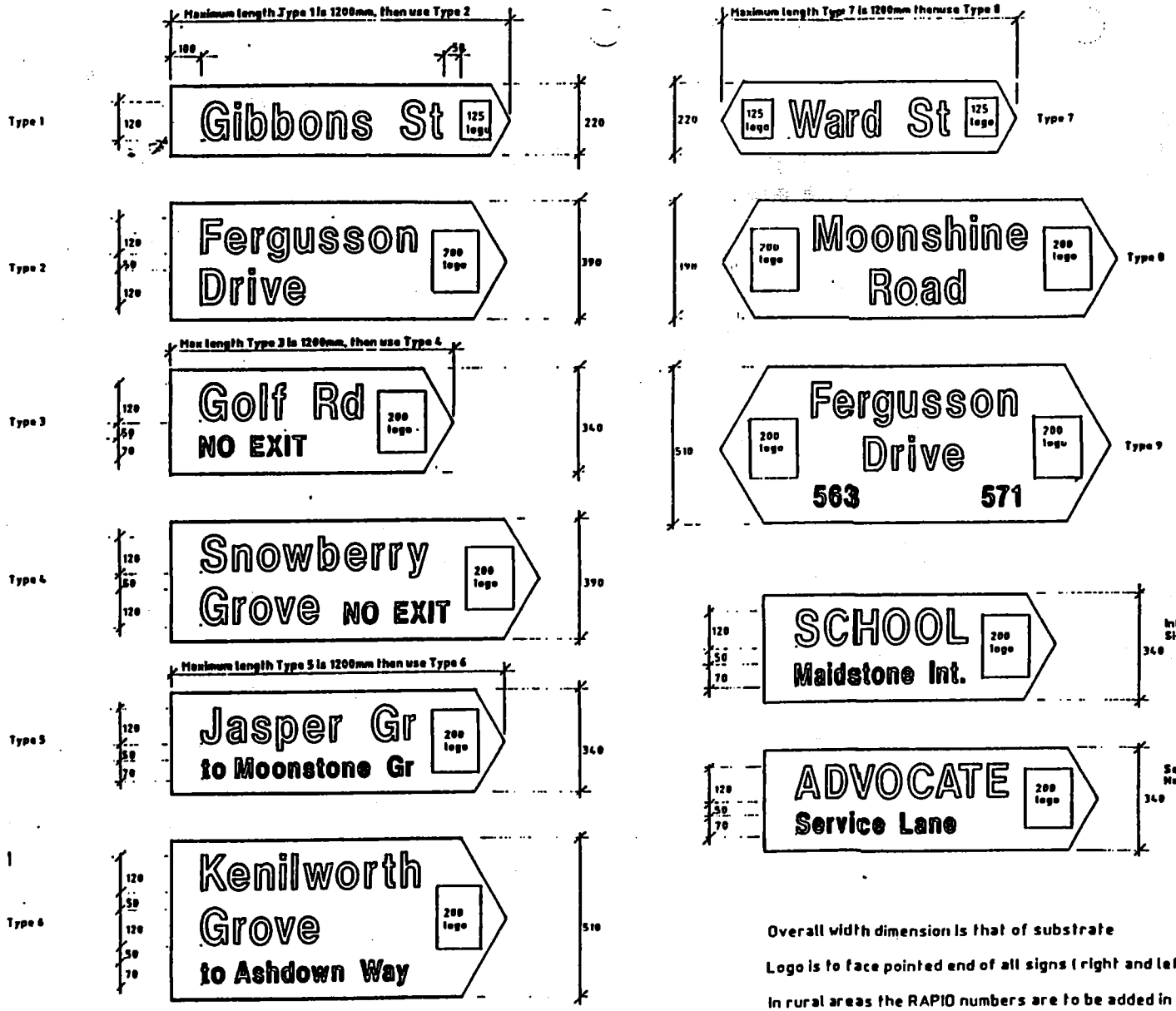
LOCATION DETAILS

PLAN No 5757

SHEET 3 OF 3

FILE

Appendix C Fig 21



ALL letters Series E, 80% condensed with 30% increased spacing.

STREET NAMEBOARDS Type 1 to 9

LETTERS	HI Reflectorised white
BACKGROUND	HI Reflectorised green
FRAMING	White
LOGO	White

INFORMATION SIGNS

LETTERS	Black
BACKGROUND	HI Reflectorised yellow
FRAMING	Black
LOGO	Black

SERVICE LANE NAMEBOARD

LETTERS	Black
BACKGROUND	HI Reflectorised orange
FRAMING	Black
LOGO	Black

Overall width dimension is that of substrate

Logo is to face pointed end of all signs (right and left hand required)

In rural areas the RAPID numbers are to be added in the "NO EXIT" location

ISSUE	AMENDMENTS	DATE	INITIAL

THE UPPER HUTT CITY COUNCIL

APPROVED
DATE 11/95

	NAME	DATE
DESIGNED	J M NEVILLE	11/95
DRAWN	J M NEVILLE	11/95
CHECKED		11/95
RECOMMENDED		11/95
SCALE	1 - 10	

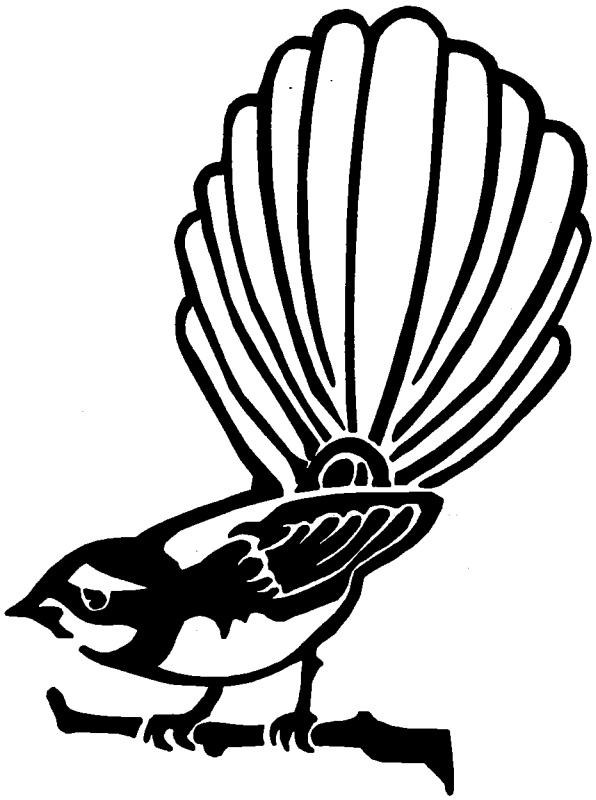
STREET NAMEBOARDS and other MISCELLANEOUS SIGNS. GENERAL LAYOUTS

Appendix C Fig 22

PLAN No. 5757

SHEET 1 OF 3

FILE



UPPER HUTT CITY COUNCIL

ENGINEERING STANDARDS

No.	Amendments	Date

STREET SIGN LOGO

Drawing Number 5904

Scale

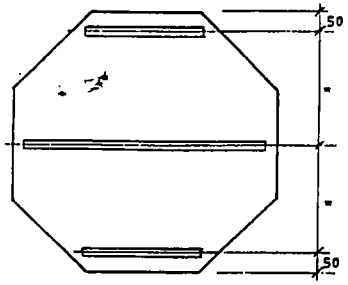
Sheet of

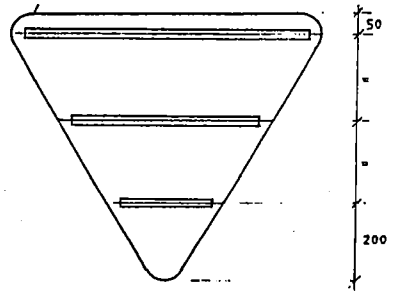
Drawn	Checked	Recommended	Approved Director of Operations

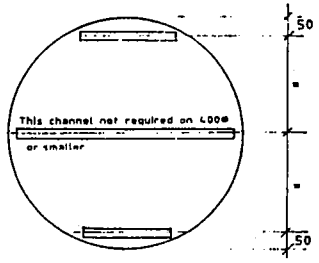
Appendix C

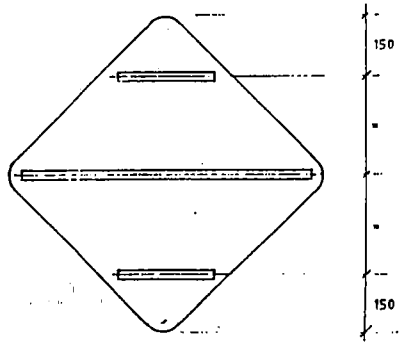
Fig. 22 (a)

M:\1524\ACAD\C-22A.DWG

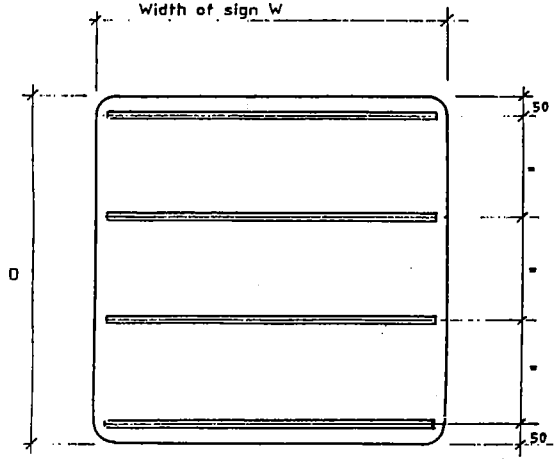




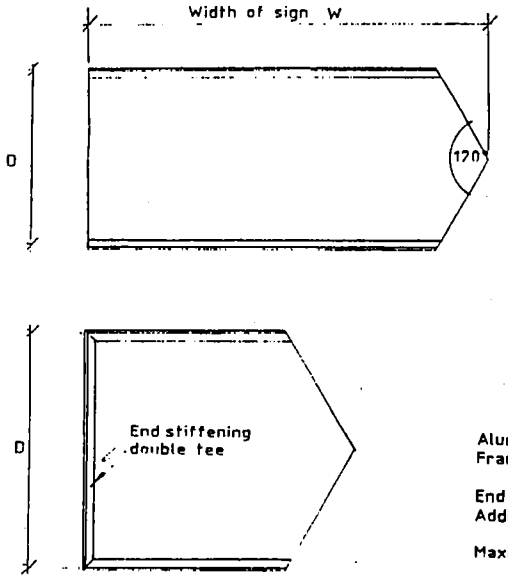


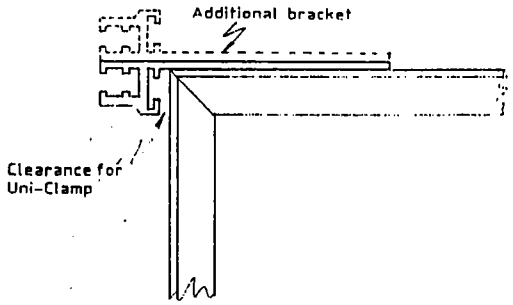


Aluminium substrate 2.5mm thick, alloy HE30 (6061/T6)
SIGNFIX small channel section 19NZ7888, length to be to 25mm from edge of sign
Rivets at maximum centres 150mm with end rivet 25mm from end of channel



Aluminium substrate 2.5mm thick alloy HE30 (6061/T6)
SIGNFIX small channel section 19NZ7888 where W not greater than 600mm.
medium channel section 19NZ7887 on all other signs
Maximum channel spacing, small section 300mm, medium section 500mm
Maximum sign size 2400mm × 1200mm.....for larger signs use Traffic Plank system





Aluminium substrate 2.5mm thick alloy HE30 (6061/T6)
Framing with SIGNFIX Double Tee 22NZ2955 or where W is less than 600mm
use Mini Tee 22NZ6211 extrusion
End stiffening required where D is greater than 450mm
Addition bracket required top and bottom where W is greater than 1200mm
or W x D is greater than 0.6m²
Maximum value for W is 1500mm

SUE	AMENDMENTS	DATE	INITIAL

THE UPPER HUTT CITY COUNCIL

APPROVED
DATE 11/95

	NAME	DATE
DESIGNED	J M NEVILLE	11/95
DRAWN	J M NEVILLE	11/95
CHECKED		11/95
RECOMMENDED		11/95
SCALE	nts	

SIGN CONSTRUCTION

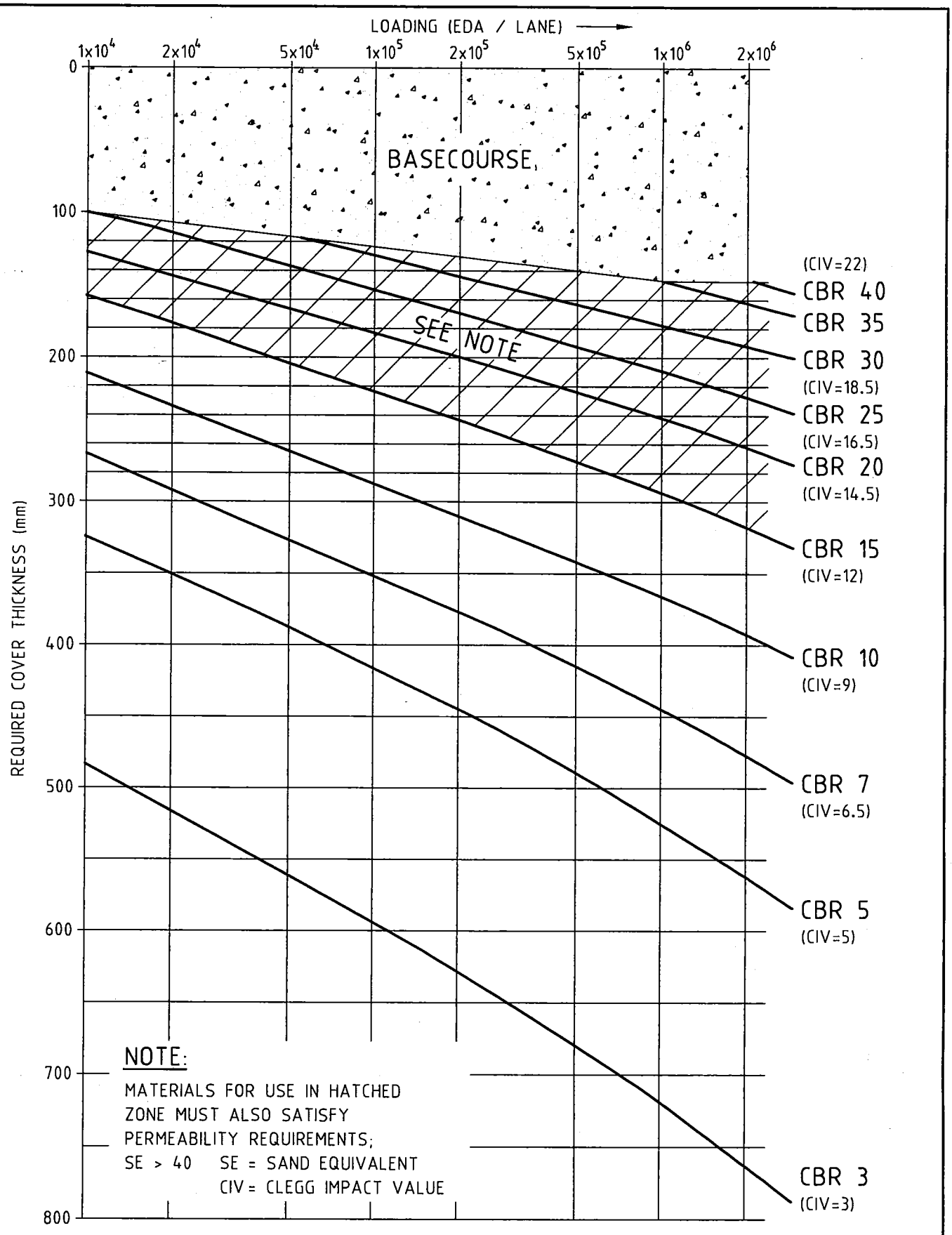
GENERAL DETAILS

Appendix C Fig 23

PLAN No. 5757

SHEET 2 OF 3

FILE 329



UPPER HUTT CITY COUNCIL

ENGINEERING STANDARDS

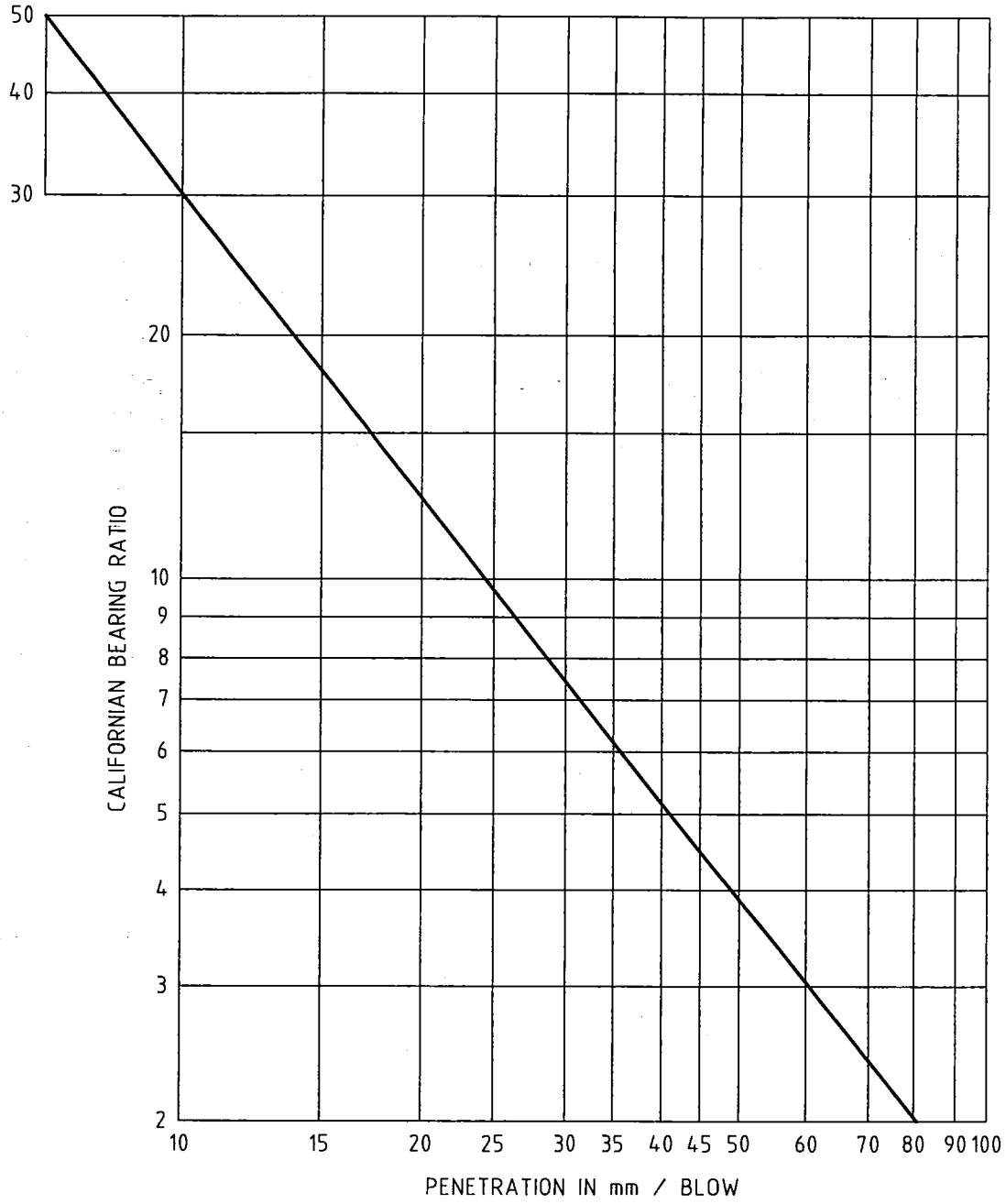
No.	Amendments	Date

DESIGN CHART FOR FLEXIBLE PAVEMENTS WITH THIN SURFACING FROM N.R.B.S/4 OCT. 1974

Drawing Number	5904	
Scale 1:20		Sheet of
Appendix C		Fig. 24

Drawn	Checked	Recommended	Approved Director of Operations

M:\1524\ACAD\C-24.DWG



CORRELATION OF DYNAMIC CONE BLOWS PER mm AND CALIFORNIAN BEARING RATIO (SCALA PENETROMETER)

DOES NOT APPLY TO COHESIONLESS SOILS
UNLESS VERIFIED BY FIELD CBR TEST.

