



**DESIGN GUIDELINES AND CONSTRUCTION
STANDARDS**

Issued Jan, 2007



FORWARD

This manual is intended to provide an information guide to set standards governing design, preparation and submission of plans and specifications for construction of municipal improvements in Yellowhead County. It is intended for use by Developers, Engineering Consultants, Utility Companies and County Departments. These standards are provided to set out the “minimum” allowable levels to which the requisite improvements are to be built. In instances where the standards do not cover a particular situation or occurrence, good engineering judgement shall be used. All development shall comply with the requirements of Yellowhead County, all applicable Land Use Bylaws and Provincial and Federal legislation.

No departure from these standards shall be permitted without the written approval of the Director of Infrastructure. The County shall be the final authority on any disputed plans. Minor revisions may be given verbal approval by the Director of Infrastructure, but a change order shall be issued to record such revisions.

All completed plans, records and documents shall be submitted a minimum of 30 days prior to final design acceptance by the County.

No construction shall commence until all designs have been accepted by the County and the following has been submitted:

- a) Design drawings
- b) Letters of Credit
- c) Authority Contacts & Approvals
- d) Development Agreement
- e) All Levies & Fees

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E-Mail: info@yellowheadcounty.ab.ca

END OF SECTION



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Abbreviations

The following abbreviations may be used in this document:

BC	-	Beginning of Curve
BOW	-	Back of Walk
BVC	-	Beginning of Vertical Curve
CCC	-	Construction Completion Certificate
EC	-	End of Curve
EVC	-	End of Vertical Curve
FAC	-	Final Acceptance Certificate
FOW	-	Face of Walk
ha	-	Hectare
ID	-	Inside diameter
Kg	-	Kilogram
lcd	-	Litres per capita per day
m ³	-	meter cubed
OC	-	On Centre
OD	-	Outside diameter
PVI	-	Point of Vertical Intersection

Other abbreviations may be used or defined elsewhere in this document. Where undefined, an abbreviation shall carry a meaning consistent with industry standards. Ascertaining the meaning of a word or abbreviation in context is the responsibility of the Developer.



Section 1: Design Guidelines



DESIGN GUIDELINES AND CONSTRUCTION SPECIFICATIONS FOR ALL PROJECTS

GENERAL CONDITIONS AND ENGINEERING PROCEDURES FOR MUNICIPAL DEVELOPMENT

Page 2

1 GENERAL CONDITIONS AND ENGINEERING PROCEDURES FOR MUNICIPAL DEVELOPMENT

1.1 GENERAL CONDITIONS

1.1.1 Scope

These design standards shall apply to the design and installation of the municipal infrastructure for new subdivisions and developments in Yellowhead County. This includes the installation of water mains, sanitary sewers, storm sewers, services to properties, surface reconstruction, the installation or alterations to roads, sidewalks, curbs and gutters; and the surface drainage of residential, commercial, industrial, institutional and multi family developments within Yellowhead County. These design standards also apply to all respective connections and appurtenances and any other services that are required to be designed and/or installed.

These design standards do not cover the design or installation of street lighting, ornamental lighting, power, gas, telephone and television services, but do include coordination with the various utility companies. The general location of such services must be approved by the County.

The Standard Drawings, as referred to in various sections, will form an integral part of these design standards. Standard drawings are provided in Section 3.

No departure from these design standards will be permitted without approval from The Director of Infrastructure.

1.1.2 Definitions

In these design standards, unless the context otherwise indicates, the following words shall have the meaning hereinafter assigned to them.

“Applicant”/“Developer” shall mean a person who has applied for the subdivision, development or installation to serve an existing parcel of land, whether as the owner or an agent for the owner of the land included therein.

“Contractor” will mean any person, persons or corporations that shall undertake the installation of Municipal Services on behalf of either the Applicant or the County.

“Developer’s Engineer” shall mean a qualified Professional Engineer registered and licensed to practice in the Province of Alberta, who is appointed or engaged by the Developer to be responsible for the design and preparation of drawings and specifications and provision of engineering supervision during the construction of the municipal improvements for the development area.

“Director of Infrastructure” means the Director of Infrastructure of Yellowhead County or his assigned designate.

“County” shall mean or refer to Yellowhead County, in the Province of Alberta.



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GENERAL CONDITIONS AND ENGINEERING PROCEDURES FOR MUNICIPAL DEVELOPMENT

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“Municipal Improvements” or “Infrastructure” may also mean “Local Improvements” and shall mean both underground and surface structures including, but not necessarily limited to, watermains, sewer systems, storm drainage systems, roadways, walkways, park areas, shallow utilities, signage, fencing, street lighting, and other improvements as required by the County, all of which shall become the property of the County to operate and maintain.

“Prime Contractor” as defined by Occupational Health and Safety.

1.2 PROCEDURE

The Applicant shall retain the services of a Professional Engineer, registered and licensed to practice in the Province of Alberta, who shall be responsible for the design and preparation of drawings and specifications for all infrastructure (including lighting, telephone, and power) to be constructed within and/or related to the proposed development area, as required, within Yellowhead County. All required municipal improvements shall be designed in accordance with accepted engineering practices and shall meet or exceed Yellowhead County Design Guidelines and Construction Standards as set out herein. If landscaping plans are deemed required by the Director of Infrastructure, the landscape plans will be prepared and stamped by a Landscape Architect or a Professional Engineer as required by Provincial Legislation.

The installation of services or municipal infrastructure to serve an existing property shall be in accordance with the Utility Bylaw. The services do not necessarily require engineer design; however, the applicant must provide proof that the installation will conform to these design standards. If the Director of Infrastructure deems it necessary that the installation be monitored by a professional engineer, the applicant shall pay all costs for the monitoring.

The design drawings must show all existing and proposed services. It shall be the responsibility of the Developer’s Engineer to coordinate with the utility companies to establish the location of their existing and proposed services.

The Developer’s Engineer shall be responsible for carrying out all surveys and investigations necessary to prepare the design. It shall further be the responsibility of the Developer’s Engineer to identify the need for any easements or additional right-of-way required. The plans and related documents shall be prepared by a qualified licensed Alberta Land Surveyor at the Developer’s expense.

The Developer’s Engineer shall bring to the attention of the Applicant the need for any right-of-way, outside the subdivision, that the Applicant will have to obtain. The applicant shall provide proof of right-of-way to the County prior to the installation of services on such properties. Rights-of-way shall be assigned in the name of the County or, as applicable, the utility company. The applicant is to pay all costs associated with registering the right-of-way and fulfill all terms and conditions associated with establishing rights-of-way.

Alberta Environment shall review and approve engineered drawings for all water, wastewater, or storm extensions or new installations. All drawings shall be approved by Alberta Environment (AE) prior to construction.

While the Developer’s Engineer may arrange to have certain portions of the work carried out by other qualified persons, he shall remain responsible for the coordination of the work and certification of its quality and accuracy.



1.2.1 Geotechnical Report

As part of the Subdivision application, the Developer may be requested to submit a Geotechnical Engineering Report, prepared by a qualified Professional Engineer or Geologist that identifies and evaluates the subsurface ground characteristics of the subdivision development area.

Such report shall identify soil types and conditions, including frost susceptibility, soil stability, and water table elevations, as well as any potential difficulties that could be encountered during the construction of the municipal improvements.

As a requirement of the County, additional geotechnical information may be requested outlining recommended design and construction requirements and techniques that may have to be followed to satisfactorily develop the subdivision, particularly related to water and sewer main construction and roadway structures.

1.2.2 Submission of Engineering Design

Upon completion of the design drawings, the Developer's Engineer will submit to the Director of Infrastructure, three (3) complete sets of stamped and signed drawings and specifications of the proposed works, including the following:

- a) Calculations of sanitary and storm sewer capacity, as shown on the overall sewer and water plan, and pipe loading, where these services are to be installed.
- b) Water distribution analysis as specified in Water Distribution Systems.
- c) A print of the registered plan of the subdivision (if not already supplied by the Applicant).
- d) A copy of the soils investigation report, judged by the County to be pertinent to the stage of subdivision.
- e) A copy of the Contract Documents proposed for construction purposes.