UPPER HUTT CITY COUNCIL

ENGINEERING STANDARDS

No.	Amendments	Date

RELATIONSHIP CBR V's SCALA PENETROMETER

Drawing Number 5904

Scale 1:20

Sheet of

Drawn	Checked	Recommended	Approved Director of Operations

Appendix C

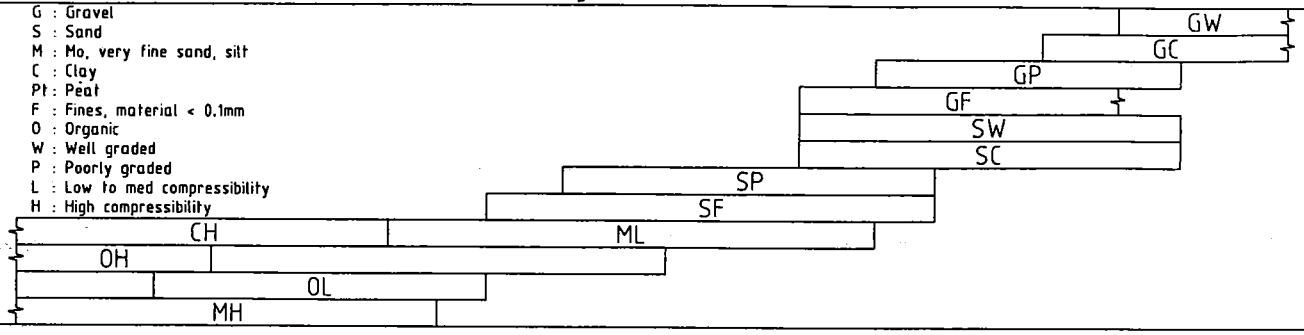
Fig. 25

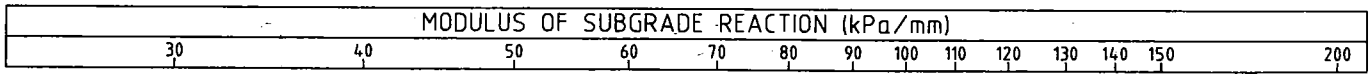
M:\1524\ACAD\C-25.DWG

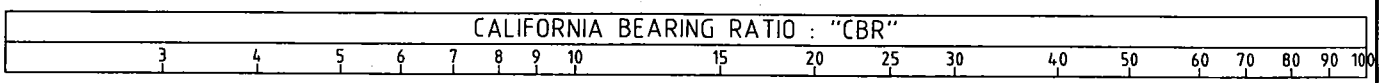
VERY POOR SUBGRADE	POOR SUBGRADE	FAIR TO GOOD SUBGRADE	EXCELLENT SUBGRADE	GOOD SUB-BASE	GOOD BASE	BEST BASE

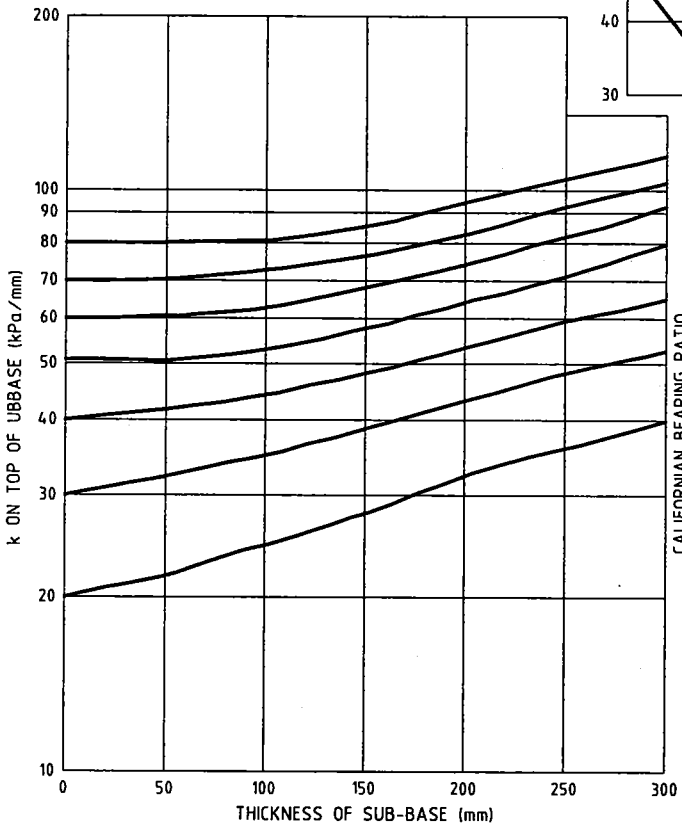
U. S. E. D. (Casagrande's) SOIL CLASSIFICATION

G : Gravel
S : Sand
M : Mo, very fine sand, silt
C : Clay
Pt : Peat
F : Fines, material < 0.1mm
O : Organic
W : Well graded
P : Poorly graded
L : Low to med compressibility
H : High compressibility

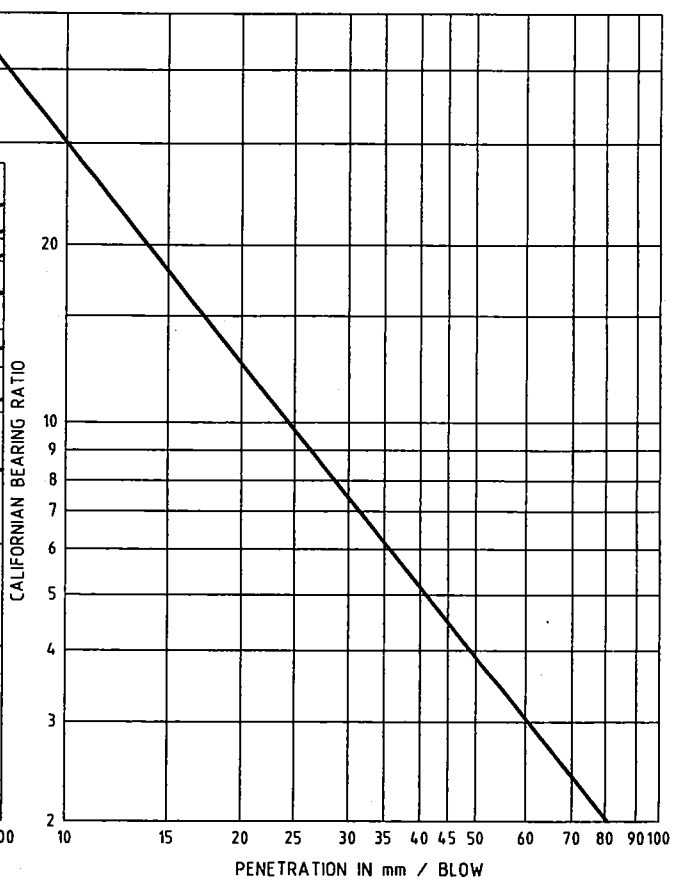








EFFECT OF VARIOUS SUB - BASE THICKNESSES ON k VALUE



CORRELATION OF DYNAMIC CONE BLOWS PER mm AND CALIFORNIAN BEARING RATIO (SCALA PENETROMETER)

DOES NOT APPLY TO COHESIONLESS SOILS UNLESS VERIFIED BY FIELD CBR TEST.

UPPER HUTT CITY COUNCIL

ENGINEERING STANDARDS

No.	Amendments	Date

PARAMETER RELATIONSHIP

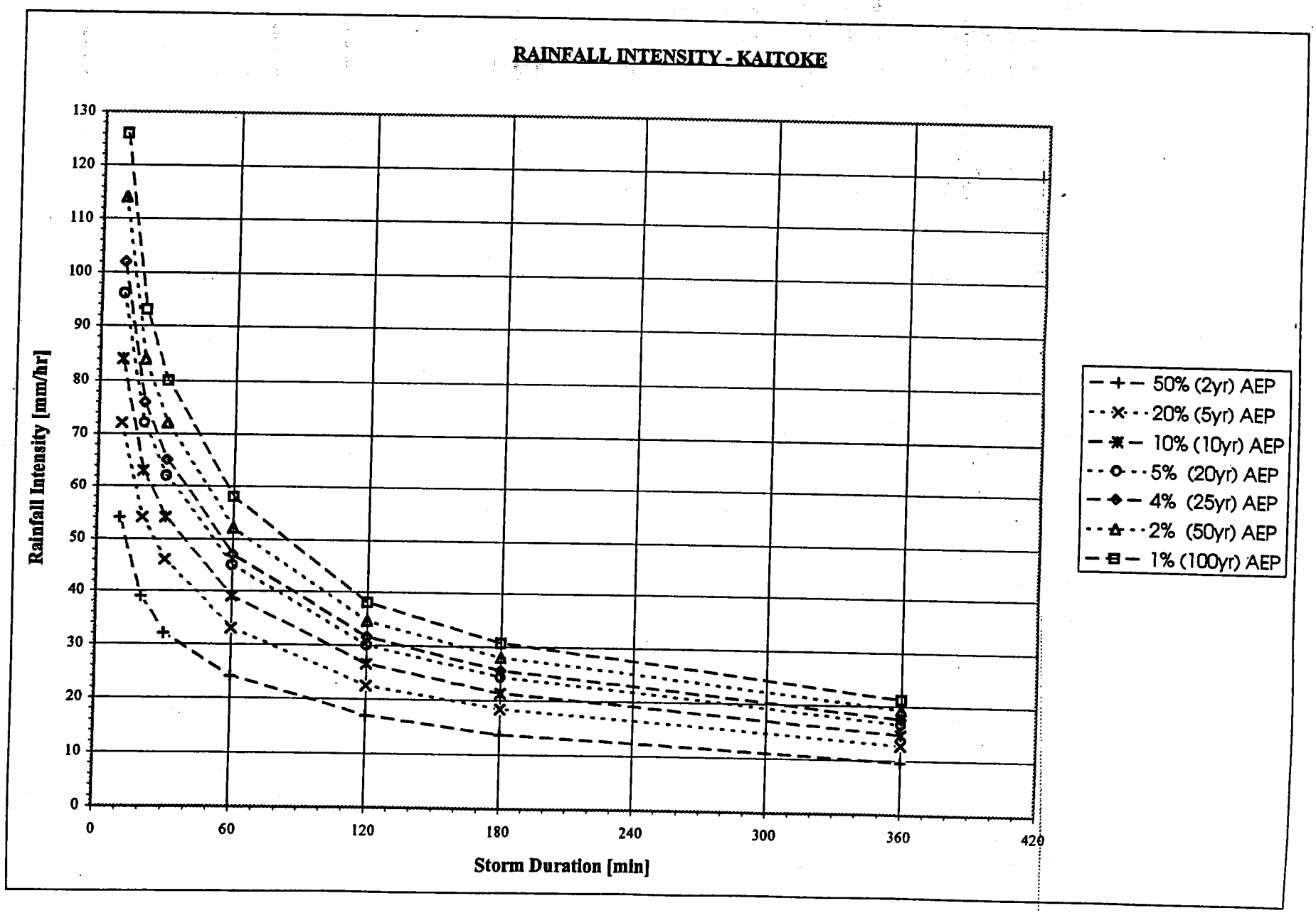
Drawing Number 5904

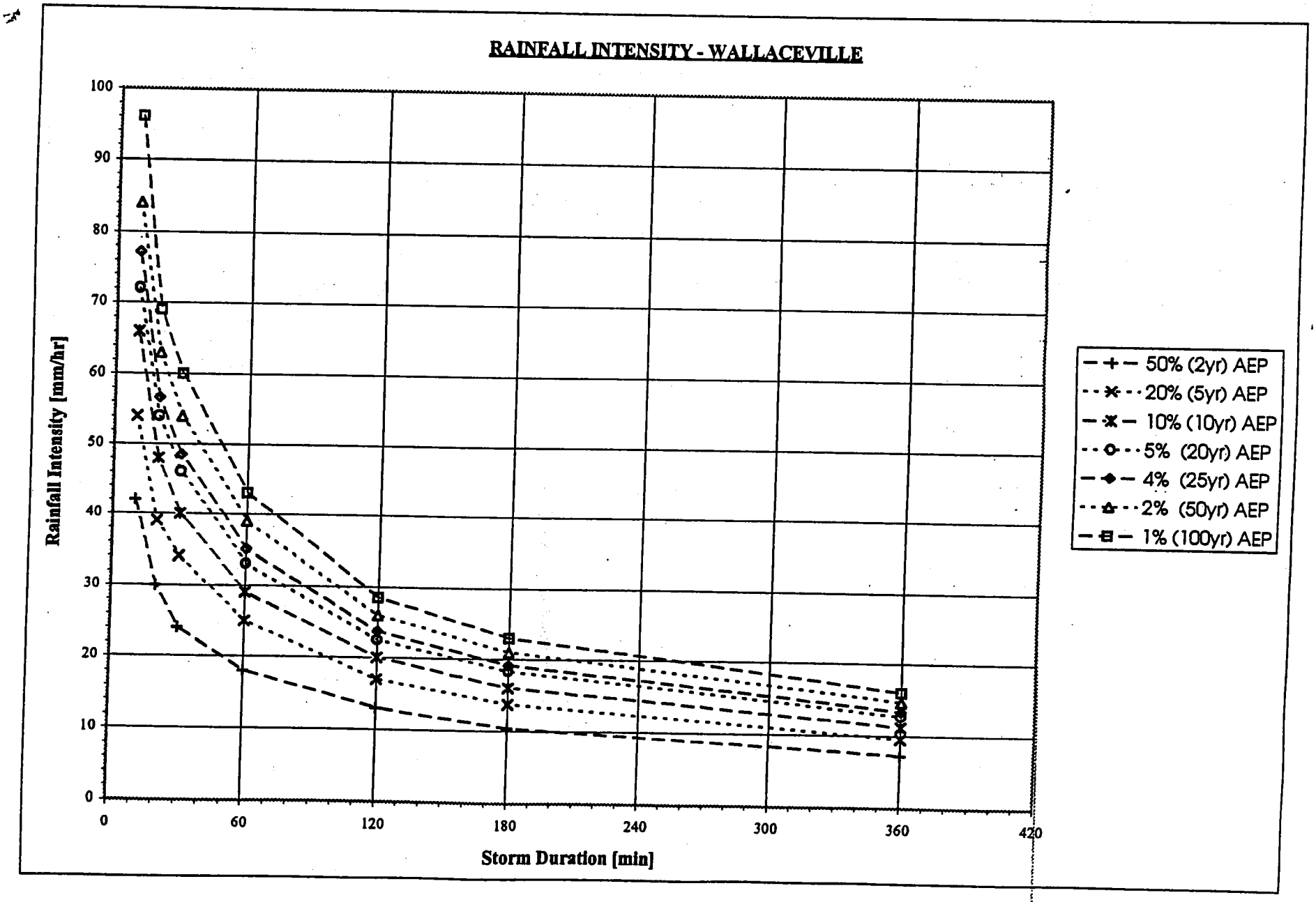
Scale 1:20

Sheet of

Drawn	Checked	Recommended	Approved Director of Operations	Appendix	Fig.
				C	26

M:\1524\ACAD\C-26.DWG


RAINFALL INTENSITY - KAITOKE
Rainfall Intensity [mm/hr]
130
120
110
100
90
80
70
60
50
40
30
20
10
0
0
60
120
180
240
300
360
420
Storm Duration [min]
50% (2yr) AEP
20% (5yr) AEP
10% (10yr) AEP
5% (20yr) AEP
4% (25yr) AEP
2% (50yr) AEP
1% (100yr) AEP



Appendix C, Fig 28

APPENDIX C, FIGURE 29

RATIONAL FORMULA / RUNOFF COEFFICIENT

The description of the Rational Method and its inputs which follows is applicable to and will generally be acceptable for use with catchments of 500 Ha or less. For larger catchments and in some cases for catchments of less than 500 Ha specific methods will need to be selected to best suit the catchment being considered.

The Rational formula is:

$$Q = \frac{CiA}{360}$$

where Q = runoff in cubic metres per second

C = runoff coefficient

i = rainfall intensity in mm/hour

A = area of catchment above the point being considered in hectares

Runoff Coefficient (c)

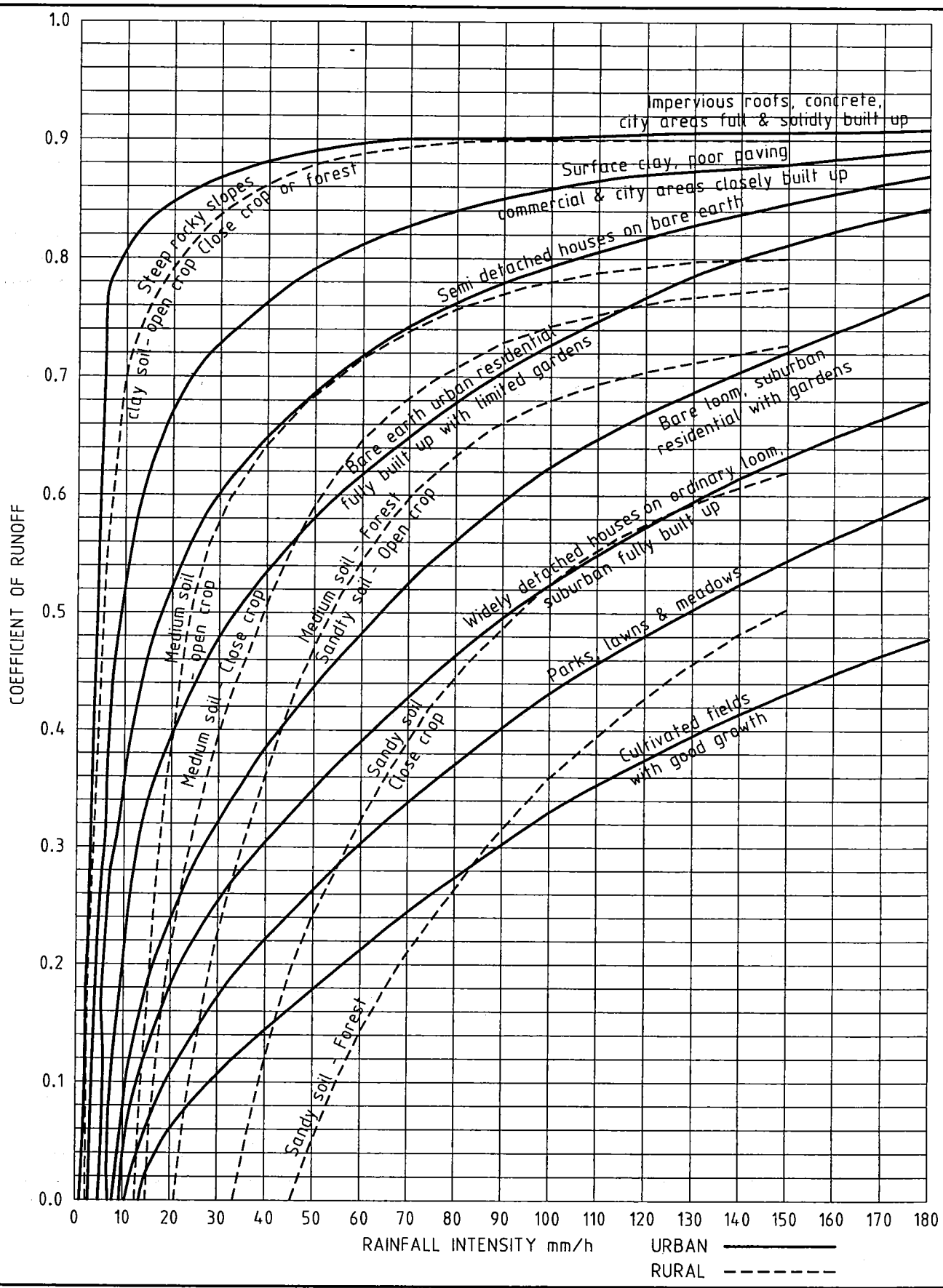
Values of runoff coefficient for various land use types can be obtained from the graph in *Appendix C, Figure 30.* Where an area comprises different land use types, an average run-off coefficient shall be determined based on the areas and run-off coefficients of the component land use types.

The chosen runoff coefficient shall be based realistically on the conditions likely to exist after the full catchment development allowable under the District Plan, including deferred zonings.

The following approximate composite coefficients may be used based on average land use.

Fully paved or roofed areas	C = 0.95
Industrial, commercial, shopping areas, and town house development with limited lawn and garden areas	C = 0.7 (+0.05)
Residential areas in which impervious area exceeds 35% of gross area (includes most urban subdivisions)	C = 0.5 (+0.10)
Other areas	C = 0.35 (+0.15)

The above coefficients are acceptable for flow calculations of frequency 0 to 25 year return period. For less frequent (eg. 50 year and 100 year) events the C values should be increased by not less than the amounts shown in brackets.



UPPER HUTT CITY COUNCIL

ENGINEERING STANDARDS

No.	Amendments	Date

RUNOFF COEFFICIENTS URBAN AND RURAL CATCHMENTS

Drawing Number 5904

Scale 1:20

Sheet of

Drawn	Checked	Recommended	Approved Director of Operations	Appendix	Fig.
				C	30

M:\1524\ACAD\C-30.DWG

APPENDIX C, FIGURE 31

TIME OF CONCENTRATION

The time of concentration, and hence the critical storm duration for a catchment, is the time taken for surface water runoff to reach the design point from the furthest point (in time) of the catchment, so that the whole catchment is contributing to the maximum discharge at the design point for any given probability of occurrence.

It should be noted that in some catchments due to shape, surface water network and varying permeabilities within the catchment, part of the catchment under consideration may produce a higher peak flow than the whole of the catchment. Whilst this may be the result of modelling approximations or real circumstances it needs to be recognised in the analysis and the worst situation used for design. Also for events more rare than the primary design event, when flow is occurring in overland flow paths the time of concentration will have a component of overland flow.

The time of concentration T_c may be calculated from the formula:

$$T_c = t_e + t_f$$

where t_e = Time for runoff to travel overland, from roofs and downpipes from carriageways and gutters, etc, to the 'point of entry' at either a pipe or channel inlet.

t_f = Time of network flow; comprising time of flow in pipes and/or channel to design point.

(a) The time to reach a street sump shall be taken as:-

(i) 5 minutes for Commercial and Industrial areas.

(ii) 10 minutes for Residential areas.

(b) Time of flow in piped drains or watercourses likely to be piped should be calculated from the hydraulic properties of the drain or watercourse. To take into account the effect of the flow "build up" velocities of 0.8 times the flowing full velocity may be used for t_c calculation unless better information is available.

(c) The time to reach a watercourse via overland flow may be calculated using Chart appended as *Appendix C, Figure 33.*

(d) Time of flow in watercourses shall be based on the actual velocity of the flood wave, which is not the peak waterway velocity.

Suitable formulae for the total time of concentration of catchments with limited upstream piping are:

Ramser-Kirpich Formula

$$T_c = 0.0195 L^{0.77} S_a^{-0.385}$$

where Tc is time of concentration, in minutes

Sa is average channel slope, in m/m

L is flow length from the farthest point on the catchment to the outlet, in m.

Bransby-Williams Formula

$$T_c = \frac{0.953\,L^{1.2}}{A^{0.1}H^{0.2}}$$ **Error! Switch argument not specified.**

where T_c is time of concentration, in hours

L is maximum flow length, in km (100 Ha = 1 km^3)

A is catchment area, in km^2

H is the difference in elevation between the highest and lowest points on the main channel, in metres

US Soil Conservation Service Formula

$$T_c = \left(\frac{0.87\,L^3}{H}\right)^{0.385}$$ **Error! Switch argument not specified.**

where T_c is time of concentration, in hours

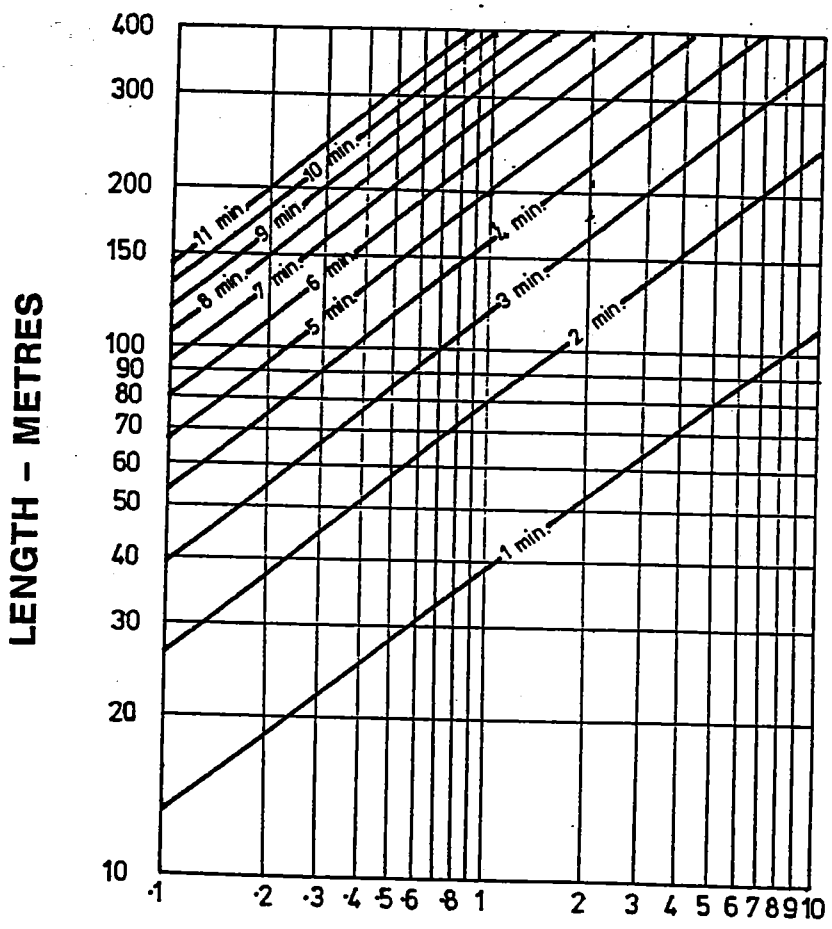
L is maximum flow length, in km

H is the difference in elevation between the highest and lowest points on the main channel, in metres

The Bransby-Williams formula tends to over-estimate the time of concentration (T_c) for smaller catchments and all the formulae will give different answers. Generally T_c should be calculated by more than one method before defining the design T_c which should be rounded to the nearest 5 minutes.

These formulae account for both overland and stream flow components.

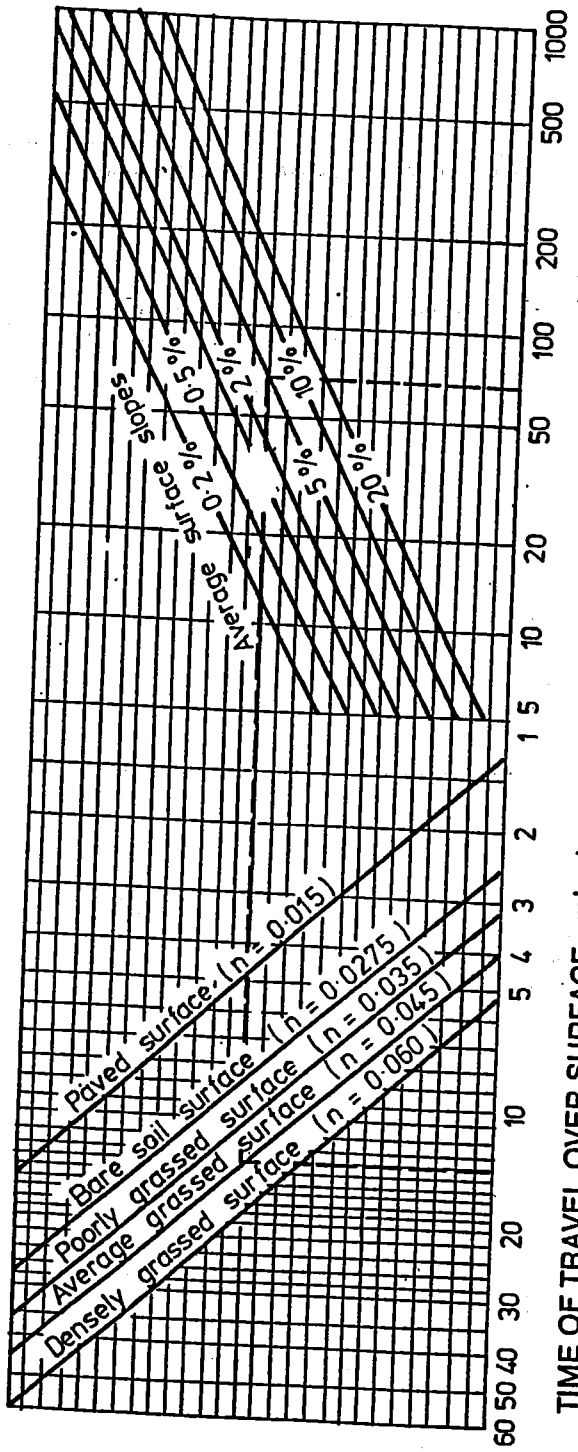
Time of Gutter Flow
This is the time of flow from entry to the gutter (road carriageway channel) to entry at the catchpit. The method described here requires to know the length and slope of the gutter. The time of flow is obtained from the Chart in Figure 3.



GUTTER FLOW TIME

From Institution of Engineers Australia 1977.
'Australian Rainfall & Runoff Flood Analysis & Design'

UPPER HUTT CITY COUNCIL			ENGINEERING STANDARDS
No	Ammendments	Date	GUTTER FLOW TIME
			Drawing Number
			Scale / Sheet of
Drawn	Checked	Recommended	Approved Director of Operations
			Appendix C Fig. 32



TIME OF TRAVEL OVER SURFACE - minutes

LENGTH OF OVERLAND FLOW - metres

TIMES FOR SURFACE FLOW

(2) *Institution of Engineers Australia 1977. 'Australian Rainfall & Runoff Flood Analysis & Design'.*

UPPER HUTT CITY COUNCIL

ENGINEERING STANDARDS

No	Ammendments	Date

SURFACE FLOW TIMES

Drawing Number

Scale | Sheet of

Drawn | Checked | Recommended | Approved | Director of Operations

Appendix C Fig 33

APPENDIX C, FIGURE 34

OPEN CHANNEL DESIGN

Capacities of open channels and secondary flow paths can be determined using Mannings formula.

$$V = \frac{R^{2/3} S^{1/2}}{n}$$ **Error! Switch argument not specified.**

where V is Velocity in metres/second

n is Coefficient of Roughness of the channel surfaces

R is the hydraulic radius of the channel in metres

$$\left(R = \frac{Wetted\ Area\ of\ water\ way}{wetted\ perimeter} \right)$$ **Error! Switch argument not specified.**

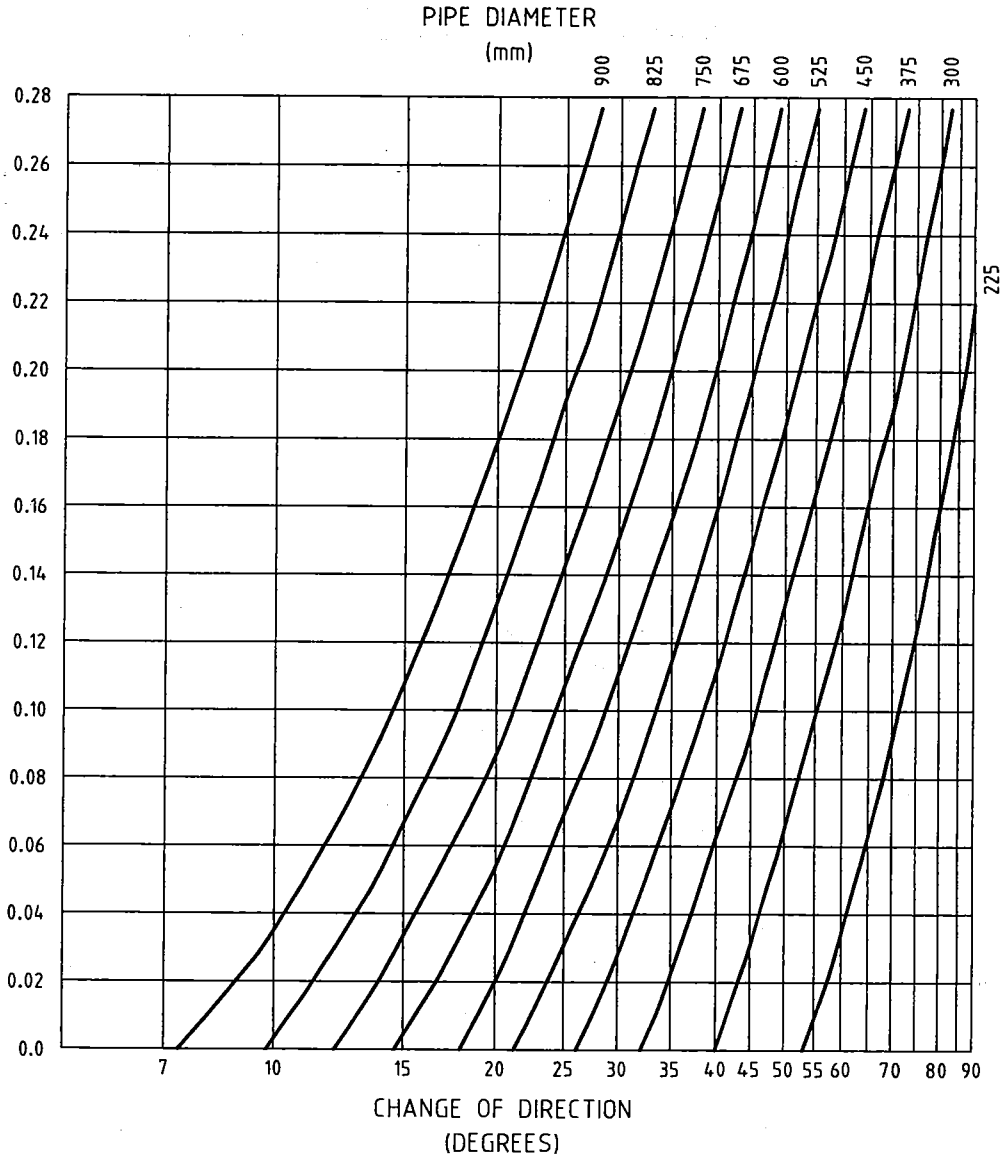
S is Channel Slope

Typical "n" values allowing for average condition and the inevitable presence of some debris in most channels are:

Corrugated metal drains	n = 0.025
Concrete channels/culverts	n = 0.016
Maintained/grazed grass straight channels	n = 0.025 to 0.04
Other natural channels (require specific consideration)	n = 0.03 to 0.15

A suitable visual guide to roughness factors is provided in the book, "Roughness Characteristics of NZ Rivers", Hicks and Mason, Water Resources Survey, DSIR Marine and Freshwater, 1991.