All proposed streets should be named on the drawings. All street names are to be approved by Yellowhead County Council in accordance with County Policy CP 32-11 for Naming of Roads.

1.2.3 Design Review

All design drawings, specifications, and relevant data will be examined by the Director of Infrastructure, and any revisions directed to the Developer's Engineer and/or marked on the prints during the review shall be incorporated in the final design drawings.

1.2.4 Design Approval

Upon completion of all revisions, the Developer's Engineer shall submit four (4) complete sets of Contract Drawings and Specifications to the Director of Infrastructure.

When the design is approved, the Director of Infrastructure shall stamp "**Approved for Construction**" on the drawings, returning one set of the drawings to the Developer's Engineer, or issue a letter advising that the design is accepted and listing any conditions of acceptance.

No work will be commenced within any new parcel of land or any of the services to be provided by the Applicant until the County has examined and stamped the revised Contract Drawings and a Permit to Construct form has been submitted to the County for approval and execution.



1.2.5 Rights-of-Way and Easements

Where easement or right-of-way documents are deemed necessary, they will be prepared by a registered Alberta Land Surveyor at the Applicant's expense. Rights-of-way and/or easements will be provided for all utilities not located on streets, lanes, or utility lots, including rights-of-way for ditches or water courses accommodating surface runoff. Rights-of-way shall be registered in the name of the County or, as appropriate, in the name of the utility company. Ownership to be confirmed with the County.

1.2.6 Construction Approval

Upon receipt of "Approved for Construction" drawings and specifications, the Applicant shall proceed to install Municipal services subject to:

- a) Satisfactory execution of a Development Agreement pertaining to the development or subdivision.
- b) Letter of Authorization from Alberta Environment, through the Developer's Engineer, and a copy received by the Director of Infrastructure.
- c) A list of materials that are being installed and a construction schedule submitted to the County's Department of Infrastructure.

A copy of all approved drawings and specifications will be maintained by the applicant at the construction site during the installation of services and be made readily available to County representatives.

Underground subdivision services will not be permitted to operate as part of existing Municipal services until the respective subdivision services have been inspected, tested by the Developer's Engineer and the test results have been approved in writing by the Director of Infrastructure.

1.2.7 Engineering Supervision

The applicant shall retain the services of an Engineer, who shall be responsible for the layout to ensure finished construction conforms to the lines and grades shown on the approved plans for inspection and approval of all materials to be used, and for supervision of installation of all services, that are the responsibility of the Applicant. The Developer's Engineer, or his authorized representative, shall be available at all times to visit the site during the installation of services.

The Developer's Engineer will be responsible for maintaining field surveys and recording of all record drawings.

In addition to supervision carried out by the Developer's Engineer, the Director of Infrastructure, or his designate, may periodically inspect any work being completed. The Director of Infrastructure will bring the use of any unacceptable materials or practices to the attention of the Contractor and/or the Developer's Engineer. If remedial action is not taken to the satisfaction of the Director of Infrastructure, he may order the work to cease until such time as the corrective action has been taken.

If the Developer's Engineer wishes to make any changes in the design, either before or during the execution of the work, he will first submit a marked print, showing proposed



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revisions, to the Director of Infrastructure. If approval is granted for revision, the original drawing will be immediately revised and new prints issued.

1.2.8 Testing

It will be the responsibility of the Developer's Engineer to ensure that testing of all materials called for in the specifications is carried out by an accredited testing firm. Copies of all test results shall be forwarded to the Director of Infrastructure prior to issuance of the Construction Completion Certificate. The costs of the tests shall be borne by the Developer.

1.2.9 Record Drawings

Within three weeks of the Construction Completion Certificate of the underground improvements, the Developer's Engineer shall deliver to the Director of Infrastructure record drawings indicating the service connections, tie-ins, invert charts on plan/profiles, and service invert elevations on lot grading plans. All record drawings must also be submitted in digital format compatible with the County's latest version of AutoCAD.

No development permits or building permits will be processed until the County receives a set of record drawings, including completed design building grades for each lot. As an exception, one show home may be constructed with the written approval by the Director of Infrastructure, provided the subdivision design grades have been submitted and approved.

Within two months of completion of roadway base course asphalt, the Developer's Engineer will deliver good quality mylar sepias of the record drawings, one complete set of prints and a digital copy (in the County's latest AutoCAD software version) of the research records to the Director of Infrastructure.

1.2.10 Municipal Acceptance and Maintenance Period

The Developer shall apply for a Construction Completion Certificate for each group of improvements for each stage of development. A Construction Completion Certificate will be required by the Developer from the County for each group of the following improvements to be constructed and installed by the Developer; namely:

- a) Sanitary and storm sewers, and water distribution system, including service connections for water and sewer.
- b) Sidewalks, curbs and gutters, catch basins, concrete walkways, and paved and graveled lanes.
- c) Paved and gravel roads.
- d) Landscaping, including boulevards, uniform fencing, and subdivision signage.

The Developer shall make application to the County for the issuance of a Construction Completion Certificate. No such application will be considered by the County unless it is requested in respect of all of the Development Area or one or more approved stages of development.

The County may issue a Construction Completion Certificate, issue a Conditional Construction Completion Certificate or provide a list of deficiencies that must be corrected in order to obtain a Construction Completion Certificate. The details of the process will be



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GENERAL CONDITIONS AND ENGINEERING PROCEDURES FOR MUNICIPAL DEVELOPMENT

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outlined in the development agreement. The Developer will not be issued a Construction Completion Certificate after October 15th unless approved by the Director of Infrastructure.

The Developer shall maintain all Municipal Improvements constructed pursuant to this Agreement to the standard to which they were constructed, reasonable wear and tear excepted, for the period commencing upon the issuance of a Construction Completion Certificate and continuing for the periods as stated in the table below:

Table for Maintenance Period

Underground Services and Utilities	- 24 months
Roads and Sidewalks	- 12 months
Uniform Fencing, grass and sod for landscape areas	- 12 months

Upon completion of the Maintenance Period, and after final inspection and correction of all deficiencies thereof, a Final Acceptance Certificate will be issued by the Director of Infrastructure, and the issuance of a Construction Completion Certificate.

1.2.11 Development Permits

No Development Permits or building permits will be issued until the subdivision plan is registered, all essential services have been provided as specified in the Development Agreement and underground utility service record drawings have been submitted and accepted by the Director of Infrastructure.

1.2.12 Existing Utilities

Prior to connecting to existing utilities, the County's Utilities Department shall be given a minimum of two working days notification of the work being done.

Once operational, hydrants or main line valves shall only be operated by County staff.

No sanitary sewers will be used to discharge storm water

1.2.13 Temporary Road Closures and Construction Within Road Rights-of-Way

In the event that a road must be partially or fully closed due to construction activity, the party causing this event will provide all detours, signs, flag persons, barricades, and other safety requirements necessary to provide for the orderly control of traffic around the construction area. A Traffic Accommodation Strategy shall be submitted for approval to the Director of Infrastructure prior to commencing construction



1.2.14 Survey Control System

The Developer shall provide a survey control system within, and adjacent to the subdivision. The survey control system shall consist of survey monuments of a design mutually acceptable to both the County and Alberta Environment, Land Administration Division. The survey monuments shall be placed so as to be inter-visible between adjacent pairs and spaced approximately 300 metres apart. Measurements shall be made between monuments, and connection shall be made to existing geodetic monuments to not less than third order specifications, as defined by the Geodetic Survey of Canada, to establish vertical and horizontal coordinates based on a three degree transverse mercator projection. The County and Alberta Environment, Land Administration Division, shall be provided with the survey measurements, to the satisfaction of the Director of Surveys, Alberta Environment, Land Administration Division, for the survey control system.

The Developer shall undertake to preserve all existing and new monuments and, should it be necessary to destroy a monument, the Developer shall establish a new one in lieu thereof and provide the County and Alberta Environment, Land Administration Division, with survey measurements for it to the satisfaction of the Director of Surveys. Any legal pins disturbed or removed during construction must be replaced prior to Final Acceptance by the County. The Developer shall supply a certificate from a registered legal survey that all lot and corner pins are intact.