LOSS COEFFICIENT K FOR CHANGE OF DIRECTION IN 1050 DIA. ACCESS CHAMBER



UPPER HUTT CITY COUNCIL

ENGINEERING STANDARDS

No	Amendments	Date

ENERGY LOSS COEFFICIENTS THROUGH STANDARD MANHOLE

Drawing Number 5904

Scale 1:20

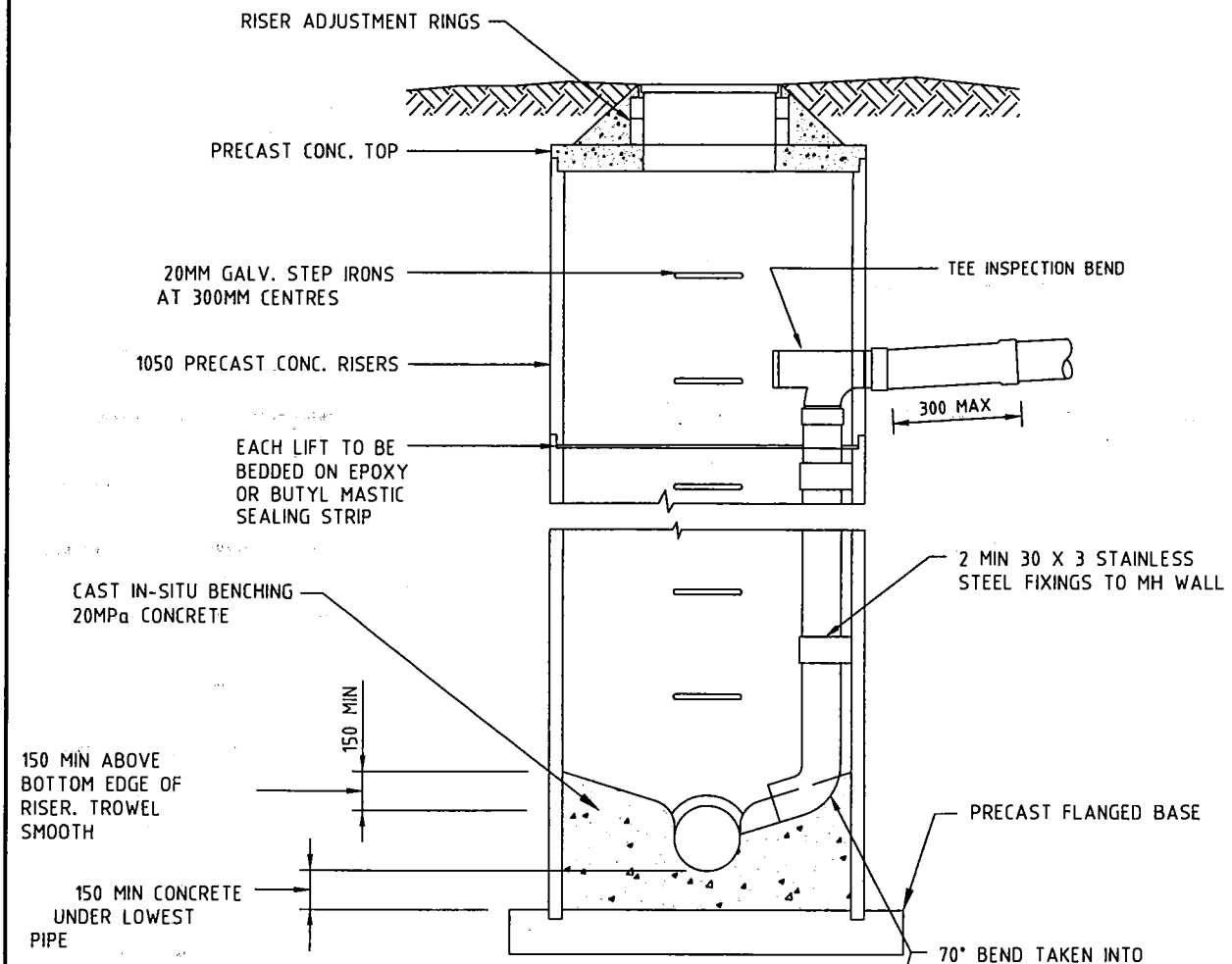
Sheet of

Drawn	Checked	Recommended	Approved Director of Operations

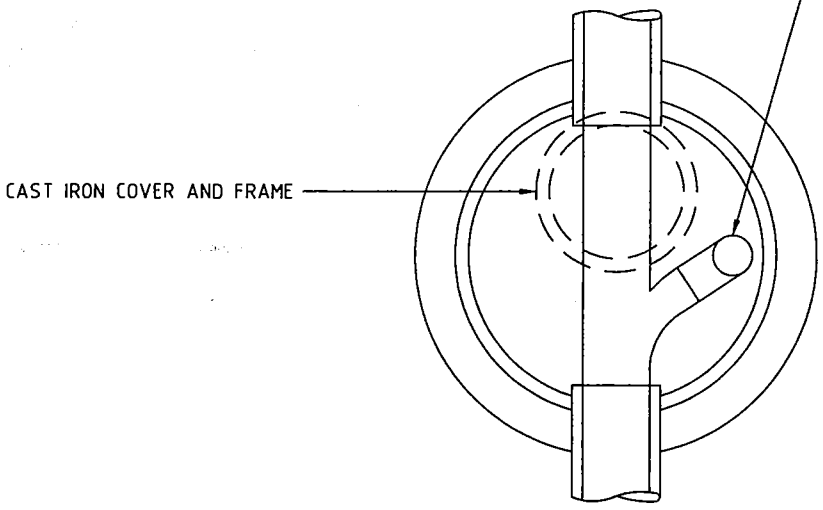
Appendix C

Fig. 35

M:\1524\ACAD\C-35.DWG



TYPICAL ELEVATION



PLAN

NOTE :-
INTERNAL DROP MANHOLE SUITABLE FOR DROPPING PIPES OF 150 MM I.D. MAX

UPPER HUTT CITY COUNCIL

ENGINEERING STANDARDS

No.	Amendments	Date

DROP MANHOLE

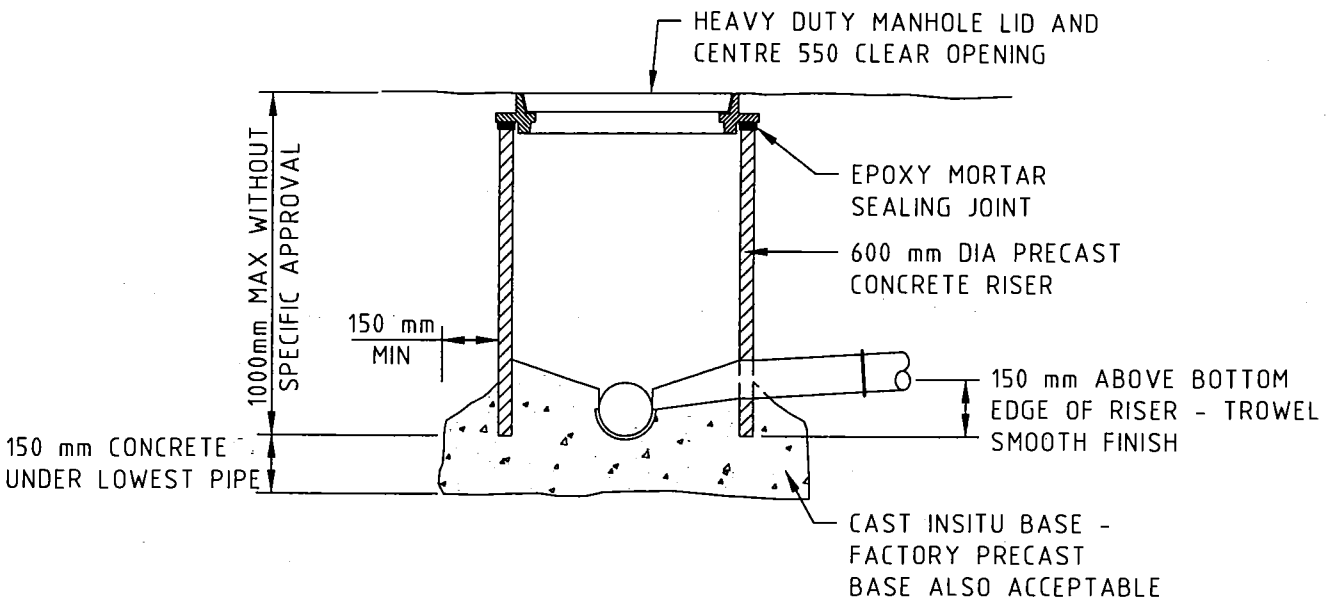
Drawing Number 5904

Scale

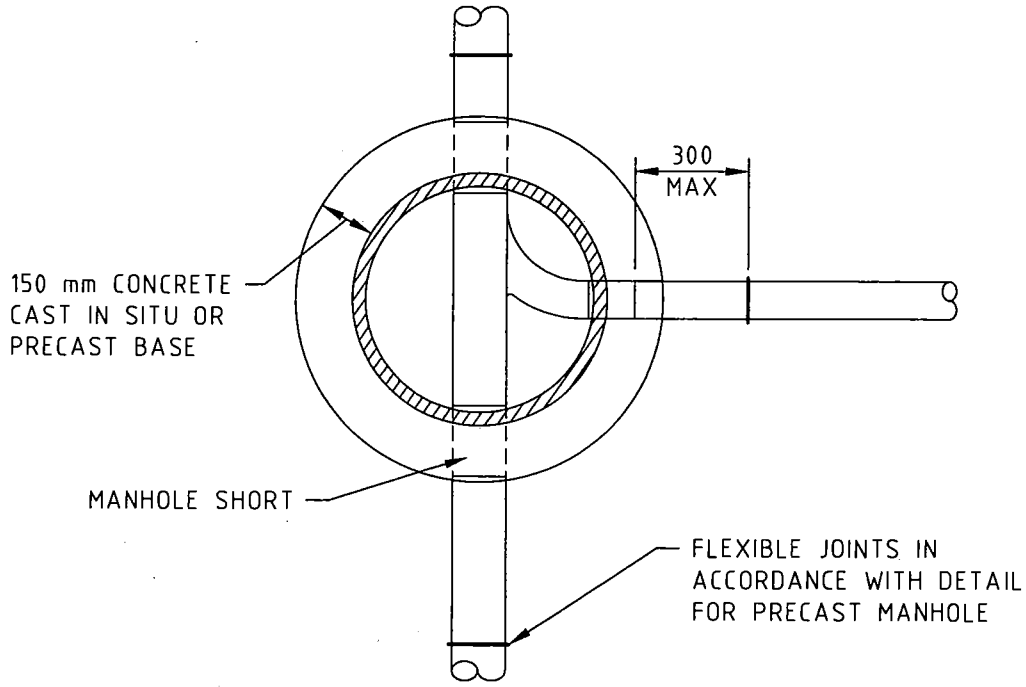
Sheet of

Drawn	Checked	Recommended	Approved Director of Operations	Appendix	Fig.
				C	36

M:\1524\ACAD\C-36.DWG



TYPICAL SECTION



NOTES:

1 MINI-MANHOLES ARE NOT TO BE USED ON PIPES OF GREATER DIAMETER THAN 250mm.

2. CONNECTIONS INTO MINI-MANHOLES SHALL HAVE A MAXIMUM DIAMETER OF 100mm AND WILL NORMALLY BE LIMITED TO TWO. STANDARD MANHOLES ARE REQUIRED AT A MAXIMUM OF 90m CENTRES.