1.2.15 Insurance

The Developer shall, without limiting his obligations or liabilities herein and at his own expense, provide and maintain the following insurances in compliance with the Alberta Insurance Act, and in forms and amounts acceptable to Yellowhead County. The Developer shall be responsible for obtaining the following insurance coverage for any construction, with exception to the construction of approaches to private land, on public land for the duration of construction until issuance of the Construction Completion Certificate by Yellowhead County. For private land, insurance will only be required if any portion of the land within the Development is registered to Yellowhead County at the time of construction and that the land in question is proposed for construction.

- a) General Liability Insurance in an amount not less than five million dollars (\$5,000,000) inclusive per occurrence, insuring against bodily injury, personal injury and property damage including loss of use thereof. Yellowhead County is to be added as an additional insured under this policy for any and all claims arising out of the Developer's operations. The policy shall be endorsed to state it is primary and will not require the pro rata sharing of any loss by any insurer of the County. Such insurance shall include but not be limited to:
- Products and Completed Operations Liability;
 - Owner's and Developer's Protective Liability;
 - Blanket Written Contractual Liability;
 - Contingent Employer's Liability;
 - Personal Injury Liability;



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-
- Non-Owned Automobile Liability;
 - Cross Liability with respect to additional insured;
 - Employees as additional insured;
 - Broad Form Property Damage Endorsement;
 - Operation of Attached Machinery;
 - Sudden and accidental pollution;
- and where such further risk exists:
- Blasting, Demolition, Pile Driving, Caisson Work or Tunneling, as applicable;
 - Elevator and Hoist Liability;
 - Towing/On Hook Coverage.
- b) Automobile Liability on all vehicles owned, operated or licensed in the name of the Developer in an amount not less than \$5 million.
- c) Aircraft and/or Watercraft Liability for all craft owned, operated or licensed in the name of the Developer and for all non-owned craft used in the operations of the Developer, in an amount not less than \$5 million per occurrence and including passenger hazard liability where applicable.

The Developer shall provide Yellowhead County with a certified true copy of each policy prior to execution of the Development Agreement.

The Developer shall ensure that Products and Completed Operations coverage, as applicable, shall be in force for the duration of the warranty period.

All required insurance shall be endorsed to provide Yellowhead County with 30 days advance written notice of material change or cancellation.



DESIGN GUIDELINES

GENERAL CONDITIONS AND ENGINEERING PROCEDURES FOR MUNICIPAL DEVELOPMENT

	PERMIT TO CONSTRUCT On County Property/Public Lands	Yellowhead County 2716 1 st Avenue Edson, AB, T7E 1N9 Tel. (780) 723-4800 Fax. (780) 723-5066
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Project Address: _____

Roll #: □□□□□□ Lot: _____ Block: _____ Plan: _____
 Qtr: _____ Sec: _____ Twp: _____ Rge: _____ Mer: W_____

Application Date: _____
(yy/mm/dd)

Applicants Name: _____ Contractor Name: _____ Billing Address: _____
 Address: _____ Address: _____ County/Prov: _____
 County/Prov: _____ County/Prov: _____ Postal Code: _____
 Postal Code : _____ Postal Code: _____

Telephone: _____ Telephone: _____ Fax: _____
 Fax: _____ Fax: _____

Type of Work Proposed:

- Concrete Work
 - Sidewalk
 - Asphalt
 - Curb and Gutter
 - Pavement Cut
 - Driveway Approach
- Utilities
 - Water – size and type: _____ (yy/mm/dd)
 - Sewer – size and type: _____ Closed Ditch Inspection Date: _____ (yy/mm/dd)
 - Storm – size and type: _____
 - Gas – size and type: _____ Inspector: _____
 - Telephone Approved: _____ Rejected: _____
 - Cable

Reasons for Rejection: _____

- Roads
 - Road closure
 - Signage
 - Paving and gravelling
 - Gravel Size _____mm
 - Dust control
 - Pavement markings
 Length of time for Road Closure: _____
- Boulevards/Green spaces
 - Trees
 - Turf
 - Rock
 - Other

Project Description: _____

(drawing attached _____ Yes \ _____ No)

Project Start Date: _____ (yy/mm/dd) Estimated Completion Date: _____ (yy/mm/dd)



DESIGN GUIDELINES

GENERAL CONDITIONS AND ENGINEERING PROCEDURES FOR MUNICIPAL DEVELOPMENT

Conditions

1. All work is to meet Yellowhead County design standards. Failure to have work inspected will result in the removal of backfill material at the cost of the builder to allow inspector access to work in question.
2. A two-year warranty is to be given to any work and repair beginning on the date of completion.
3. The County standards for traffic control must be met.
4. Occupational Health and Safety standards must be met (vests, excavation side slopes, etc.).
5. Any excavation on oiled roadways must be backfilled and cold mix placed in the hole within 48 hours. Hot mix must be placed in hole by October 31 of that year.
6. Inspection is mandatory for all utilities – bedded in sand, all joints and connections exposed. A minimum of two working days notice is required for all inspections.
 - Note: inspections outside of normal working hours (8:30 AM to 4:30 PM, Mon – Fri) will not be permitted.
7. Street must be returned to clean condition prior to opening road to public. Street abutting construction site must be kept clean at all times.
8. Proof of insurance is to be provided to the County pursuant to Section 1.2.16 of the design Guidelines

I, _____, acknowledge that I have received, read and understand all of the above, and I further acknowledge my commitment to the conditions stated in this form.

Date

Applicant's Signature

Print Name

DECISION:

The application to construct is hereby:

1. Approved subject to the following conditions:
2. Refused for the following reasons:

CONDITIONS OF APPROVAL \ REASONS FOR REFUSAL:

County Representative


The personal information on this form is collected under the authority of Section 32 (c) of the Alberta Freedom of Information and Protection of Privacy Act, Section 642 of the Municipal Government Act and/or Section 39 of the Safety Codes Act. The information will be used to process your application(s) and your name and address may be included on the reports that are available to the public.



DESIGN GUIDELINES

GENERAL CONDITIONS AND ENGINEERING PROCEDURES FOR MUNICIPAL DEVELOPMENT

Construction Completion Certificate

	<p>CONSTRUCTION COMPLETION CERTIFICATE</p>
<p>Development or Subdivision: _____ Permit or Subdivision #: _____</p> <p>Developer: _____</p> <p>Contractor: _____</p> <p>Municipal Improvement: _____</p> <p>Location of Municipal Improvement referred to herein is as shown, outlined in red, on the plan on the reverse hereof, (Or see attached).</p> <p>Date of Application: _____</p> <p>PURSUANT TO THE DEVELOPMENT AGREEMENT, I _____ OF THE FIRM "DEVELOPER'S ENGINEERS", HEREBY CERTIFY THAT AS OF THE ABOVE DATE, THE SAID MUNICIPAL IMPROVEMENT IS COMPLETE AND CONSTRUCTED IN ACCORDANCE WITH THE SERVICING STANDARDS AS SET OUT IN THE DEVELOPMENT AGREEMENT, AND I HEREBY RECOMMEND THIS MUNICIPAL IMPROVEMENT FOR APPROVAL.</p> <p style="text-align: right;">Date: _____</p> <p>(Developer's Engineering Firm) Project Engineer (seal) Date: _____</p> <p style="text-align: right;">Date: _____</p> <p>Signing Officer (Developer's Engineering Firm) Date: _____</p> <p>Authorized County Inspector</p> <p>Approved on (date): _____</p> <p>Conditional Approval (date): _____</p> <p>Conditions: (See attached report) _____</p> <p>Rejected on (date): _____</p> <p>Reason for rejection: _____</p> <p>I HEREBY CERTIFY THAT THE ITEMS LISTED AS REASONS FOR CONDITIONAL APPROVAL OR FOR REJECTION HAVE BEEN CORRECTED.</p> <p>Project Engineer (Seal) (Developer's Engineering Firm) Date: _____</p> <p>Approved: _____ Date: _____ Director of Infrastructure Services</p> <p>Date Maintenance Period to Start: _____</p> <p>Date Maintenance Period to Expire: _____</p>	
<p>Director of Infrastructure Services: _____</p> <p>Director of Infrastructure Services: _____</p> <p>Director of Infrastructure Services: _____</p>	



DESIGN GUIDELINES

GENERAL CONDITIONS AND ENGINEERING PROCEDURES FOR MUNICIPAL DEVELOPMENT

Final Acceptance Certificate

	<p>FINAL ACCEPTANCE CERTIFICATE</p>
<p>Development or Subdivision : _____ Permit or Subdivision #: _____</p> <p>Developer: _____</p> <p>Contractor: _____</p> <p>Municipal Improvement: _____</p> <p>Location of Municipal Improvement referred to herein is as shown, outlined in red, on the plan on the reverse hereof, (Or see attached).</p> <p>Date of Application: _____</p> <p>Maintenance Expiry Date: _____</p> <p>PURSUANT TO THE DEVELOPMENT AGREEMENT, I _____ OF THE FIRM _____ "DEVELOPER'S ENGINEERS", HEREBY CERTIFY THAT AS OF THE ABOVE DATE, THE SAID MUNICIPAL IMPROVEMENT MEETS ALL REQUIREMENTS FOR FINAL ACCEPTANCE AS SPECIFIED IN THE DEVELOPMENT AGREEMENT AND I HEREBY RECOMMEND THIS MUNICIPAL IMPROVEMENT FOR FINAL ACCEPTANCE.</p> <p>Project Engineer (Developer's Engineering Firm) (Seal) _____ Date: _____</p> <p>Signing Officer (Developer's Engineering Firm) (Seal) _____ Date: _____</p> <p>Authorized Director of Infrastructure _____ Date: _____</p> <p>Approved on (date): _____ Director of Infrastructure Services: _____</p> <p>Rejected on (date): _____ Director of Infrastructure Services: _____</p> <p>Reason for rejection: (See attached report) _____</p> <p>I HEREBY CERTIFY THAT THE ITEMS LISTED AS REASONS FOR REJECTION HAVE BEEN CORRECTED. _____ Date: _____</p> <p style="text-align: center;">Project Engineer (Developer's Engineering Firm) (Seal)</p> <p>Approved: _____ Date: _____</p> <p style="text-align: center;">Director of Infrastructure</p> <p>Date Maintenance Period to Start: _____</p>	

END OF SECTION

2 PREPARATION OF ENGINEERING DRAWINGS

2.1 DESIGN DRAWINGS

2.1.1 Scope

The following specifications will govern the preparation of Engineering Drawings for all Municipal Developments.

2.1.2 Drawing Size, Material

The Standard Drawing A-1 drawing size (600mm x 850 mm) will be used.

2.1.3 Originals will be prepared in ink on 20 or 24 Pound Bond Paper sheets.

2.1.4 Scales

Urban Residential/Industrial and Rural Industrial drawings shall be prepared using the following scales:

Overall Plans	1:500
Plan/Profile	Horizontal 1:500 Vertical 1:50
Cross-Sections	Horizontal 1:100 Vertical 1:50

Rural Residential drawings shall be prepared using the following scales:

Overall Plans	1:2000
Plan/Profile	Horizontal 1:2000 Vertical 1:50
Cross-Sections	Horizontal 1:2000 Vertical 1:50

2.1.5 Drawing Technique

Points of drawing technique that are significant to the preparation of drawings are as follows:

- a) Care in ensuring balanced distribution of detail throughout the drawing.
- b) Letters and figures shall be clearly legible, 2mm size or larger (Leroy or equivalent), well spaced, properly formed and proportioned.
- c) Lines shall be uniform in weight and density.
- d) Dimensioning shall be in the metric system. Dimensioning of a drawing is extremely important and should be such that it will not be misinterpreted. Dimensions should be given from an iron pin, lot line, a centreline or any other reference that can be readily established. Wherever possible, all dimensions shall be provided to a minimum of two (2) property lines.

2.1.6 Title Block

All drawings must clearly show the following in the title block:

- a) Developer's / Owner's Name.
- b) Developer's Engineer or consulting engineering name.
- c) Subdivision name, including staging and / or phasing.
- d) Drawing name, number and issue date.

- e) Drawing scale, including horizontal and vertical axis.
- f) Space for dates and signature of the designer, draftsman, reviewer or checker, and approving professional or principal.
- g) Space for professional stamps and permits.
- h) Space for revisions, including number, date, description, and approved signature.

2.1.7 General Requirements for All Drawings

Elevations will be relative to the Geodetic datum. The reference bench marks and elevations will be shown on the design drawings.

A north arrow, the name of the subdivision and, where appropriate, phase as included in the Development Agreement, adjacent lots and plan numbers, street names and the legal description of the parcel being subdivided, will all be shown on the drawing. In general, the north arrows should be orientated toward the top of the plan.

An Engineer's stamp and Permit to Practice stamp, signed by an Engineer registered in the Province of Alberta will be shown on the engineering drawings.

2.1.8 Required Engineering Drawings

The following plans will form a part of the design drawings set:

Cover Sheet:

This will show the name of the subdivision, stage of development, location plan, County logo, and names of the Developer and Developer's Engineer. Space permitting, the index plan may be included here. A key plan of Yellowhead County, or a significant portion thereof, shall be included, illustrating the location of the development or project.

Index Plan:

This plan will be prepared on a scale of 1:500, or a reduction thereof to fit the standard size sheet, and will indicate that portion of the street that relates to a particular plan/profile sheet.

Contour Plan:

This plan will be drawn at a scale of 1:1000 and will indicate the existing contours at 1.0 metre intervals (rural developments) and 0.5 metre intervals (urban developments), the proposed land use and all significant above ground features, such as buildings, structures, trees, utilities and water bodies.

Sanitary Sewer, Storm Sewer and Water Main Overall Plan:

This plan will be drawn to a scale of 1:500 and will indicate the alignments and locations of mains, size of mains, valves, hydrants, manholes, catch basins, storm catchment areas with areas labeled in hectares, direction of sewer main flows and locations of appurtenances.

Road, Sidewalk and Walkway Plan:

This plan will be drawn to a scale of 1:500 and will show all locations and widths of roads, lanes, sidewalks, walkways, and right-of-way widths and alignment, and the storm drainage system including the local drainage areas, catch basins, pipe and culvert locations, sizes, inverts, direction of flow, as well as all proposed approaches.

Lot Grading Plan:

This plan will be drawn to a scale of 1:500 and will indicate the original contours at 0.5metre intervals (shown in screened format), proposed areas of grading, finished lot corner elevations, grades and direction of finished surface drainage flows.

Shallow Utilities Plan - Power, Gas, Telephone and Cable:

This plan will indicate the alignments of power, gas, telephone and cable, and shall be drawn to a scale of 1:500. Existing infrastructure and other relevant features shall also be shown in detail.

Detailed Plan/Profile drawings:

Plan/Profile drawings shall be drawn to a scale of 1:500. The profile portion shall have a 10 times vertical exaggeration.

2.1.9 Detailed Plan/Profile

Generally, all underground services and surface improvement profiles are shown on the same drawing. The plan portion of the sheet shall be at the top, and the title blocks, revisions, legends, company stamps, and similar features will be placed along the bottom of the sheet.

The following information will be included on the detailed plan/profile drawings:

2.1.9.1 Requirements for Sanitary and Storm Sewer:

The following information will be shown on the profile:

- a) Size, type, class of pipe and class of bedding.
- b) Length and percent grades between manholes.
- c) Invert elevations at both inlet and outlet of manholes.
- d) Rim elevations at finished grade.

The following information will be shown on the plan:

- a) Tie location of manholes, cleanouts, and other appurtenances to property lines.
- b) Pipe offsets from property line.