UPPER HUTT CITY COUNCIL

ENGINEERING STANDARDS

No.	Amendments	Date

PRECAST MINI-MANHOLES

Drawing Number 5904

Scale

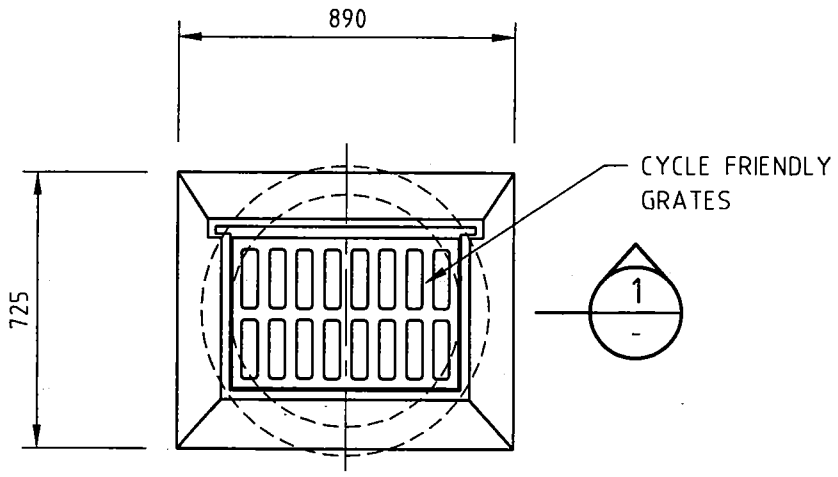
Sheet of

Drawn	Checked	Recommended	Approved Director of Operations

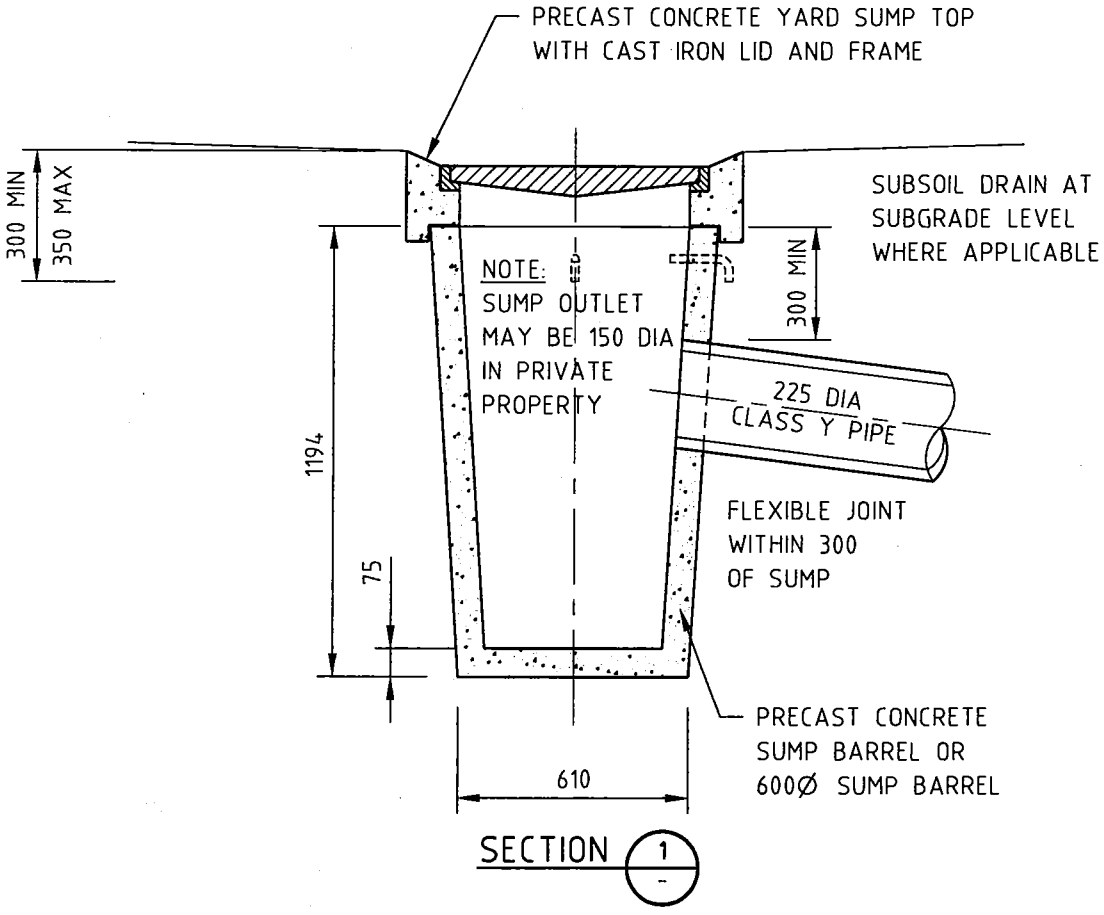
Appendix C

Fig. 37

M:\1524\ACAD\C-37.DWG



PLAN



UPPER HUTT CITY COUNCIL

ENGINEERING STANDARDS

No.	Amendments	Date

YARD SUMP

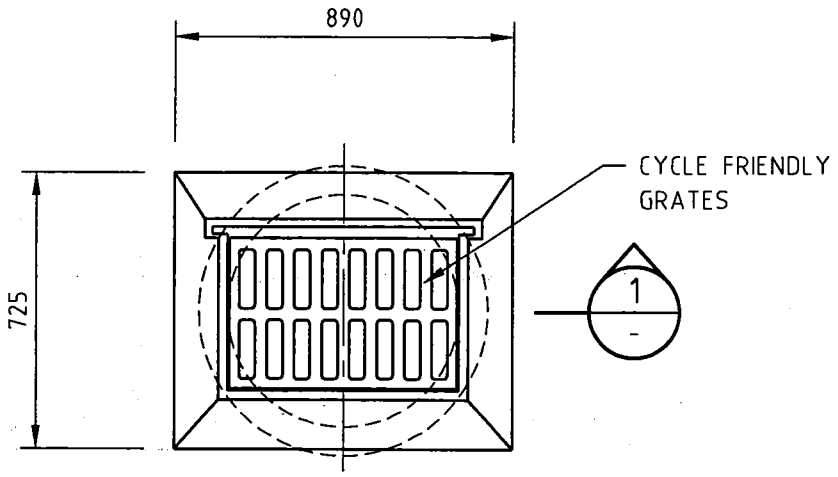
Drawing Number 5904

Scale 1:20

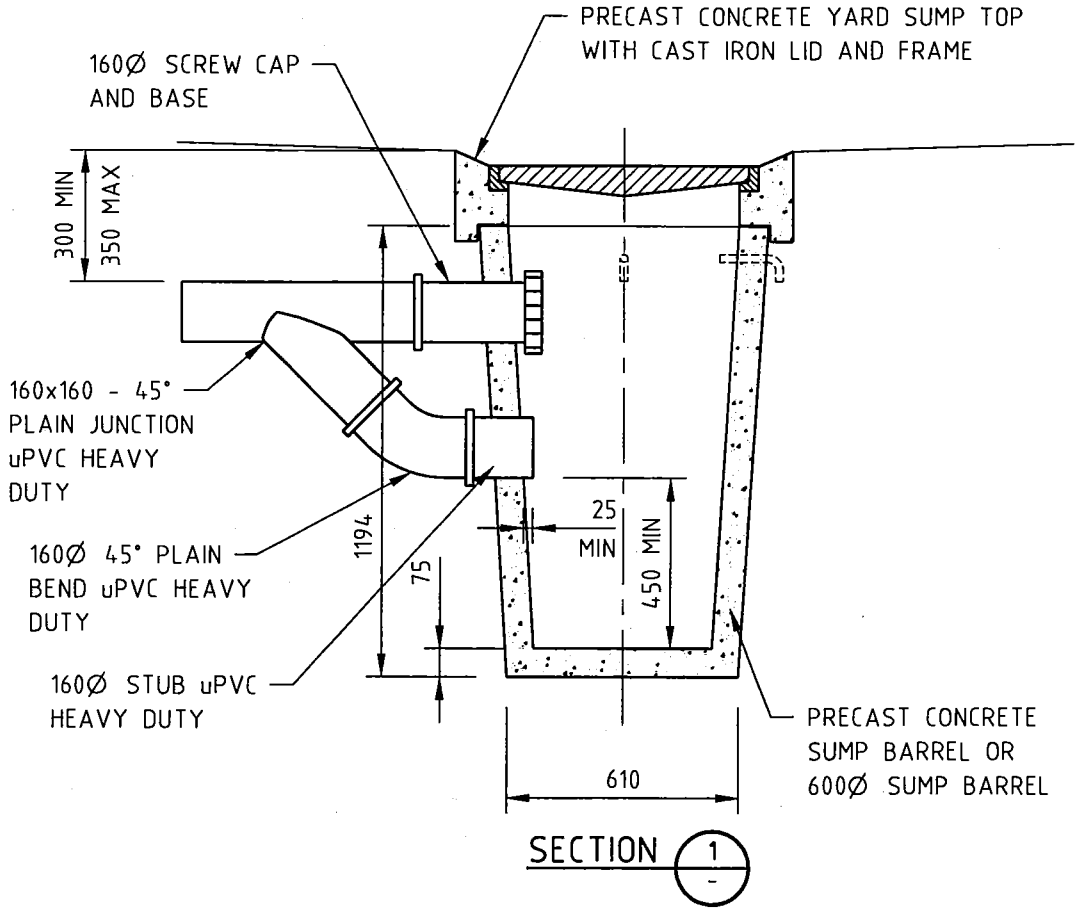
Sheet of

Drawn	Checked	Recommended	Approved Director of Operations	Appendix C	Fig. 38

M:\1524\ACAD\C-38.DWG



PLAN



SECTION 1 -

UPPER HUTT CITY COUNCIL

ENGINEERING STANDARDS

No.	Amendments	Date

TRAPPED YARD SUMP

Drawing Number 5904

Scale 1:20

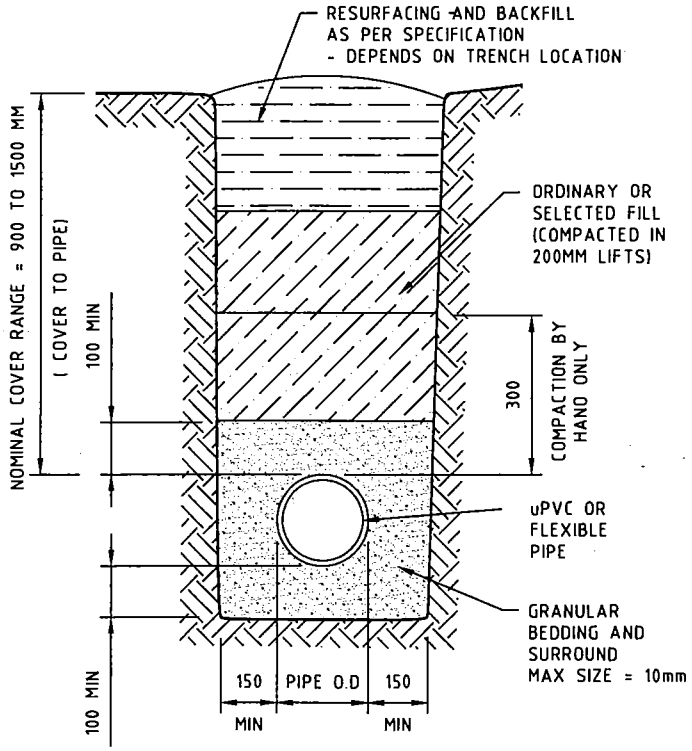
Sheet of

Drawn	Checked	Recommended	Approved	Director of Operations

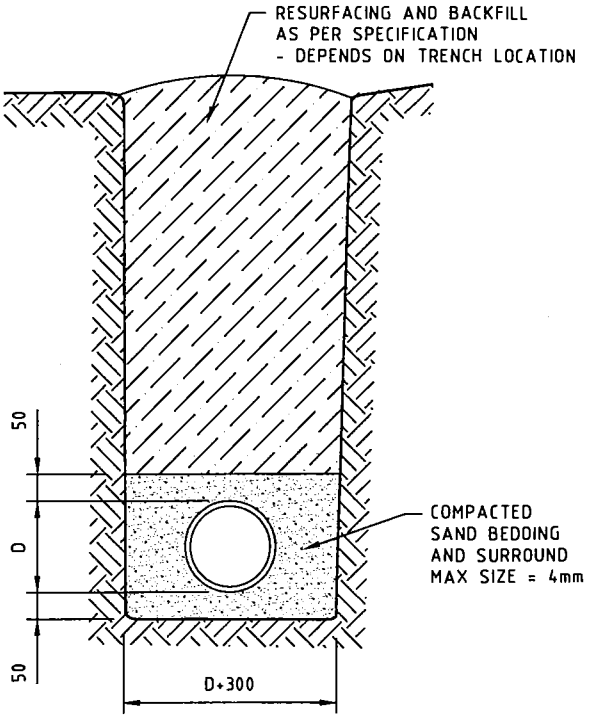
Appendix C

Fig. 39

M:\1524\ACAD\C-39.DWG

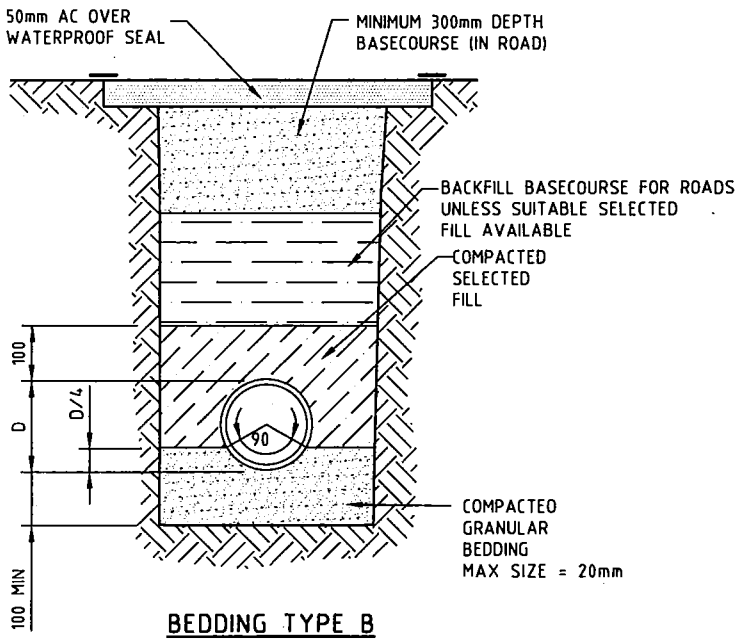


PIPES OVER 63mm DIA.
(ALL TERRAIN)
BEDDING AND SURROUND



PIPES LESS THAN 50mm DIA.
(ALL TERRAIN)

FLEXIBLE PIPES



BEDDING TYPE B
(SHOWING TYPICAL ROAD SITUATION)

NOTES

1. GRANULAR BEDDING AND SURROUND METAL TO BE CLEAN FREE DRAINING METAL OF MAXIMUM SIZE
   RIGID PIPES MAXIMUM SIZE = 20mm
   FLEXIBLE PIPES = 10mm
2. MAXIMUM TRENCH WIDTH TO BE OD + 400mm

A) FLEXIBLE PIPES INCLUDE :-
   HIGH, MEDIUM AND LOW DENSITY POLYETHYLENE PIPES
   POLYBUTYLENE PIPES
   ALL FORMS OF PVC PIPES
   ALL FORMS OF FIBREGLASS PIPES
   COPPER AND ANY OTHER METAL PIPES WITH EASILY DEFORMED WALLS

B) RIGID PIPES INCLUDE :-
   ALL CONCRETE PIPES
   ALL CORRUGATED STEEL AND ALUMINIUM PIPES
   ALL EARTHENWARE PIPES
   ALL STEEL, IRON OR DUCTILE PIPES
   REGARDLESS OF JOINT TYPE.

RIGID PIPES

UPPER HUTT CITY COUNCIL

ENGINEERING STANDARDS

No.	Amendments	Date

PIPE BEDDING REQUIREMENTS

Drawing Number 5904

Scale

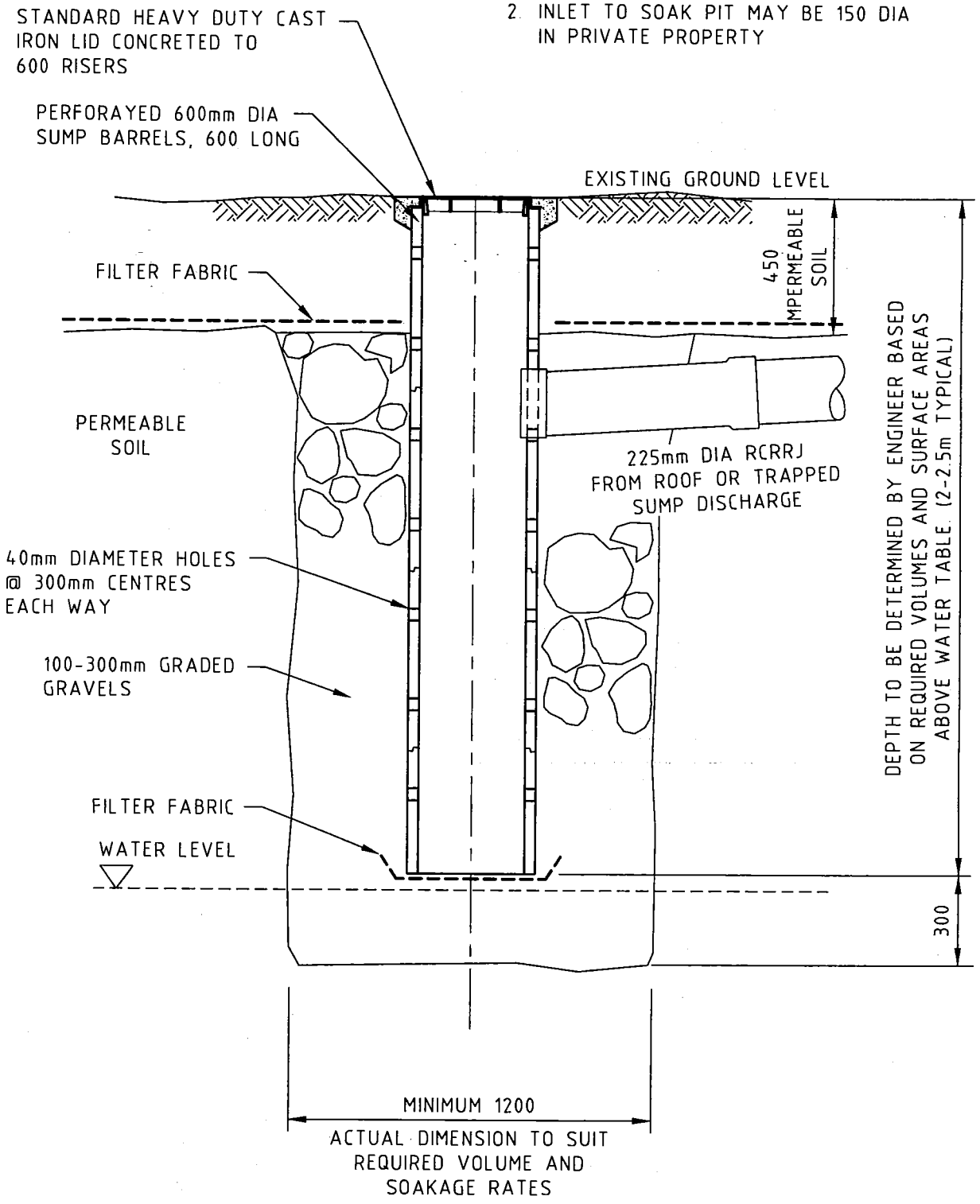
Sheet of

Drawn	Checked	Recommended	Approved Director of Operations	Appendix C	Fig. 40

M:\1524\ACAD\C-40.DWG

NOTE

1. EFFECTIVE STORAGE VOLUME IS APPROX EQUAL TO THE RISER VOLUME + 40% OF THE STONE FILLED ZONE
2. INLET TO SOAK PIT MAY BE 150 DIA IN PRIVATE PROPERTY



UPPER HUTT CITY COUNCIL

ENGINEERING STANDARDS

No.	Amendments	Date

STANDARD SOAK PIT MANHOLE

Drawing Number 5904

Scale 1:20 | Sheet of

Drawn	Checked	Recommended	Approved Director of Operations	Appendix	Fig.
				C	41

M:\1524\ACAD\C-41.DWG

M:\1524\ACAD\C-42.DWG

UPPER HUTT CITY COUNCIL

ENGINEERING STANDARDS

SERVICE CORRIDORS

No.	Amendments	Date

Drawn

Checked

Recommended

Approved Director of Operations

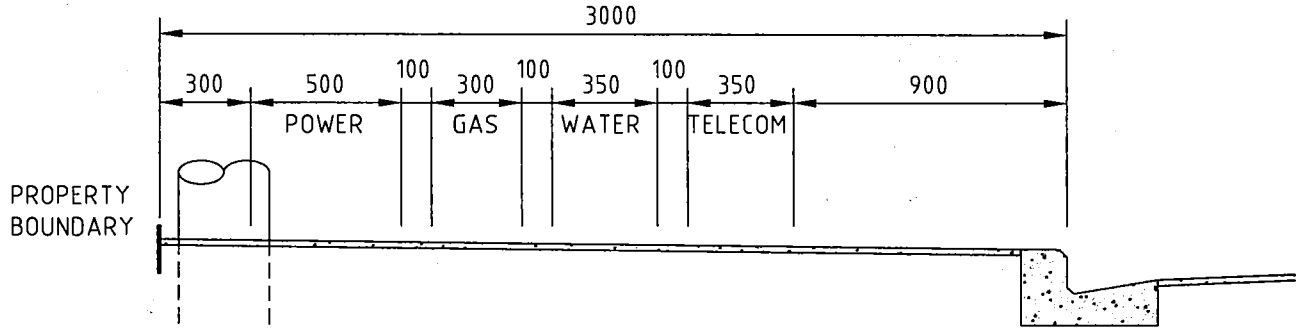
Drawing Number 5904

Scale 1:25

Sheet of

Appendix C

Fig 42



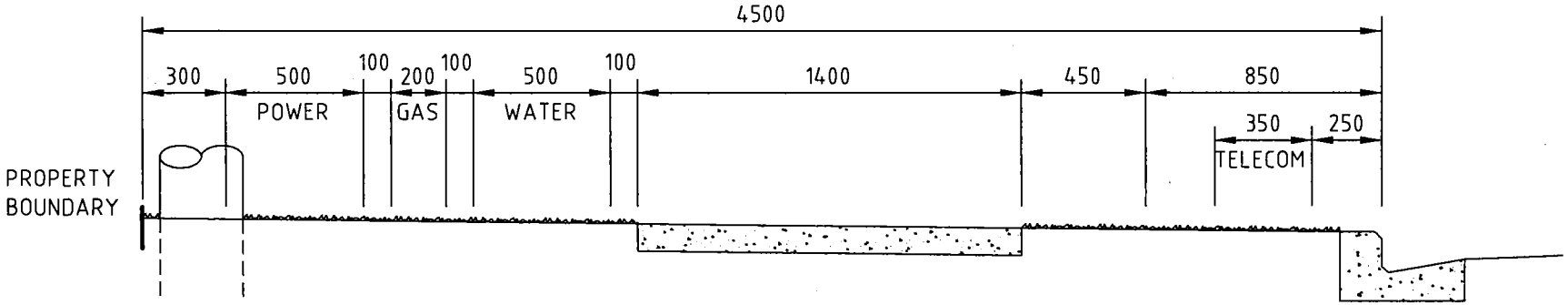
INDUSTRIAL AND COMMERCIAL

WASTEWATER & STORMWATER MAINS

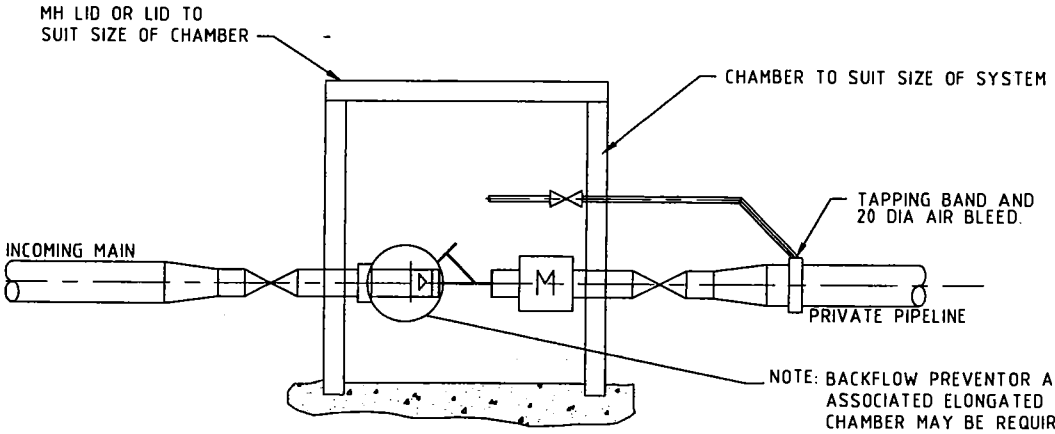
SHALL BE LAID IN THE ROAD CARRIAGEWAY WITH ALIGNMENT AND POSITIONS OF SURFACE OPENINGS CLEAR OF MAIN TRAFFIC WHEEL LINES.

TRUNK MAINS

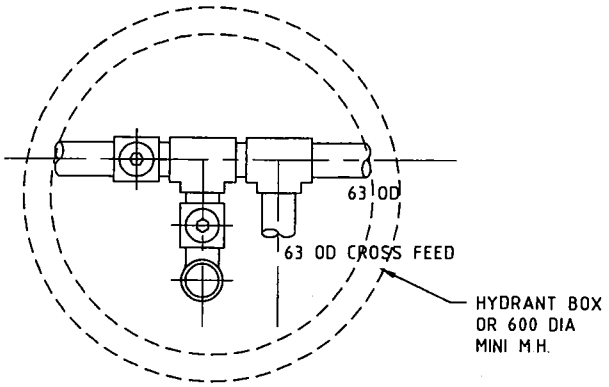
SUCH AS LARGE DIAMETER WATER & WASTEWATER MAINS WITH LIMITED CONNECTIONS SHALL GENERALLY BE LAID IN THE CENTRE OF THE ROAD CARRIAGEWAY.



OTHER ROADS

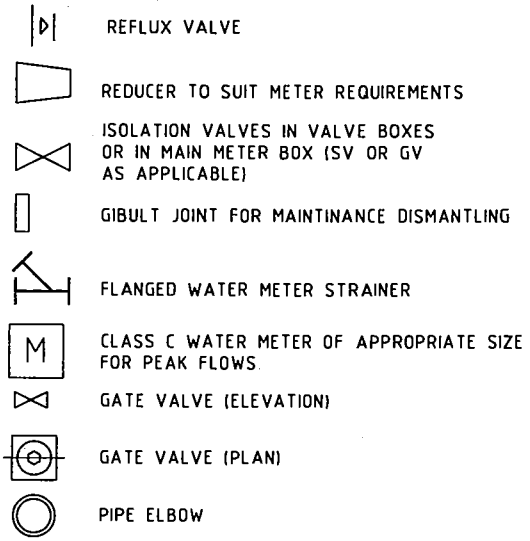


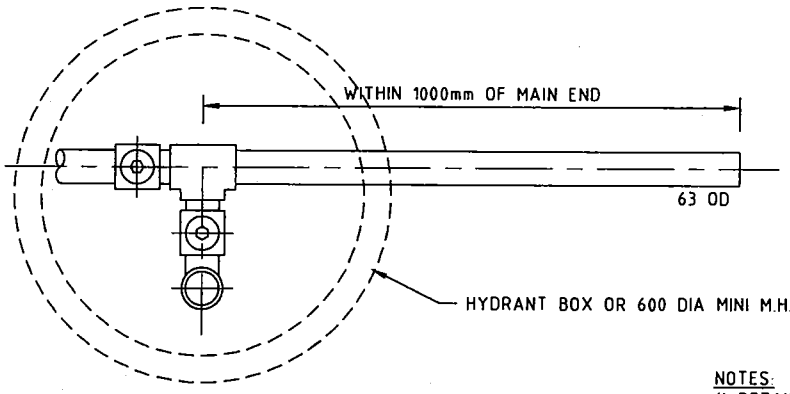
SCHEMATIC LAYOUT - WATER METER



SCHEMATIC DETAIL RIDER MAIN SCOUR AT NON-DEAD END

(SCALE 1:10)





SCHEMATIC DETAIL RIDER MAIN SCOUR AT DEAD END

(SCALE 1:10)