The following additional information will also be shown on an appropriate part of the drawing:

- a) Manholes shall be numbered.
- b) Where the sanitary sewer or water and storm drain are to be installed in a common trench, detail a typical cross-section showing distance between pipes, class of pipe and bedding.

2.1.9.2 Requirements for Water:

- a) Tie the location of hydrants and other appurtenances to the nearest property pin.
- b) Show the offset of the main from the property line and locate the end of the main to the nearest property pin.
- c) Indicate extent of work required in making the connection to the existing water main.
- d) Indicate the size, type, class of pipe, bedding and CSA specification number on the plan.

2.1.9.3 Requirements for Roads:

- a) Both plan and profile must be tied to a property pin, preferably near or at 0 + 000 chainage.
- b) Show the road width and the curb offsets measured from the property line to the curb face.
- c) Chainages of the BC and EC of horizontal curves will be shown together with the delta angle, radius, tangent length and arc length for each curb.
- d) The percent grade, to two decimal places, shall be shown on the profile, together with the following information on vertical curves:
 - 1) The chainage and elevations of BVC, EVC and PVI.
 - 2) The external value, "e".
 - 3) The length of vertical curve.
 - 4) The elevation and chainage of the low spot of sag curves or the high spot of crest curves.
- e) Road profiles shall show the Centerline or Lip of Gutter elevations, identifying which has been used.
- f) The profile will be shown at true centreline length and projected above the plan in as close a relationship as possible.
- g) Locate catch basins (using road chainage) and show leads between the catch basin and manhole.
- h) Label limits of construction.

2.1.9.4 Requirements for Storm Water Management Facilities

The engineering drawings for any SWM facility are to include the following information, in addition to the physical dimensions:

- a) Stage-Volume and Stage-Area Curves;
- b) Elevations at Normal Water Level (NWL), 5 Year Level and High Water Level (HWL);
- c) Volumes at NWL, 5 Year Level and HWL;
- d) Freeboard elevation;
- e) Notation indicating the lowest allowable building opening elevation for lots abutting the detention area;
- f) Depth at NWL, 5 Year Level, 25 Year Level and HWL.

2.1.10 Lot Grading Plan Requirements

This plan will include:

- a) Invert and location of sewer and water services.
- b) Proposed top-of-curb or back-of-walk elevations.
- c) Existing and proposed contours at 0.5 metre intervals.
- d) Proposed finished lot corner elevations.
- e) Proposed finished lot elevations on side property lines at 6.0, 12.0 and 18.0 metres back from the front property line.
- f) Proposed finished lot elevations on side property lines at 6.0 metres from the rear property line.
- g) Distances from a property pin to the proposed grade break points on property lines that divide properties.
- h) Proposed finished lot elevations at grade break points.
- i) Standard detailed drawings shall govern the lot grading design, and critical swales elevations will be calculated as per the types shown.
- j) The lot grading plan will have the following note: "The surveyor shall design and stake out the house elevations and finished grades at house to meet the building code slope requirements for drainage to critical swales".
- k) The grading plan will identify lots with weak subsoil conditions and have a notation indicating the requirement for a geotechnical engineer's footing design.
- l) The grading plan will identify all lots with areas of 1.0 metre of fill or greater, with these lots shaded a different colour.
- m) Direction of surface drainage and critical swale elevations on side property lines.

2.1.11 Power, Gas, Telephone and Cable Utility Plan Requirements

This plan will include:

- a) Street Light Locations.
- b) Dimension of all Easements.
- c) Location of pedestals, transformers, cabinets, and other hardware.
- d) Lot Numbers.

2.2 RECORD DRAWINGS**2.2.1 Scope**

This procedure pertains to the record drawings of the following services:

- a) Storm and sanitary sewers, watermains, roads, curbs, sidewalks, culverts and other miscellaneous permanent structures.

2.2.2 General

The record drawings shall be affixed with the stamp and seal of a Professional Engineer who, by signing, is certifying the information to be accurate and correct.

The record drawings will clearly show the locations of all services, curb cocks, valves, hydrants and manholes, using right angle measurement from survey pins.

Red line record drawings are to be submitted for review, indicating changes.

The record drawings are to be submitted to the Director of Infrastructure on high quality mylar sepia sheets, within three weeks of the installations, along with one complete set of prints.

The record drawings referred to in this section will also be submitted to the Director of Infrastructure in digital format, as per the following requirements:

- a) Must be compatible with the County version of AutoCAD.
- b) Accompanied by a layer list and description.
- c) Will conform to layering and symbol standards as established by the County or their consultant.
- d) Be submitted on CD ROM.
- e) Two (2) paper copies.

On record drawings submitted to the County, the following information will be included on each drawing:

- a) Date of completion.
- b) Name of the contractor.
- c) Date on which record details were added.

2.2.3 Storm and Sanitary Sewer

The following information will be included for storm and sanitary sewer systems:

- a) Size, pipe material, pipe class, bedding and location of mains.
- b) Location of manholes, cleanouts, and other appurtenances.

- c) Grades, lengths, inverts of mains and rim elevation.
- d) Profile of pipe top and bottom.
- e) Corrected flow calculations.

2.2.4 Water

The following information will be included for water systems:

- a) Size, type and location of pipe.
- b) Location of valves, tees, hydrants and other appurtenances.
- c) Profile of pipe top and invert.

2.2.5 Road, Curb, Sidewalks

The following information will be included for roads, curbs, and sidewalk:

- a) Location of curbs, sidewalks and elevations of lip-of-gutter.
- b) Lip-of-gutter for each curb.
- c) End of curb, sidewalks and pavement.
- d) Type of road structure on overall road plan and each plan profile.
- e) A typical cross-section referencing the above and representing all conditions.

2.2.6 Water, Sanitary and Storm Service Connections

A table on each plan/profile drawing will be prepared giving the following information with respect to service connections:

- a) Lot number.
- b) Distance of service saddle from the downstream manholes.
- c) Invert elevation at the end of sanitary and storm service.

The service connection provided to each lot will be shown on the plan and the location triangulated to the property lot corners.

The typical location of the curb stop will be identified on each plan/profile, (i.e. 0.3 metre F.O.W., 2.65 metre B.O.W.) by means of a table chart.

2.2.7 Mechanical Systems

Where the subdivision includes mechanical systems, such as lift stations, the Developer will provide detailed drawings of the facility, as well as operation/maintenance manuals, including the make and model of all equipment, to the satisfaction of the County.

2.2.8 Building Grade Certificates

Prior to issuance of a Construction Completion Certificate for water, sanitary, and storm services, the Developer shall provide to the County the relevant Building Grade Certificate for each lot in the Development using Drawing # R-26 Building Grade Certificate.



Building Grade Information

The following information shall be shown on the Building Grade Certificate:

- a) Water, sanitary, and/or storm services location and inverts at property line or easement line.
- b) Power, telephone, and cable television service location.
- c) Sidewalk and boulevard width.
- d) Easements.
- e) Lot corner surface elevations.
- f) Landscape elevations at front and rear of house.
- g) Lot drainage pattern.
- h) Surface Appurtenances
- i) Lowest top of footing Elevation.

This information shall be provided in the form as shown on the sample Building Grade Certificate.

END OF SECTION

3 WATER DISTRIBUTION SYSTEM

3.1 GENERAL

The design of the water system shall conform to the “Standards and Guidelines for Municipal Waterworks, Wastewater, and Storm Drainage Systems in Alberta”, as published by Alberta Environment and as amended by these Guidelines and Standard Details.

3.2 MUNICIPAL WATER SYSTEM

The Developer may be required to tie into a municipal water system or to shut off system valves to undertake the proposed work. When this is required, the Developer shall:

- a) Give the Department of Infrastructure sufficient notice of the proposed work and schedule so proper planning and approvals can take place.
- b) Supply all water necessary for the work and obtain written permission from the Department of Infrastructure prior to using any hydrants.
- c) The Developer shall be held responsible for any damage done to the hydrants or surrounding area. The Municipality will require their own personnel to operate their valves and/or hydrants.
- d) Make an agreement with Yellowhead County for payment of water used.
- e) Be responsible for the supply of all water necessary for the work.
- f) Provide 24 hours notice to any property owner affected by water service disruption.
- g) Supply an alternative water service if the water disruption is longer than 4 hours.
- h) For establishments relying on an uninterrupted water source for their operations, an alternative water source shall be provided.
- i) The above noted requirements shall be done at the Developers cost.

3.3 DESIGN REQUIREMENTS

The minimum size of distribution main shall be 150mm diameter for residential, 200mm diameter for commercial and 300mm diameter for industrial.

PVC pipe shall be used and the value of “C” in the Hazen-Williams formula shall be 120 for all types of pipes.

Per capita consumption shall be:

Average Daily Demand	-	375 lcd
Maximum Daily Demand	-	2.0 x Average Demands
Peak Hourly Demand	-	4.0 x Average Demands

The design population shall be the ultimate for the area under consideration.

For non-residential developments, the minimum water consumption rate shall be equal to 0.2 litres per second per hectare. The applied peaking factor shall be $Pf = 10Q^{-0.45}$ to a maximum of 25 and a minimum of 2.5, Q being in litres per second. Where possible, water demand shall be based upon site specific requirements for identified uses. Fire flow requirements are to be included in all calculations.

An analysis will be made for Peak Hour Demand, and mains shall be sized such that there will be a minimum residual pressure of 300 kPa (43.5 psi) at ground level at any location in the system. In order to avoid damage to household piping, maximum system pressure should not exceed 700 kPa (102 psi).

Due to physical boundaries and topographical restraints, the maximum pressure in some localized areas may be found to exceed 550 kPa. The recommended solution for this problem is the provision of pressure reducing valves in the affected properties, to be owned, maintained and operated by the property owner. Materials for the affected mains and services will be of an appropriate pressure class.

Separate analysis shall be made for Maximum Demand plus Fire Flow. The residual pressure at any location at the ground level shall not be less than 150 kPa (22 psi).

Fire flow requirements shall be in accordance with the Fire Underwriters Survey publication entitled "Water Supply for Public Fire Protection – a Guide to Recommended Practice", latest revision thereof. Generally these are: for single family residential 100 l/second, for multi-family residential 180 l/sec, for Institutional 300 l/sec, commercial 300 l/sec, and light industrial 300 l/sec.

Main line flow velocities should not exceed 1.5 m/s during peak hour flow conditions and 2.5 m/s during maximum day plus fire flow conditions.

Where the size of the area to be developed warrants, or if required by the County, a network analysis will be carried out and all relevant information will be submitted with the design documents.

Water main looping will be required where the number of lots exceed 20 lots unless otherwise approved by the Director of Infrastructure Services.

3.3.1 Water Main - Location and Installation

All water mains shall be a minimum of 150mm in diameter.

Mains shall be installed to provide a minimum depth of cover of 3.0 metres below the final finished surface grade.

In all cases a distance of 3.0 metre from the centreline of a road shall be maintained.

A minimum of a 3.0 metre horizontal separation shall be maintained between a water main center line and any sewer main centerline. Vertical separations of 0.30 metre and 0.50 metre must be maintained for water mains crossing above sewers and below sewers respectively.

The minimum requirement for pipe bedding shall be Class "B" bedding

Water main installation shall be in accordance with manufacturer's requirements and these specifications.

Water mains less than or equal to 300mm diameter in size will not apply for oversize.

3.3.2 Hydrant - Location and Installation

The maximum allowable spacing between fire hydrants shall be 150 metre in single-family residential areas and 90 metre in multiple-family residential, school, and 100 metres in industrial/commercial areas.

Hydrant locations shall be such that the distance to any building shall be no greater than 75 metres. For the case of multi-family and/or commercial buildings with standpipes, the distance shall be 45 metres unobstructed driving distances, between hydrant and standpipe.

In cul-de-sacs which are 90 metres or less in length, the fire hydrant shall be installed on the intersecting street at or near the intersection with the cul-de-sac.

Hydrants on the distribution main will be installed at the projection of property lines, except:

- a) Where the hydrants are installed at the intersections, they shall be installed adjacent to the cut-off corners of the lot.
- b) Where the hydrants are installed in a cul-de-sac, they will not be installed within the turning circle but shall be located at the tangent points.
- c) Where a hydrant and sanitary manhole fall on the same property line projection, the manhole will be moved a minimum of 5 metres away from a hydrant.
- d) All hydrant leads shall be a minimum of 150mm in diameter.

Hydrants shall be located to conform to curb and sidewalk design and shall be installed as follows:

- e) For Urban Cross-Sections the center of the barrel is to be 1.5 metres back of face-of-curb where separate sidewalk or no sidewalk exists and 3.0 metres from face of curb where monolithic sidewalk exists.
- f) With rural cross-sections, install hydrants 1.0 metre from property line.
- g) Shall be installed in accordance with the Standard Drawing and the Engineering Specifications outlined in these documents.

Additional hydrants shall be installed at high value properties if deemed necessary by the County.

3.3.3 Valve - Location Spacing and Installation

All valve boxes located in streets shall be left flush with the base course asphalt. Immediately prior to the final lift of asphalt being placed, these valve boxes shall be raised to final grade.

The location and spacing of valves in the water system should be such that when in operation:

- a) No more than two hydrants may be taken out of service by a water main shutdown.
- b) No more than four valves are required to effect a shut down.
- c) No more than 30 single family lots may be taken out of service by a water main shut down.

Valves on the distribution mains will be installed:

- d) At the projection of a property line at intersections or in mid-block.
- e) With two valves at a tee and three valves at a cross.



- f) All hydrant leads shall have isolation valves 1.0 meter offset from the hydrant.

3.3.4 Flushing of Existing and New Water Mains

Prior to flushing of any watermains, Yellowhead County Infrastructure Services Office and the County's Utilities Department will receive a minimum of two working days notice. **Only County personal will operate existing valves.**

3.3.5 Usage of County Water

Prior to using County water, a Credit application must be processed by Yellowhead County to establish a billing account. Credit applications will be processed within 24 hours of receipt of application during regular business hours. The Developer's Engineer shall be responsible for calculating the water used for flushing of mains. This calculation shall be submitted to the County at the time of the Construction Completion Certificate (CCC). The Developer shall be responsible for the cost of the water used to flush the mains and shall be invoiced accordingly. The cost of this water shall be calculated using the current charges, as may be amended from time to time, as outlined in the Utilities Bylaw No. 11.06 in Schedule A for commercial bulk users.

END OF SECTION

4 SANITARY SEWERAGE SYSTEM

4.1 DESIGN FACTORS

The sanitary sewerage system shall be of sufficient capacity to carry peak flows plus infiltration. Foundation weeping tile and roof leaders shall **not** be connected for discharge into the sanitary sewer system. The following factors shall be used in design of sanitary sewerage systems:

4.1.1 Design Flows

a) Residential

Population estimates for the purpose of system design shall be based upon the actual lotting proposed for the development and a persons/dwelling estimate of not less than 4.0.

The County reserves the right to require additional system capacity to accommodate potential future subdividing of larger lots.

Average Sewage Flow	-	320 lcd
Peaking Factor	-	$1 + 14 / (4 + p 0.5)$

(Harmon's Formula)

Where p equals the equivalent population in 1,000's

Infiltration	-	0.20 L/s/ha
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b) Commercial, Industrial and Institutional:

Average Sewage Flow	-	Commercial: 40,000 l/ha/d Industrial: 30,000 l/ha/d
Infiltration	-	0.28 l/s/ha (24,000 l/ha/d)
Minimum Velocity	-	0.61 m/s

4.1.2 Pipe Design

- a) Pipe sizing shall be determined by using the Manning's Formula with an "N" value of 0.013.
- b) The minimum size for sanitary sewer mains shall be 200mm diameter for residential and 250mm for industrial/commercial areas.
- c) Sanitary sewers may be required to be oversized to conform to the County's Sanitary Sewer planning.
- d) Velocity Requirements:
 - (i) Sanitary sewers shall be designed to achieve a mean flow velocity when flowing at the depth corresponding to the design peak dry weather flow of not less than 0.61 m/s, to provide for self cleansing. For the upstream reaches of the sanitary system, where it is not feasible to obtain a 0.61 m/s flow velocity without resulting in excessive slopes, the pipe slope shall be maximized within the limits dictated by the system depth constraints. The designer is to optimize the use of the

available elevation difference to provide extra slope in the reaches of the water system where design flows are minimal.