NOTES:
1) DETAILS SCHEMATIC-PIPE JOINTS AND FITTING DETAILS TO BE SELECTED BASED ON PIPE TYPE AND DIAMETER

UPPER HUTT CITY COUNCIL

ENGINEERING STANDARDS

No.	Amendments	Date

SCHEMATIC WATER DETAILS WATER METER & RIDER MAIN SCOURS

Drawing Number 5904

Scale 1:20

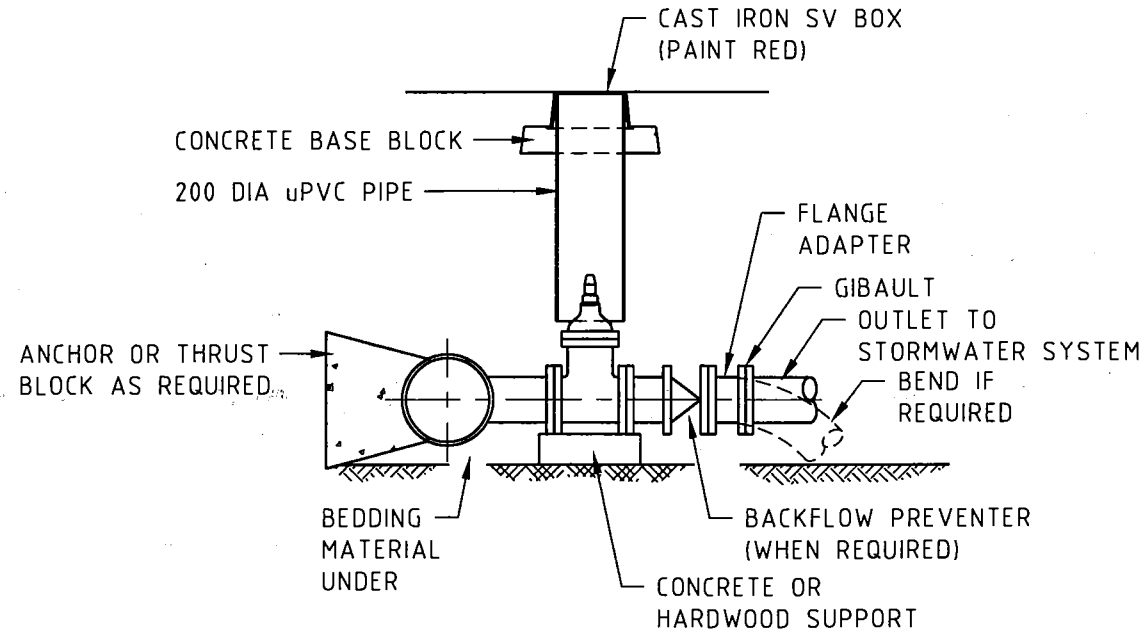
Sheet of

Drawn	Checked	Recommended	Approved Director of Operations

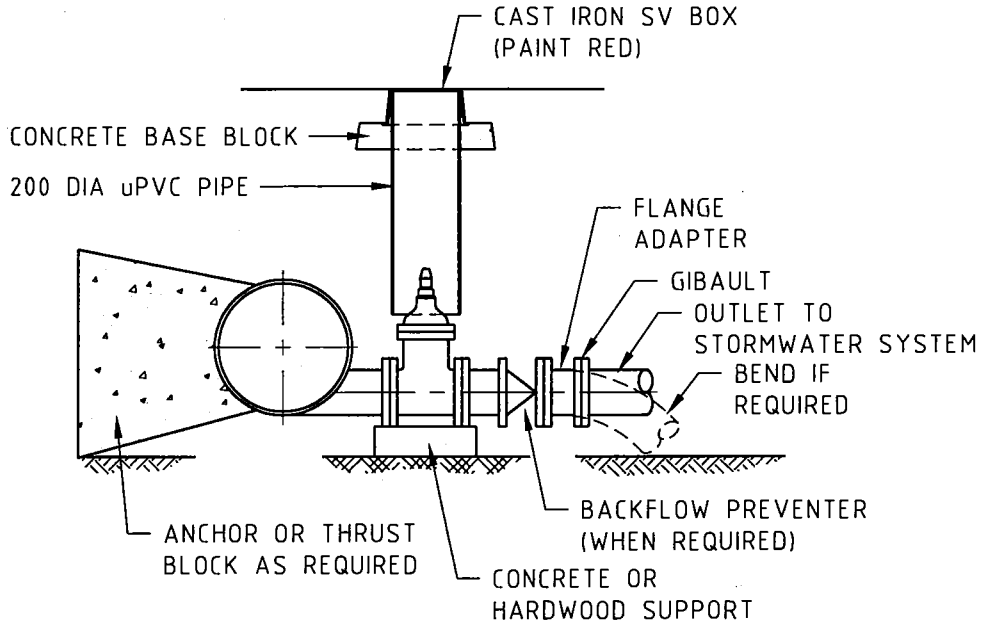
Appendix C

Fig. 43

M:\1524\ACAD\C-43.DWG



FOR MAINS UP TO DN 250mm



FOR MAINS DN 300mm AND LARGER

NOTES:

DIAMETER OF SCOUR TO BE DESIGNED TO PRODUCE SCOURING VELOCITY OF 2.0 METRES PER SECOND WHERE STORMWATER SYSTEM CAN COPE.

UPPER HUTT CITY COUNCIL				ENGINEERING STANDARDS	
No.	Amendments	Date	SCOUR DETAILS	Drawing Number 5904	
				Scale	Sheet of
Drawn	Checked	Recommended	Approved Director of Operations	Appendix C	Fig. 44

M:\1524\ACAD\C-44.DWG

APPENDIX C, FIGURE 45

WATERMAIN THRUST BLOCKS

Approx Thrust (in kN) for Every 10 m Head of Water					
Int. Pipe Diameter	90 Bend	60 Bend, Tee or Deadend	45 Bend	22.5 Bend	11.25 Bend
100	1.4	0.95	0.75	0.4	0.12
150	2.8	2.0	1.6	0.8	0.4
200	4.9	3.5	2.7	1.4	0.7
250	7.5	4.9	4.1	2.1	1.1
300	10.7	7.55	5.8	3.0	1.5
375	16.5	11.7	9.0	4.6	2.4
450	23.5	16.7	12.75	6.5	3.3
525	31.8	22.5	17.2	8.8	4.5
600	41.3	29.25	22.4	11.4	5.8

Bend thrusts are based on the formula

$$R = 1.57\times10^{-5}\, H d^2 \sin\left(\frac{\theta}{2}\right)$$

with H in m
d in mm
R in kN

Thrusts for Tees or closed end are based on the formula

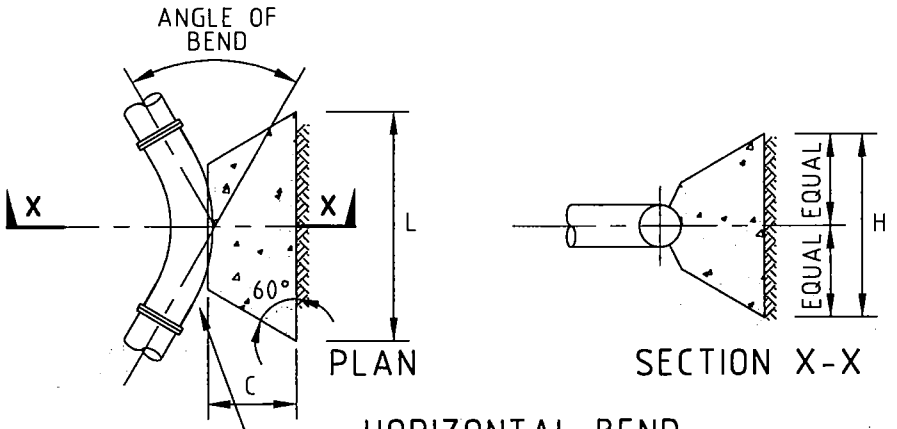
$$R = 0.785\times10^{-5}\, H d^2$$

which equates to the thrust for a 60° bend approx.

The internal diameter is taken as 10 mm greater than the specified nominal dia in preparation of the above table.

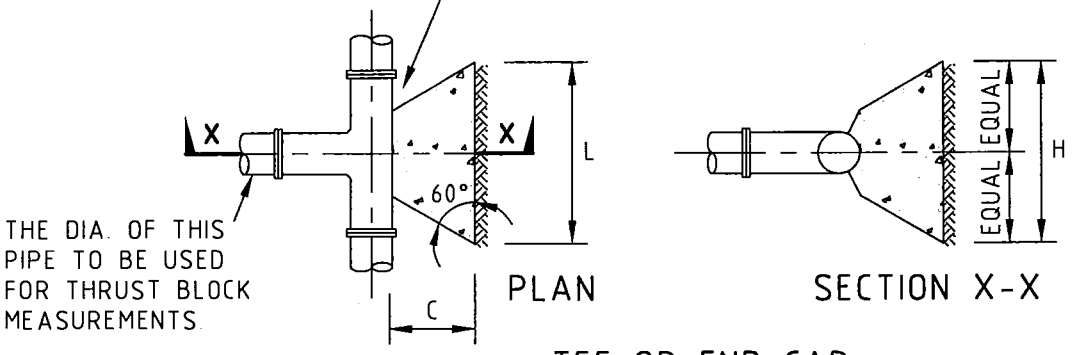
Thrust blocks should be sized based on the worst of test pressures or estimated water hammer pressures whichever are the greater.

Thrust blocks should be poured against natural ground. They should be kept clear of all pipe joints and pipes should not be encased beyond the point of maximum pipe diameter.

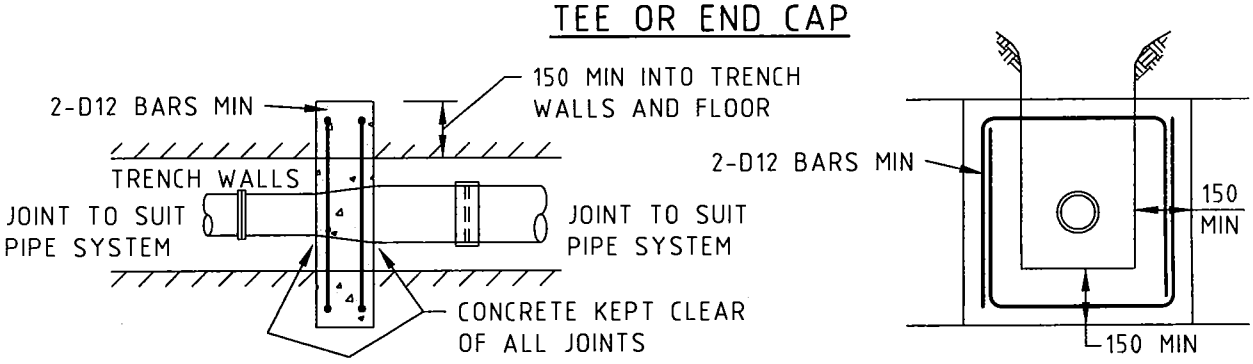


HORIZONTAL BEND

CONCRETE ALWAYS TO BE KEPT CLEAR OF JOINTS



TEE OR END CAP



NOTES

TAPER

1. L MAY BE UP TO 1.4 TIMES H. C SHOULD GENERALLY BE APPROXIMATELY 50% OF L. TAPERS REQUIRE INDIVIDUAL DIMENSIONING
2. THRUST BLOCK CONCRETE SHOULD BE KEPT CLEAR OF ALL PIPE JOINTS AND SHOULD NOT ENCASE BEYOND THE POINT OF MAXIMUM PIPE DIAMETER (EXCEPT FOR TAPERS).
3 UPLIFT THRUSTS DO NOT DEVELOP SOIL BEARING PRESSURE IN THIS WAY AND THEY MUST BE DESIGNED SPECIFICALLY. FOR UPLIFT THRUSTS THE TOTAL THRUST MUST BE HELD BY THE MASS OF THE THRUST BLOCK AND GALVANISED STEEL TENSION STRAPS SHALL BE USED TO HOLD THE PIPE TO THE THRUST BLOCK.
4. ALL BEARING FACES OF THE THRUST BLOCKS TO BE POURED AGAINST NATURAL GROUND.
5. ALL BOLTS SHALL BE POSITIONED SUCH THAT BOLTS CAN BE REPLACED.
6. WRAP ALL PLASTIC PIPES IN DENSO TAPE OVER LENGTHS IN CONTACT WITH THRUST BLOCK CONCRETE.
7. CONCRETE STRENGTH TO BE 20MPa.

UPPER HUTT CITY COUNCIL

ENGINEERING STANDARDS

No	Amendments	Date

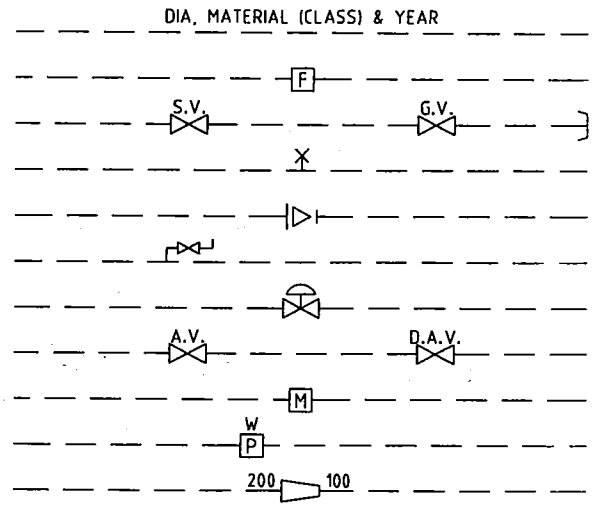
TYPICAL DETAILS
WATERMAIN THRUST BLOCKS

Drawing Number **5904**

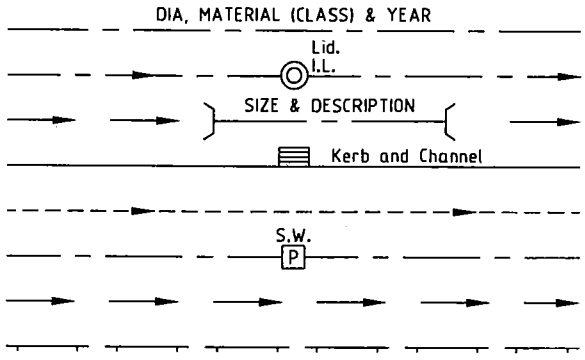
Drawn	Checked	Recommended	Approved Director of Operations	Scale NTS	Sheet of
				Appendix C	Fig 46

M\1524\ACAD\C-46.DWG

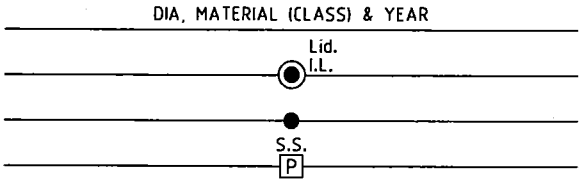
WATER WORKS



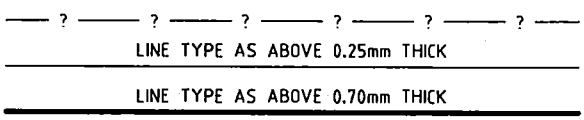
STORMWATER DRAINAGE



WASTEWATER DRAINAGE



MISCELLANEOUS



UPPER HUTT CITY COUNCIL

ENGINEERING STANDARDS

No.	Amendments	Date

STANDARD SERVICE SYMBOLS

Drawing Number 5904

Scale NTS

Sheet of

Drawn	Checked	Recommended	Approved Director of Operations	Appendix	Fig.
				C	47

M:\1524\ACAD\C-47.DWG

APPENDIX C, FIGURE 48

STREET TREES COMPATIBLE WITH UNDERGROUND SERVICES

The following trees have been found suitable for use in berm and other areas in close proximity to underground services. All trees in road reserve shall be planted with a root guard to protect adjacent kerbs and paths.

Botannical Name	Suitable for berm width (m)				Height	Spread	Comments
	0.75-1.25	1.25-1.50	1.50-2.00	2.00 +	(m)	(m)	
Acer rubrum Columnare			x	x	8-10	5-6	
Acer rubrum Scanlon			xRG	x	8-10	5-6	
Acer Palmatum Nigrum				xRG	8-10	6-8	
Alectryon excelsus			xRG	x	8-10	5-6	
Alnus species	xRG	x	x	x	5-6	4-5	
Arbutus unedo	x				4-5	3-4	Suitable for planting under power lines
Betula species		xRG	x	x	8-10	5-6	
Cercis siliquestrum	x	x	x		4-5	3-4	Suitable for planting under power lines
Casuarina species		xRG	x	x	6-8	4-5	
Fraxinus 'oxy' Raywoodii			xRG	xRG	8-10	6-7	
Fraxinus excelsior 'Aurea'			xRG	xRG	8-10	6-7	
Fraxinus mariesii		xRG	x	x	4-5	3-4	Suitable for planting under power lines
Gleditsia 'tri' Sunburst		xRG	x	x	6-7	4-5	
Gleditsia 'tri' Skyline		xRG	x		5-6	4-5	
Liquidamber styraciflua		xRG	x	x	8-10	5-6	Not suitable for exposed windy sites
Liquidamber styraciflua 'richared'		x	x	x	6-8	4-5	Not suitable for exposed windy sites
Liquidamber 'worplesdon'	xRG	x	x		4-5	3-4	Not suitable for exposed windy sites
Liridendron tulipifera Arnold		xRG	x	x	6-8	4-5	
Magnolia species	x	x			4-6	3-4	Decidious Spp under 4-6m in height
Melia azardarach		xRG	x	x	7-9	4-6	
Malus species		x	x	x	4-5	3-4	Suitable for planting under Power lines
Plagianthus betulinus		x	x	x	5-7	4-5	
Pittosporum crassifolium	x				4-6	2-4	
Pittosporum eugenioides	x				4-6	3-4	
Pittosporum ralphii	x				6-8	3-4	

Botannical Name	Suitable for berm width (m)				Height	Spread	Comments
	0.75-1.25	1.25-1.50	1.50-2.00	2.00 +	(m)	(m)	
Pittosporum tenuifolium	x				6-8	3-4	
Prunus species	xRG	x	x	x	4-6	3-4	Upright growing forms 4-6m height, suitable for planting under power lines.
Quercus robur		xRG	xRG	x	8-10	6-8	On major streets.
Robinia pseudoacasia 'Frisia'		xRG	x	x	6-7	4-5	
Robinia pseudoacacia inermis (Mophead Robina)		xRG	x	x	6-7	4-5	
Robinia casque rogue		xRG	x	x	4-6	4-5	
Sophora microphylla		x	x	x	8-10	4-6	
Sophora tetraplera		x	x	x	8-10	4-6	
Sorbus species	x	x			3-4	2-4	Suitable for planting under power lines
Tilia cordata			xRG	xRG	10-12	6-8	
Ulmus hollandica 'wredei'			xRG	xRG	5-6	4-5	
Ulmus pumila 'Den Haag'			xRG	xRG	5-6	4-5	
Ulmus procera 'Louis Van Houtte'			xRG	xRG	10-12	5-6	Not suitable for planting under power lines.

R.G. Recommend Root Guard to be installed around the tree at the time of planting

NOTE: (1) Root penetration, depth and spread will vary depending on soil condition, therefore, it is recommended that each site should be assessed by an arborist for selection of suitable trees.

(2) Berm width, site condition, underground and overhead utilities should be considered whilst selecting trees.

(3) For larger trees installation of root guard around trees is recommended.

APPENDIX C, FIGURE 49

EXAMPLE LAYOUT - ASSET VALUATION

The following sheets show a typical format for asset valuation. All components of each asset must be shown.

1. Roading Asset - Typical format

The roading asset includes pavements, kerbs, paths, berms, culverts, sumps and sump leads.

Description	Unit	Quantity	Value
a) Road Components Road surface (describe type)	m^2		
Road pavement (describe type)	m^2		
Road embankment (where applicable)	m^2		
Kerb and channelling	lin m		
b) Footpaths and berm facilities Footpaths (describe type)	m^2		
Pedestrian accesses, cycleways etc (describe)	m^2		
Berms and planting	m^2		
c) Roading supporting structures eg. bridges, crib walls etc (describe type)	LS		
d) Stormwater drainage Sumps Leads (dia) Roads - Culverts (dia) Special structures (describe)	 No. Length Length No.		
e) Road furniture, signs etc eg. seats, street signs, marker posts (describe)			
f) Other headings as necessary			
Total Value Roading Asset			

2. Stormwater Drainage Asset

Ensure that stormwater associated with roading is not double counted both under roads and stormwater.

Pipe lengths shall be taken from the centres of manholes. Manholes, chambers, normal inlet structures etc. shall be counted separately.

Sumps and sump leads shall be covered under Roading.

Example format:

Description	Unit	Quantity	Value
200 dia gravity uPVC c/c	m		
375 dia RCRRJ Cl	m		
Manholes	No		
Special structures, eg. detention, pump etc	No		
100 dia house leads	No		
Total Stormwater Asset			

3. Waste Water Asset

Breakdown into components as necessary to clearly define the asset being valued, eg. all pipes of different diameter should be covered separately.

Description	Unit	Quantity	Value
150 dia gravity uPVC c/c	m		
100 dia. pressure	m		
100 dia house leads	No		
Manholes	No		
Pump station including all M&E equipment	No		
Total Waste Water Asset			

4. Water Supply

Pipe lengths are inclusive of all fittings. Hydrants, valves etc. are counted separately.

Example format:

Description	Unit	Quantity	Value
100 dia uPVC	m		
50 ID MDPE rider	m		
15 ID connection	No		
Hydrants	No		
Valves	No		
Special items, eg booster pump and chamber	No		
Total Value Water Asset			

PART D

CONSTRUCTION: A MEANS OF COMPLIANCE

CONTENTS

PART D CONSTRUCTION: A MEANS OF COMPLIANCE

D1. Earthworks - Construction

D1.1 Introduction

Earthworks shall be carried out to the levels, positions and batter slopes detailed on the approved drawings so as to provide stable land of the form intended by the design. Methods used shall be appropriate to achieve the geometric and compaction standards required by the design and relevant controlling Codes and Standards.

D1.2 Unexpected Conditions

Where conditions exposed on opening up the land are different to those envisaged during design the Designer shall take specialist advice and modify and adapt the design as necessary to cope with the changed conditions. The IQP shall be advised of such situations and design modifications shall be fully documented and submitted to them for approval prior to recommencing work on the affected areas.

D1.3 Geotechnical Monitoring of Earthworks

The control of moisture content and the compaction of fill material, accurate laying of cut and fill batters and silt control are the most important aspects of bulk earthworks projects. To ensure proper control of the works the Designer through an experienced Geotechnical Engineer shall monitor the works and carry out adequate inspections and testing to enable a proper evaluation of the standard of the works and to prepare a report as to the compliance of the works with the Specification and design intent.

Where necessary, work may be stopped until the Geotechnical Engineer has completed such tests and has authorised continuation of work. In the event of any test results not meeting the specified standards, the Contractor shall carry out further compaction or recompaction to the satisfaction of the Geotechnical Engineer until the desired densities are achieved.

D1.4 Compaction Standards for Fill Material

Compaction standards shall comply with the higher of the specified standards or the minimum requirements of NZS 4431: 1989 "Code of practice for earthfill for residential development".

D1.5 Dust and Silt Control

The Developer shall employ the best practical means to ensure that the problem of windblown dust or soil nuisance or waterborne erosion and siltation is minimised during the course of the earthworking operations and for the period after earthworks as necessary, until there is clear evidence that permanent drainage control measures and growth have minimised any erosion or siltation problems. Refer *Part B* of this Code.

Cut and fill areas shall be re-topsoiled, sown and fertilised as soon as possible after earthworks to keep scour damage and wind-blow sand and soil to a minimum. This work should be programmed to suit seasonal conditions. The batter faces of cuts and fills should be protected by grassing, hydroseeding, tree planting, or suitable vegetative cover.

Silt traps shall be constructed to the design or otherwise accepted standards and regularly cleaned of collected silt to ensure their effective operation during rainfall events.

D1.6 Explosives

If the use of explosives is necessary, the Constructor shall be responsible for ensuring that the blasting operations and the storing of explosives are carried out in compliance with the appropriate laws, bylaws and regulations. The Constructor shall apply for and uplift a Resource Consent and indemnify the Upper Hutt City Council by means of an insurance policy to the satisfaction of the Upper Hutt City Council against any claim that may arise from the storage or use of explosives.

D1.7 Fills

D1.7.1 Clearing and Stripping

After topsoil has been removed, areas to be filled shall be benched at the toe of the embankment to give a platform at least 3.5 metres in width. If the original ground slope is steeper than 1 in 4, benches shall be continued at vertical intervals not exceeding 2 metres.

D1.7.2 Subsoil Drains

Where moisture is encountered during benching operations, subsoil seepage drains shall be laid in an approved filter material and shall be installed in accordance with details provided by the Designer.

D1.7.3 Protection of Existing Structures

Any pipeline or structure located under the embankment shall be protected while the embankment is being built and any damage made good.

D1.7.4 Trafficking of Fills

Only that traffic necessary for the construction of the fill shall travel over the fill area. This traffic shall be distributed as evenly as possible over the area of fill and shall not be allowed to form well defined tracks across the fill, except for haul roads.

D1.7.5 Over-wetting of Fill Areas

In the event of sections of the fill or foundation becoming excessively wet, the Designer or Council may direct that all traffic shall be kept off such wet sections until conditions improve.

D1.7.6 Spreading and Compacting

All materials shall be spread and compacted in uniform and homogeneous layers of 200 mm thickness. The maximum size of material shall not exceed one half of the loose layer depth. Crushing to the approved maximum size may be achieved on the fill or the oversize is to be disposed of in a safe and legal manner.

D1.7.7 Moisture Content

Prior to and during compaction, the materials in each layer shall have a moisture content which will permit compaction to the specified compaction standards.

No filling is to be placed if its moisture content is more than 2% above or below the optimum moisture content as determined by Test No 2.1 of NZS 4402: 1986 "Methods of Testing Soils for Civil Engineering Purposes". If the material is too wet it shall be dried by blading, discing, etc or by the controlled mixing with drier material. If the material is too dry it shall have moisture added by controlled watering. In each case the dried or wetted material shall be thoroughly mixed to ensure that a uniform distribution of moisture within the material is achieved.

D1.7.8 Fill Batter Slopes

Fill batter slopes shall be checked for placing accuracy at 4 metre height intervals and where position has deviated from design by 500 mm or more measures shall be taken to correct the problem. At no point on any fill batters shall position deviate from design by more than 500 mm in any direction. Fill batters shall be contoured into the adjacent natural land at each end and base of the fill.

D1.7.9 Unsuitable Material

Highly plastic clay, peat or material containing a high percentage of organic matter shall not be placed in fills. Such materials, if encountered in the excavation, shall be disposed of away from the fill area. Should any such unsuitable material be found below subgrade level, or underneath any fill areas, it shall be excavated and replaced with suitable material compacted to the requirements of the earth fill specification.

D1.7.10 Topsoiling of Batters

Before spreading of topsoil on fill batters, all loose material shall be raked off or rolled. Topsoil shall then be spread in a manner such that the thickness is even and no large lumps are present. The depth of the topsoil shall be 100 mm minimum after settlement and natural consolidation. As soon as topsoil is spread, grass seed shall be sown together with fertiliser appropriate to the seed and soil types. A sward of not less than 95% of the sown area shall be achieved and cut once before Completion Documentation will be accepted by the IQP.

D1.8 Cut Batters

Cut batters and benches shall be laid accurately to line and level.

Survey position checks shall be made at the position of each bench or in 8 metre vertical height steps whichever is the more frequent. At no point shall cut batters deviate from design position by more than ±300 mm. Where such deviations have occurred measures shall be taken to adjust positions by adjustment of bench width rather than steepening of batters. If the error is large the batter top may need to be repositioned in which case consequential adjustment will need to be made to land areas and facilities at the top of the batter.

The edges and top of cut batters shall be rounded to minimise sudden changes of contour where the batter abuts the natural contours.

D1.9 Earthfalls in Cuts and Fills

Should any earthfall or slip occur in the batter of any cutting or fill either during or after excavation but before the completed work has been taken over by Upper Hutt City Council, the Contractor shall remove the material brought down by such an earthfall or slide and make good the damage caused to the satisfaction of the IQP.

D1.10 Stormwater Drainage

i. The surfaces of all cuts and fills shall be kept adequately drained at all times. Surfaces shall be shaped, graded and rolled to a smooth surface (to shed water) each night throughout the duration of filling operations.

ii. Temporary drains and ditches shall be dug to remove water from the surface during and on completion of the work. The drains shall discharge water onto natural ground at places where the water cannot flow over any cutting, batter or embankment slope of collect at the top of any embankment or cutting. Suitable protection against scouring of the drains shall be made. All temporary drains shall be maintained in a clean and tidy condition so that they function satisfactorily, until the works are taken over by Upper Hutt City Council.

iii. The Designer shall at all times ensure that the works are carried out in such a manner and necessary interception and settlement traps constructed, so as to prevent the deposition of silt or other deleterious material on land outside the contract area by the action of water or any other cause. Such facilities shall be maintained during the works and until such time as the land becomes stabilised to the satisfaction of Upper Hutt City Council. Any damages within or outside the contact area caused by inefficient or insufficient drainage or any other reasons shall be made good by the Contractor.

iv. The publications "Guidelines for Silt Control Associated with Mass Earthworks" Revised June 1988, Wellington Regional Council, and "Erosion and Sediment Control for Earthworks, Technical Publication No. 97". ARC, provide acceptable design bases for silt control.

v. The requirements of any Resource Consents shall be complied with.

D1.11 Completion of Earthworks

On completion of the Earthworks, road subgrade surfaces, the batters and earthworked areas shall be cleaned of all debris and surplus materials. Earthworked surfaces shall be left with a firm smooth surface true to line and cross fall and properly drained.

D1.12 As Builts and Completion Documentation

On completion of earthworks information and documents as required herein and under *Part B* of this Code shall be provided to the IQP.

D2. Roads - Construction

D2.1 Introduction

Road construction shall be carried out to the alignments and standards detailed in the approved drawings and with the specified materials so as to provide the intended design life.

The road construction includes for all associated work required to complete adjacent footpaths, berms and road reserve areas.

D2.2 Subgrade Checking

Where the extent of cut or fill for the project is too great to make subgrade CBR testing feasible at the design stage it may be done on completion of earthworks when subgrade levels have been exposed. Even in cases where subgrade has been tested as part of the design its condition shall be reviewed on exposure during construction and pavement thicknesses adjusted accordingly.

The results of such testing and/or review along with any consequent adjustments to pavement layer thicknesses shall be advised to the IQP before placing of pavement layers commences.

Any permanent wet spot in the subgrade shall be drained to the under-channel drainage system. Where the wet area is below the level of the under-channel drain, it shall be drained using approved filter drainpipes connected to the nearest stormwater system.

Between the date the subgrade is completed and the application of the first metal-course aggregate, the subgrade shall be maintained true to grade and cross-section. Should pot-holes or ravelling develop in the subgrade the area so affected shall be scarified and clean metal added and recompacted.

D2.3 Spreading and Compaction of Metal Course Aggregates

The metal course aggregates shall be placed on the prepared subgrade in layers. The aggregate layers shall be of adequate thickness and stiffness to ensure that with adequate compaction the minimum required deflections are achieved.

D2.4 Subbase

The subgrade shall be inspected by the IQP who may require from the Construction Supervisor information supporting the suitability of the proposed subgrade for the design pavement before giving approval to the placing of subbase. Such information may include proof rolling confirmatory soils testing and design revisions.

Subbase material shall be placed in an initial layer of not greater than 200 mm except when the subgrade sensitivity to load makes a thicker initial layer desirable in which case the layer thickness shall be between 300 and 350 mm before any heavy traffic is put over the metal. No initial layer shall be less than twice the nominal maximum size of the aggregate. Subsequent material shall be placed in layers of lesser thickness than the initial layer, as long as segregation is prevented and full compaction is continued during the construction of these layers. Subbase shall be compacted to not less than 98% relative density and tested for compliance in terms of NZS 4402: 1981.

The layers shall be so placed that when compacted they will be true to the grades and levels required. The laying procedure shall be arranged to minimise segregation. Grader use shall be restricted to essential shaping and final trimming, with minimum working of the final surface.

The subbase layer shall not be used by construction traffic.

D2.5 Basecourse

Basecourse shall be placed as above except that it shall be placed and compacted in layers not exceeding 150 mm.

It shall be placed and compacted in terms of TNZ Specification B/2: 1985 and shall be compacted to not less than 100% relative density and tested for compliance in terms of NZS 4402: 1981.

To assist compaction, water may be added as a fine mist spray. Particular care shall be taken to avoid excess water reaching the formation or subbase course.

Fine aggregate may be hand spread in a comparatively dry state over any open textured portion of the final compacted aggregate surface. The fine aggregate shall be vibrated or rolled into the interstices of the basecourse. The use of such surface choking material shall be kept to a minimum. Special attention shall be paid to the consolidation of the edges of the basecourse.

The construction of the basecourse shall be carried out in a manner that will ensure the production of a stone mosaic surface.

D2.6 Maintenance of Basecourse

The finished aggregate surface shall be maintained at all times true to grade and cross-section by watering as required, trimming, planing, rolling and taking appropriate measures to ensure the even distribution of traffic.

Every precaution shall be taken to ensure that the surface of the basecourse does not pot-hole, ravel, rut or become uneven, but should any of these conditions become apparent, the surface shall be patched with suitable aggregate and completely scarified and recompacted. The basecourse shall be maintained to the specified standards until covered with an impermeable surfacing layer.

D2.7 Basecourse Preparation for Surfacing

Any loose or caked material shall be removed from the surface without disturbing the compacted base, and the material so removed shall be disposed of. The surface shall then be swept clean of any dust, dirt, animal deposits, or other deleterious matter. The surface of the road at the time of surfacing shall be clean, dry, uniform, tightly compacted and shall present a stone mosaic appearance. Immediately prior to any form of surfacing a strip 600 mm wide contiguous to each channel or seal edge shall be sprayed with an approved ground sterilising weed killer at the manufacturer's recommended rate of application.

For second coat sealing, repairs shall be carried out three months prior to sealing. Areas to be patched shall be cleaned and loose material removed before application of an emulsion tack coat and asphaltic patching material. The repairs shall provide a finished surface flush with the levels and grades of the surround pavement, and shall not hold water.

Prior to commencement of sealing the surface preparation shall be inspected by the IQP.

D2.8 Pavement Deflections

Deflections on the basecourse surface shall be measured and shall comply with the requirements of *B3.11* of this Code before surfacing commences.

D2.9 Road Surfacing

The sealing season is from 1 October to 15 March. Surfacing outside of this period may be approved for specific projects by Upper Hutt City Council depending on the prevailing weather conditions and the type of surfacing treatment proposed.

Chipsealing construction standards shall comply with TNZ Specifications P3 and P4.

Asphaltic concrete construction standards shall comply with TNZ Specification P9.

D2.10 Surfacing Tolerances

Surfacing on all roads shall satisfy the tolerances and roughness requirements of *B3.12* of this Code.

D2.11 Bitumen Application Rate

Bitumen application rate for chipseals and tack coats shall be assessed based on current TNZ design methods and ambient weather conditions at the time of construction.

D2.12 Footpaths

D2.12.1 Concrete

Concrete footpaths shall be formed over not less than 100 mm of compacted metal. The formation is to be thoroughly compacted by rolling before any concrete is placed. Porous areas shall be blinded with sand prior to placing concrete.

The foundation shall be evenly trimmed to a cross-fall of 1 in 50.

The prepared foundation shall be sprayed with an approved weed killer. If the foundation is dry, it shall be moistened in advance of placing concrete.

The concrete paths shall be laid with construction joints at intervals of not greater than 5 metres. If paths are constructed by continuous pour techniques, clean, true, well oiled 5 mm thick steel strips at least 40 mm deep shall be inserted at 5 metre intervals to facilitate controlled cracking. These shall be carefully removed after the concrete has set. Alternatively, the joints may be cut by means of a concrete cutting saw. In this case the

cutting shall be carried out not more than 48 hours after pouring and shall be to a depth of 40 mm.

Concrete in both footpaths and kerb and channel shall be cured for at least 7 days during dry weather.

Where required, vehicle and pram crossings shall be constructed in accordance with UHCC standard details.

D2.12.2 Asphaltic Concrete

Asphaltic concrete footpaths shall be placed over not less than 100 mm of compacted basecourse after removal of all organic and soft subgrade. Asphalt concrete paths shall not puddle water and shall be edged with either concrete or 100 x 50 ground treated timber where abutting berms or other grassed areas.

D2.12.3 Concrete Pavers

Concrete pavers shall be placed over not less than 100 mm of compacted basecourse after removal of all organic and soft subgrade. Laying shall be in accordance with NZS 3116: 1981 "Interlocking Concrete Block Paving". Pavers shall be laid to 5 mm above tops of channels and other drawing features.

D2.12.4 Surface Finish, Tolerances

Surface finish and tolerances on footpaths shall comply with *B3.13* of this Code.

D2.13 Kerb and Channel

Kerb and channel may be either cast insitu or extruded.

For cast insitu kerb and channel, formwork shall be clean dressed timber or steel sections adequately oiled or otherwise treated to allow ease of striking without staining or damaging of the stripped concrete surface.

For extruded kerb and channel, concrete used shall be of such consistency that after extrusion it will maintain the kerb shape without support. The extrusion machine shall be operated to produce a well compacted mass of concrete free from surface pitting.

Finished tolerances and standards shall not exceed those required by *B3.13* of this Code.

No formwork shall be stripped until at least two days have elapsed from time of pouring concrete.

D2.14 Berms and Trees

Berms shall be formed after all other works have been completed. The topsoil shall be free of weeds, stones and other foreign matter and shall be graded to footpath edge and shall finish 15 mm above footpath level to allow for settlement.

After topsoiling, the berm shall be sown with grass seed that conforms with the following mix proportions:

4 parts by weight Perennial Ryegrass
2 parts by weight Chewings Fescue
1 part by weight Brown Top
1 part by weight Crested Dogs Tail

Berms shall be sown and maintained mown free of weeds for the contract maintenance period.

A sward coverage of not less than 90% shall be achieved within one month of sowing and before Completion Documentation will be accepted for processing by the IQP.

Trees shall be planted with a rootguard and staked and loosely tied with neatly cut ground treated timber stakes capable of providing support to the tree for at least one year.

D2.15 Traffic Services, Road Furniture, Benchmarks

Traffic lines and utility services shall be painted and marked after initial surfacing and sweeping has been completed. Road furniture shall be installed, benchmarks surveyed, prior to final inspections being made by the Construction Supervisor and IQP.

D2.16 Progress Inspections

The Contractor shall give notice to the Construction Supervisor and/or the IQP as appropriate to allow them to carry out all inspections required to enable the Completion Documentation to be provided as required under *Part B* of this Code.

D2.17 As Builts and Completion Documentation

On completion of construction information and documents as required under *Part B* of this Code shall be provided by the Designer.

D3. Wastewater and Stormwater Drainage - Construction

D3.1 Introduction

All drainage systems shall be constructed to lines and grades specified in the design drawings and to standards suitable for ensuring that drainage systems are able to serve their purpose over the required design life. Drainage construction methods used shall comply with codes, standards and guidelines applicable at the time of the work.

D3.2 Setting Out

All drainage works shall be set out by a suitably qualified person to the position and levels detailed on the approved drawings.

Where the alignment is related to the street boundary drains shall be laid with reference to permanent land transfer boundary pegs or temporary boundary marks placed by the registered surveyor responsible for the final land transfer pegging. Pipes shall be laid by reference to the kerb line only where the surveyor has confirmed that the kerb is located in the correct position.