- (ii) The Maximum flow velocity shall be limited to 3.00 m/s this is to prevent undue turbulence, minimize odors due to sulphide generation and limit the erosive and momentum effects of the flow.

e) Slope Requirements:

- (i) It is recommended that all sanitary sewers be designed with a slope of 0.4% or greater.
- (ii) The maximum slope will be based upon limiting the maximum flow velocity of 3.0 m/s, as per 4.1.2(e).
- (iii) No sanitary sewer shall have a slope of less than 0.1%.

Minimum pipe slopes shall be as follows.

4.1.3 Determination of Peak Dry Weather Flow Rates

Peak dry weather flow rates for specific design for non-residential areas are to be determined by application of a peaking factor (PF), related to the average flow rate (Q_{AVG} in L/s) in accordance with the following expression to a maximum value of 25.0 and a minimum value of 2.5:

$$PF = 10Q_{AVG}^{-0.45}$$

TABLE 4.1

MINIMUM DESIGN SLOPES FOR SANITARY SEWERS

Sewer Diameter (mm)	Minimum Design Slope (m/100m)
200	0.40
250	0.28
300	0.22
375	0.15
450	0.12
525	0.10
600	0.10

**TABLE 4.2
MINIMUM DESIGN SLOPES FOR CURVED SANITARY SEWERS**

Sewer Diameter (mm)	Minimum Design Slope (m/100m)
200	0.40
250	0.31
300	0.25
375	0.18
450	0.15
525	0.13
600 and Larger	0.10

Sanitary sewers are to be designed to carry the design flow at a flow depth of 80% of the sewers diameter. This results in a flow rate of approximately 86% of the sewers' full flow capacity. Therefore, the required flow capacity for sizing the sewer may be computed using the following relationship:

$$\text{Required full flow sewer capacity} = \frac{\text{estimated total design peak flow rate}}{0.86}$$

4.2 SEWER MAIN INSTALLATION AND LOCATION

Mains shall be installed to provide a minimum depth of 3.0 metres from top of pipe to final finished grade at the surface.

Mains shall be installed to provide adequate sewer service connection depth at the property line.

Mains shall be located within the road right-of-way in accordance with the Standard Drawings R-01.

Pipe bedding shall be provided for all mains in accordance with the Standard Drawings S-03.

4.3 MANHOLE INSTALLATION AND LOCATION

Manholes shall be located at the end of each line, at all changes in pipe size, grade or alignment, at all junctions, and at intervals no greater than 120 metres along the length of the sewer.

Inverts in manholes at changes in direction shall have at least 50mm fall across manhole. To maintain a continuous energy gradient through manholes, the obvert (crown) elevation of the lowest upstream pipe shall be equal to, or higher than, the obvert of the downstream pipe.

Manholes shall be installed as shown on Standard Drawings S-01, S-02, S-06. Manhole bases shall be pre-cast slabs, concrete poured bases, vaults or pre-cast tees. Pre-benched manholes shall be used when possible. All manholes shall be 1200mm inside diameter for all pipe 900mm diameter and less. For pipe exceeding 900mm diameter, manhole diameter shall be pipe diameter plus 600 mm, or a Tee-Riser shall be used.

An interior drop manhole shall be used where invert levels of inlet and outlet pipes differ by more than 750 mm.

Manhole frames and covers to be Type F-39 in landscaped areas, Type NF-80 in paved areas and Type NF-90 gasketed in sags. All manhole covers are to be clearly stamped "Sanitary Sewer".

All joints shall be watertight.

Safety platforms at intermediate levels are required for manholes greater than 5.0 metres in depth when measured from the top of the frame to the lowest invert.

4.4 CURVED SEWERS

Curved sewers will be permitted, with the following restrictions:

- a) The sewer shall be laid as a simple curve, with a radius equal to or greater than 90 metres or the manufacturer's minimum recommended radius, whichever is larger.
- b) Manholes shall be located at the beginning and end of the curve.
- c) Manholes shall be located at intervals not greater than 90 metres along the curve.
- d) The main shall run parallel to the curb or street centreline.
- e) The minimum grade for sewers on curve shall be 50% greater than the minimum grade required for straight runs of sewers.

4.5 INSPECTION AND TESTING

Prior to issuance of the Construction Completion Certificate of the project, all sewer mains shall be tested as follows:

- a) Closed Circuit Television Inspection:

All sections of sanitary sewers shall be inspected with closed circuit television camera equipment prior to C.C.C and F.A.C. A written report and a colour video tape, in VHS format, shall be submitted to the County for their approval and records.

- b) Leakage Test:

The Director of Infrastructure may require each section of sewer main and service connections to be tested for water tightness by an exfiltration test and/or infiltration test. In areas where the water table rises up to the sewer pipe invert or higher, each section of the sewer main and service connections shall be tested for water tightness by an infiltration test. In all other situations, an exfiltration test shall be conducted. The test results shall be recorded for each section of the main tested and the results forwarded to the Director of Infrastructure.

4.6 LOW PRESSURE SEWAGE SYSTEMS

4.6.1 Design Factors

- a) System design shall comply with all environmental legislations, including but not limited to safety, odour control, accidental line break, spillage control, health issues, zoning development standards and its impact on existing and proposed downstream treatment facilities.

- b) System and pump configuration will need to be designed for increased future sewage flows, based on greater “per capita” sewage generation and/or staged low-pressure system expansions to existing networks, as presented in area structure and long range development plans. Accessibility and maintenance provision shall be considered when locating the units.
- c) All materials incorporated in the system shall meet County approval and be installed as per manufacturer’s instructions. Unapproved materials shall be replaced at the contractor’s or developer’s expense.
- d) All systems shall be designed for a minimum 20 year operating life span.
- e) Pipe sizing shall meet all the requirements of the design flow rate(s). The total dynamic head (TDH) at each pump location during peak flow conditions shall not exceed the recommended pump operating parameters on any flow path. Minimum inside diameter shall be 50mm.
- f) Low pressure sewage systems shall be laid out in a branched or tree configuration. The end of a branch is determined by the joining of 2 or more main sections and/or when the outfall is reached. There shall be no looping of collection mains.
- g) A minimum of 1.0 metre/sec scouring velocity shall be achieved in each sub-system at least once per day, based on design flows.
- h) Where systems require the retrofitting of existing sewage holding tanks, inspection and re-certification of the structure is required.
- i) The low pressure system can utilize either centrifugal or semi-positive displacement pumps; whichever is deemed more applicable for the particular application. In no case shall both pump styles be utilized within the same system.
- j) Design flows for low-pressure residential collection main systems shall be designed as follows:
 - (i) Centrifugal Pump System
 - $Q=1.2611 + (0.0316 \times R)$ where
 - R=The accumulative number of residences contributing sewage flows to each system segment.
 - Q=Equivalent design flows for each segment in litres/second (l/s).
 - (ii) Semi-Positive Displacement
 - $Q=N \times PR$ where
 - N=The maximum number of households contributing sewage flows to each system segment at any one time. Where pumping rates range between 0.38 l/s and 0.95 l/s, the maximum number of households shall be based on statistical evidence listed in Table 4.3.

Table 4.3

PR=Pump Pumping Rate.