D3.3 Trenching

Trenches shall be opened only after all required Consents and trench opening notices have been uplifted.

All trenches shall be opened up to widths and depths suitable for enabling the requisite bedding metal thickness below the pipe to be placed (not less than 100 mm). The trench width shall be kept to those dimensions detailed in the design drawings which ensure that it is narrow enough to allow the pipe to be laid in trench conditions but wide enough to enable pipe surround metal to be adequately placed and compacted.

All trenching in Upper Hutt City roads or on services to be taken over by Upper Hutt City shall comply with Council's Specification for "Road Opening and Reinstatement Works".

D3.3.1 Trenches in Open Land

Trenches may be opened up for up to 60 metres ahead of pipelaying provided trench depth and material are of adequate stability to minimise any risk of trench failure and to ensure safety of workers.

D3.3.2 Trenches in Road

Trenches in stable ground may be opened to a maximum of 25 metres in advance of pipe laying, but this distance shall be reduced where the public or existing services are endangered or where traffic routes are restricted.

D3.4 Control of Water

Excavations shall be kept free from water and sewage at all times. To this end pumping plant, pipes, and materials shall be provided as necessary.

Under no circumstances shall any water be allowed to drain directly into existing sanitary sewers.

D3.5 Control of Flows from Live Drains

The Contractor shall be responsible for the maintenance of interrupted pipe flows at all times during construction and shall ensure that workers or other peoples health nor flood risk to any property is not in any way affected by such flows. The Contractor shall identify how interrupted pipe flows will be maintained prior to commencing work. In the case of work on interrupted stormwater lines the full pipe capacity shall be available at the end of each days work. Where the full capacity is not available during the working day the Contractor shall have a defined contingency plan to make it available at short notice should weather conditions or other factors indicate that increased flow capacity could be required.

To achieve maintenance of flows, measures such as temporary damming of manholes and pumping or other methods shall be undertaken for the duration of the project or for parts of the project. No existing live wastewater connection shall be unable to discharge wastewater for longer than 6 hours on any one day.

Disposal of stormwater and wastewater from all properties shall not be affected by works.

D3.6 Pipe Condition

All pipes supplied for use in the works shall be examined before being laid and any showing defects of any description shall be removed from the site and not used in Council works. Any pipes damaged during laying shall likewise be removed except where damage is minor and to repairable coatings. In such cases the coatings and other damage shall be repaired to the manufacturers specification so as to achieve a condition at least as good as a new undamaged pipe.

Handling of pipes and fittings shall be in accordance with the manufacturer's recommendations. All reasonable care shall be taken in handling pipe materials to preserve intact the pipe coatings, linings, structural strength and the various features necessary for long service. Pipes with external coating shall be lifted using wide slings; ropes and chains shall not be used.

D3.7 Pipe Laying and Jointing

A registered drainlayer shall be employed to supervise and certify all pipelaying works in Upper Hutt City.

The laying and jointing of pipes shall be strictly in accordance with the manufacturer's recommendations and NZS 4452: 1986. Bedding shall be as detailed in the design documents but as a minimum shall satisfy the requirements of *Appendix C, Figure 40*.

Where on opening up, trench bases are found to contain unsuitable foundation material, such material shall be removed and replaced with sound material. The Construction Supervisor shall also be advised so that the extent of the problem can be identified and if appropriate designs modified.

D3.8 Pipe Contamination

Adequate precautions shall be taken while laying pipes to prevent the entry of debris. Where required, the pipeline shall be temporarily sealed with fixed covers or bungs to prevent entry of foreign matter or groundwater.

D3.9 Connections

Each connection shall be laid soffit to soffit except when a drop is constructed. Each connection end shall be marked by a stake extending to 600 mm above ground level.

Connections whether to reticulation lines or to manholes shall be sealed either by a factory sealed stopper or an approved plug.

D3.10 Manhole Construction

Manholes shall be constructed in accordance with the relevant standard drawings appended. A single riser shall be used wherever possible. Where more than a single riser is used in a manhole, riser joints shall be sealed with epoxy mortar.

Where a manhole excavation is found to be in soft ground the area under the manhole shall be undercut down to solid and backfilled with hardfill and compacted to provided a firm foundation for the manhole base.

Before any concrete is placed the base of the trench shall be free of all debris and water.

Inverts of all manholes shall be smoothly formed with pipe half rounds for 100 and 150 mm dia pipes or for larger pipe sizes with 2:1 sand cement render smoothed down with a steel float so as to give a well shaped smooth passage for the flow, free of any irregularities or obstructions. Haunching shall have a slope of at least 30° from horizontal so solids will flow back into the pipe invert after any flow backup has occurred.

The walls, benching and invert of the manhole shall have smooth internal finish. Any leaks shall be plugged and the internal surface left smooth.

When uPVC pipes are used factory made, grit coated "manhole shorts" shall be used at manhole entry points.

All step irons shall be tightly placed and penetrations filled with epoxy mortar.

Precast concrete manhole covers shall be placed and jointed and sealed with mortar onto the top riser. Cast iron manhole frames shall be bedded on 2:1 sand/cement mortar and surrounded with concrete. Manhole frames shall be left proud of surrounding ground level by 0 to 5 mm and at the same cross-fall as the finished surface in roads and berms and flush on footpaths and cycleways. Ponding shall not occur on manhole lids.

D3.11 Inlet and Outlet Structures

Provision shall be made for energy dissipation within and/or immediately downstream of the outlet structure.

All steel used on inlet or outlet gratings shall be hot dip galvanised.

D3.12 Progress Inspections

The Contractor shall give notice to the Construction Supervisor and/or the IQP as appropriate to allow them to carry out all inspections required to enable the Completion Documentation to be provided as required under *Part B* of this Code.

D3.13 Trench Backfilling and Surface Reinstatement

Trench backfill shall satisfy the higher of either the specified standards or Council's Specification for "Road Opening and Reinstatement Works".

Backfilling shall be carried out immediately the pipes have been tested and the As-built information recorded. Surface reinstatement shall be in accordance with Council's Specification for "Road Opening and Reinstatement Works".

The Contractor shall maintain the whole of the surfaces over the trench, or such other parts as may be affected by the operations, during the period of the Contract, and the Period of Maintenance.

D3.13.1 Resurfacing Time/Temporary Surfacing

For all arterial and collector roads and roads within the CBD, all paving of the road surfaces shall be completed at the end of each day's work either by a temporary sealed surface or the permanent surfacing. For other roads, trenches shall be surfaced within 2 working days of the work by staging the reinstatement as necessary. Over the period when any trench is not surfaced it shall be maintained flush with the adjacent road by the Contractor.

D3.14 Testing of Wastewater Pipes

Wastewater drains including manholes and connections shall be tested by water test upon completion of each section prior to backfilling.

The entire length of drain, including manholes shall be retested prior to practical completion. The timing of this test shall be advised to the IQP at least 24 hours in advance who may attend the test. If such notice is not given the IQP may require the test to be repeated at a time suiting them.

Junctions or connections shall be plugged and tested as an integral part of the main when both mains and connections are new. Where only part of the system is new, extra access or inspections shall be installed to enable secure testing of the new work.

All pipelines shall be tested in accordance with NZS 4452 or the NZ Building Code. Total water losses shall not exceed those specified and no visible leakage shall occur.

Testing may only be undertaken when trench and weather conditions permit detection of defects.

D3.15 Testing New Manholes

Manholes shall be tested for water tightness by filling with water. After all absorption has taken place the water level shall be maintained for

30 minutes. Losses shall be limited to those set out in NZS 4452. Any defects shall be made good and the manhole retested.

D3.16 Leaks

Should any leaks exist after a length of pipe has been laid, notwithstanding that such may have already been tested, such portions shall be taken up and relaid or otherwise remedied.

D3.17 Testing of Stormwater Mains

All stormwater mains and manholes of 450 mm dia or less shall be tested to the standards required for sewers as detailed above. Leaks shall be remedied as required for sewers.

Stormwater mains of over 450 mm diameter need only be tested when advised by the IQP at the design stage.

D3.18 Colour TV Record

A colour TV record shall be taken as required by *B10.5* of this Code.

D3.19 As Builts and Completion Documentation

On completion of construction, information and documents as required under *Part B* of this Code shall be provided by the Designer.

D4. Water Supply - Construction

D4.1 Introduction

Water supply works shall be constructed to the best engineering standards current at the time of the project and in accordance with the design drawings and Specifications.

D4.2 Setting Out

All water supply works shall be set out by a suitable qualified person to the position and levels detailed on the approved drawings.

D4.3 Progress Inspections

The Contractor shall give notice to the Construction Supervisor and/or the IQP to enable them to carry out all inspections required to enable the Completion Documentation to be provided as required *Part B* of this Code.

D4.4 Trenching, Excavation, Backfilling and Reinstatement

Trench standards and requirements shall be as defined under *D3, "Wastewater and Stormwater Drainage - Construction"* of this Code.

D4.5 Control of Water

The Contractor shall keep the excavations free from water and sewage at all times and shall provide all such pumping plant, pipes, and materials as may be required for this purpose.

Under no circumstances shall any water be allowed to drain directly into existing wastewater drains or water mains.

D4.6 Pipe Condition

All pipes supplied for use in the works shall be examined before being laid and any showing defects of any description shall be removed from the site and not used in Upper Hutt City Council works. Any pipes damaged during laying shall likewise be removed except where damage is minor and to repairable coatings. In such cases the coatings shall be repaired to the manufacturers specification so as to achieve a condition at least as good as a new undamaged pipe. No polymer or PVC pipes showing evidence of "sunburn" or scratching or gouging shall be used.

To minimise the risk of damage, handling of pipes and fittings shall be in accordance with the manufacturer's recommendations. All reasonable care shall be taken in handling pipe materials to preserve intact the pipe coatings, linings, structural strength and the various features necessary for long service. Pipes with external coatings shall be lifted using wide slings; ropes and chains shall not be used.

D4.7 Retention of Water Supply Flows

Laying of water mains shall be done so as to retain supply to existing users. Cut-ins requiring the shut down of an existing Council main shall comply with *B9.9* of this Code.

D4.8 Pipe Laying and Jointing

The laying of pipes and jointing shall be strictly in accordance with the manufacturer's recommendations, applicable standards and Council's requirements.

Where, on opening up, trench bases are found to contain unsuitable foundation material, such material shall be removed and replaced with sound material. The Construction Supervisor shall also be advised so that the extent of the problem can be identified and if appropriate, designs modified.

Pipes shall be laid true to line and grade and shall be uniformly bedded along their entire length. Care shall be taken to ensure that the barrel does not rest on ridges or span from joint to joint. No foreign matter shall be allowed to enter the pipe during laying. Temporary caps shall be placed over the ends of the pipe during construction. Sufficient filling should be placed and compacted around the barrel of the pipe to prevent it floating should the trench become flooded. Pipes shall be laid on and surrounded by bedding material.

Bedding material shall be continued around and above the pipe to a minimum height of 100 mm above the pipe for principal and rider mains. For connections the height of cover bedding material shall be at least 50 mm.

Pipes, valves, fittings, service connections and other items that will be part of the permanent works shall be laid during construction of the reticulation to ensure they are included in all inspections, testing and disinfection.

Cast in-situ concrete thrust blocks shall be provided at all points where an unbalanced thrust occurs including on valves and tapers. Concreting shall be done in a tidy and workmanlike manner, and supported by formwork where necessary. It shall be placed so as to not cover or obstruct bolts or bolted joints nor interfere with any flexible joint. Bearing surfaces shall always be placed directly against trench sides.

Hydrant and valve spindles shall be brought to adequate proximity to the ground surface to be readily accessible with the normal equipment, keys etc held by Council and Fire Service staff. This will generally be a position of between 150 and 300 mm below ground surface. Fire hydrants shall be fixed vertically with the centre of the valve spindle and stand pipe outlet aligned along the longitudinal access of the main.

D4.9 Service Connections

Service connections shall be located accurately in the positions shown on the contract drawings. The location of such connections shall be made evident during all stages of construction by a marker post (such as a Waratah stake) placed within 200 mm of the toby valve position.

D4.10 Surface Boxes

Surface boxes shall be fitted over fire hydrants, valves, valves on service connections, water meters, gate valves and other fittings requiring access for operation or maintenance. The tops of surface boxes shall be placed 0 to 5 mm above the finished surface levels of roads and berms, and flush on paths and cycleways. Boxes shall be fitted so as to not move under expected loads. Wood shall not be used as packing between surrounds or

surrounds and boxes. Boxes and surrounds shall be placed so that no load on the box can be transferred directly to any pipe or fitting.

For hydrants and valve boxes the following additional requirements apply:

- At least 3 precast blocks shall be used under the surface box, one surface block and two bottom blocks.
- Hydrant surface boxes and valve boxes, when rectangular shall be laid parallel to the line of the main.
- Hydrant surface boxes shall be painted yellow in accordance with NZS 4501 except that the 1200 mm diameter circle shall be omitted.
- Valves on all fire service mains or sprinkler connections shall be painted green.

D4.11 Pressure Testing

Testing shall be carried out in the presence of the IQP who shall be given not less than 24 hours notice of the test. Before testing, all thrust blocks, tees, valves, dead end caps etc shall be secured to withstand the proposed test. Sufficient backfilling shall be placed around the pipe barrels to prevent any movement. Testing against closed valves is not acceptable, except where the open end of the valve can be observed. The main shall be filled with water and all air released.

A valved 20 mm diameter connection shall be provided at the lower end of the main to enable the installation of a check pressure gauge for the purposes of the test.

The pressure in the main shall be built up to that in the nearby reticulation for 24 hours before the test is carried out. All visible leakage shall be repaired at this stage.

The test pressure shall be set at the higher of 1200 kPa or 1.5 times the maximum working pressure except where the latter would require a test pressure greater than the nominal rated pressure of polyethylene pipe, which should not be tested to a pressure greater than their nominal rated pressures.

D4.11.1 Rigid or PVC Pipes

The test standard for PVC or rigid wall pipes shall be:

The test pressure shall be left on for one hour. For all pipes, except uPVC, the quantity of water required to bring the pressure back to test pressure shall not exceed one litre per 10 mm of pipe diameter per kilometre length. For uPVC pipe the maximum allowance pressure drop is 10 percent at the end of one hour. Despite this allowable nominal loss there shall be no visible leaks.

It is necessary to remove all air from the line as the main is filled. In the case of concrete or concrete lined pipes, prefilling and soakage for 24 hours is necessary, to remove air and overcome water loss into the concrete.

D4.11.2 Medium or High Density Polyethylene Pipes

Pressure shall be increased steadily to 1200 kPa and kept at this level for 30 minutes with additional pumping to compensate for pressure loss as the MDPE pipe expands.

A control valve shall then be opened to rapidly drop the pressure to a nominal 400 kPa. The control valve shall then be closed and the pressure monitored for the next 60 minutes.

To pass the test there shall be an increase in pressure over 60 minutes of monitoring as the MDPE pipe contracts from the effect of the previous 1200 kPa loading.

If the pressure falls during the 60 minute period (despite an initial rise) then the pipe work will be deemed to have failed the pressure test. There shall also be no visible leaks.

Any areas of non compliance shall be remedied and the system retested until satisfactory results are achieved.

Any closer pipes used after pipeline testing shall not be backfilled until the joints have been tested for water tightness under mains pressure.

D4.12 Flushing and Sterilising of Pipelines

All pipes, valves, services and other fittings shall be disinfected by means of chlorination before being put into service.

The Contractor shall allow for all special tappings and fittings for the introduction and draining of the chlorine solution to the pipelines.

Prior to sterilising, all debris shall be removed from the pipelines. To do this, ridermains shall be flushed with water at a scouring velocity of at least 2.0 m/s. To remove debris from pipelines of 100 mm or larger diameter, a foam swab shall be passed through any major connections and down the main. A backflow preventer is required on any connection made to flush out or to drive a swab through a pipeline. A single, spring loaded check valve without test facilities will be satisfactory for this purpose, provided its effectiveness is confirmed prior to use.

The main or ridermain shall then be drained and slowly filled with water to which sufficient free chlorine is added to produce a concentration of not less than 50 mg/1. Note that approximately 70 grams of Calcium Hypochlorite per 1000 litres will produce a concentration of 50 mg/l.

The point of application of chlorine shall be at one end of the section to be chlorinated and the line shall be filled until water issues from a tapping point at the opposite end. Every care shall be taken to see that no air is trapped in the line, thus preventing solution contact with pipe walls.

The main shall be left filled with chlorinated water for 24 hours or where this is not possible due to public inconvenience, at least 6 hours, during which time all valves, hydrants, and other fittings on the section shall be operated. Where pipes or specialist are not contained within the chlorinated line, then they are to be swabbed with chlorinated pull-throughs.

At the end of the test period the Free Available Chlorine residual (FAC) shall be not less than the following:

Test Duration [hours]	FAC Residual [mg/litre]
24 (standard test)	5
12 *	10
6 *	20

** Shortened test acceptable only when special conditions make 24 hour test inappropriate.*

After the sterilising period, pipelines shall be flushed of the sterilising solution, (taking care to discharge, in a controlled manner, the highly chlorinated water to the sewage system or to de-chlorinate the water prior to controlled discharge to the stormwater system). The rate of discharge to the sewage system shall be limited to a maximum of 10 litres per second (or less if surcharging of the system occurs). The FAC of the wash-out water shall be tested at regular intervals during the flushing period to confirm the uniformity of the disinfection solution and to avoid unnecessary waste of flushing water.

The flushing shall continue until the FAC residual has been reduced to that of the reticulation system, (usually between 0.2 and 0.5 mg/litre) and the main left to stand for at least 6 hours. At the completion of the standing time, bacteriological samples shall be taken from all pipelines of 100 mm nominal diameter or larger, at the rate of at least 1 sample per pipeline section, except that in the case of a "long" pipeline, 1 sample shall be taken for every 300 metres of pipe length. If contamination of any pipeline is suspected, additional tests may be required.

All samples shall be tested for faecal and total coliforms as well as heterotrophic plate counts by a laboratory with TELARC or other approved quality registration for these tests and the results shall be presented in a formal report.

Sample results will be considered acceptable if the 24 hour faecal and total coliform counts are 0/100 ml and the heterotrophic plate counts are below 5 organisms per ml.

The use of a non-bactericidal jointing lubricant may prevent the achieving of the above results.

If non complying test results are obtained or if any contaminated water is allowed to enter the pipeline (for any reason) after sterilisation, the above testing and sterilising requirements shall be repeated.

Any "closer" pipes or fittings which come in contact with water for human consumption shall be sterilised by swabbing with a solution of hypochlorite prepared by mixing 10 ml of sodium hypochlorite in 10 litres of water. Any dirt or foreign matter shall be washed out of the pipe or fittings before swabbing.

The sterilisation and flushing testing shall be arranged and results recorded by the Construction Supervisor, who shall forward his record and conclusions along with the laboratory test report to the IQP for approval and forwarding to Council with all Completion Documents.

D4.13 Cut-ins to City Supply

No cut-in to existing live Council mains shall be made until the whole of the new work being connected is completed to the standard required for takeover by Council. Cut-ins shall comply with the requirements *B9.9* of this Code. It should be noted that the maximum "shut off" period to any consumer is 2 hours.

D4.14 As Builts and Completion Documentation

On completion of construction information and documents as required herein and under *Part B* of this Code shall be provided by the Designer.