Number of Contributing Pumps	Max. Daily Simultaneous Pump Operations
1	1
2-3	2
4-9	3
10-18	4
19-30	5
31-50	6
51-80	7
81-113	8
114-146	9
147-179	10
180-212	11
213-245	12
246-278	13
279-311	14
312-344	15

Note: Where pumping rates are outside the 0.38 l/s to 0.95 l/s range, verify the number of simultaneous pump operations with the pump supplier and adjust accordingly:

- (iii) All minor losses at bends and valves according to the supplier specifications.
- (iv) Elevation changes shall be taken into consideration in system design.
- k) The system shall contain provisions against any possibility of flow reversal due to back siphoning.
- l) System operating pressures shall normally be in the range of 200 kPa to 415 kPa (30.0 psi to 60.0 psi). The network shall be designed to prevent any long-term high-pressure situations.
- m) Piping material shall be either, PVC DR26 (series 160) gasketed joints or HDPE DR11 (series 160) butt fused, electro-fused or better. Pipe network shall be designed to operate at a sustained system pressure of 885 kPa (128 psi).
- n) Final plastic sewer pipe selection shall be the consulting engineer's responsibility, and shall take availability, cost, local code, soil conditions and system design requirements into consideration. Material selection must be shown to adequately meet structural and chemical conditions.
- o) Piping from sewage generating facilities to grinder pump units shall meet all applicable code requirements.
- p) An analysis is required to determine if a grinder pump (GP) or septic tank effluent pumpout (STEP) low-pressure system is best suited for the particular application.

4.6.2 System Requirements

- a) Where possible all sewer piping shall be installed at sufficient depths to prevent freezing. Where pipe sections and appurtenances have less than 3.0 metres cover, necessary rigid insulation shall be used to prevent freezing.
- b) Air release / vacuum break valves will be installed at all locations where trapped air affects system functionality.
- c) Standard water / sewer clearances shall be maintained at 30 metres horizontal and 0.5 metres vertical.
- d) Clean outs shall be installed at the upstream of each line segment and major directional changes. Maximum spacing for cleanouts and isolation valves shall be 150 metres. Units shall include a quick coupler system for system flushing compatible with County maintenance requirements.
- e) All forcemain lines will be installed with metallic tape or insulated 14 gauge copper wire for locating purposes c/w the required surface detection unit connection points. All cleanouts shall include an isolating valve. An additional check valve shall be located between the isolating valve and the cleanout assembly.
- f) Fitting connections shall be butt fused, socket weld, mechanical flange or electro – fused. All joints shall be equal to or greater than the pipe pressure ratings, be approved for use in the particular application, and be full bore with smooth interior surfaces.
- g) Valve units. The maximum number of shut-off valves clustered together shall be dependent on County policy and the access chamber size. Service line sizes shall be as per the grinder pump manufacturer's instructions and will have the same or better pressure rating as the collection mains.
- h) Low-Pressure collection lines can be installed using trenching, ploughing, or directional drilling. Prior to installation, all utilities need to be located and identified.
- i) Use of repair clamps will not be permitted.

4.6.3 Property Shut-off and Main Line Isolation Valves

- a) Isolation valves shall be located at key points, and major directional changes for maintenance and repair requirements, to a maximum of 150 metres between each other.
- b) Valves on lines less than 75mm shall be fully ported ball valves, true union type or flanged connection to allow for removal without cutting the line.
- c) Isolation valves on lines 75mm in diameter or greater shall be eccentric plug type, suited for operation in sewage systems.
- d) Isolation valves shall remain accessible via a service box or access chamber assembly. Where a chamber unit is utilized it will be insulated to prevent freezing.
- e) All service lines to individual lots shall incorporate a shut-off valve. Lot shut off valves shall be located at least 300mm outside the property limits. Accessibility shall be the same as for isolation



- f) Cast valve boxes shall be epoxy coated. Other materials shall be suited for direct bury applications and approved for use by the County. Valve open/closing rotation shall be as per water valve requirements.

4.6.4 Pump Requirements

- a) Pump operating parameters shall be based on the present and future system requirements as determined by the Engineer. The required individual grinder pumping rates shall be determined according to daily inflow rates as indicated in "Section 4.1.1".
- b) Pump units shall be submersible types, either semi-positive displacement or centrifugal, with integrally built grinder assembly and isolation valves. Pump units shall pump directly into low-pressure mains. Pumping equipment shall meet all applicable safety, fire and health requirements for the intended application and location.
- c) Grinder assemblies shall be capable of macerating all material in domestic sewage, including reasonable amounts of glass, wood, plastic, rubber, light metal objects, disposable diapers, sanitary napkins, and be specifically designed for the purpose intended. Processed material must have a consistency that will not clog any part of the discharging system.
- d) While outside below ground installations are preferred, inside installations meeting all code and collection system requirements may be allowed subject to County approval. Pump operating parameters shall be based on the present and future system requirements as determined by the Engineer. The required individual grinder pumping rates shall be determined according to daily inflow rates as indicated in "Section 4.1 Sanitary Sewage System".
- e) Grinder pump assembly to consist of 440-C stainless steel hardened to C-58-60 Rockwell. Remaining parts exposed to sewage shall be manufactured to prevent corrosion.
- f) The unit shall operate at 120 or 240 volts single phase, and be able to provide the required flows at the design total dynamic head. All complete grinder pump installation manuals including but not limited to electrical wiring, piping installations and detailed installations, shall be provided to the installer and County personnel prior to construction.
- g) The pump unit shall be constructed such that open shafts are not exposed inside the raw sewage passageways where they can become clogged.
- h) A two compartment sewage tank shall be of sufficient built-in storage to accommodate peak flow and power outage situations. Provision for mobile power generating units should be considered, where applicable.
- i) Semi-positive grinder pump unit will have a built-in automatic shut off mechanism when system back pressures cause thermal overload. Units shall be able to automatically restart after cooling.
- j) Grinder pump rated maximum pumping pressures shall not exceed 85% of low-pressure collection pump systems, designed maximum working pressures.
- k) Pumps shall be of the flooded suction type to ensure positive priming.

- l) Where high ground water levels exist, grinder pump / tank assemblies shall need to be securely anchored to avoid floating.
- m) Pump holding tanks shall be vented such that the airspace above the wastewater level is always at atmospheric pressure.
- n) Tank interior geometry and generated pump suction currents during operation must be adequate to provide scouring velocities to prevent build-up of solids.
- o) Grinder pump assembly shall include all level controls to turn unit on/off at set levels. In addition high level / pump operation alarms shall be provided.
- p) Maintenance replacement and power consumption evaluations shall be preformed as part of the final system design. Literature shall include but not be limited to:
 - parts listing
 - parts supplier
 - maintenance schedule
 - Where required provide a minimum of two manuals to County maintenance personnel.

4.6.5 System Testing

- a) The low-pressure collection system shall be pressure tested prior to commissioning, after backfilling operations are complete and at least 36 hours after the casting of concrete thrust blocks.
- b) Zero infiltration/exfiltration is permitted.
- c) Components to be tested shall include the entire collection system, up to the grinder pump assembly. Test duration shall be a minimum of 2 hours, or if the pipe network is buried, 8 hours.
- d) The test pressure shall be 1.5 times the maximum operating pressure, but not less than 350 kPa (50 psi).

END OF SECTION

5 STORM DRAINAGE SYSTEM

5.1 DESIGN FACTORS

The storm sewers or storm drainage system shall be designed as a separate system and shall be of sufficient capacity to carry storm runoff from the ultimate development the area is zoned for. The storm system should be designed considering both the minor and major drainage systems.

The minor system comprises of piping, manholes, catch basins and outfall structures. The minor system shall convey runoff from snowmelt and rainfall events to an adequate receiving water (river, stream, lake or pond) without sustaining any surface ponding or excessive surface flows for events up to and including a 1-in-5-year return period. Where required by the Director of Infrastructure, high value commercial areas shall have their minor systems designed to accommodate a 1-in-10-year return period event.

The major system comprises the street system, detention facilities, parkland and any other land required to convey runoff from events up to and including a 1-in-100 year return period to the receiving water. The major system shall be evaluated in a manner sufficient to determine that no flooding that may cause significant property damage (e.g. flooding of buildings) occurs during the 100 year event.

Effluent from sanitary sewers and any drainage from industrial, agricultural or commercial operations that may potentially be contaminated shall not be discharged to the storm sewers.

Roof leaders of residential buildings shall be splashed on the surface and shall not be connected to the storm sewer system. Roof drainage from one-family and two-family dwellings shall discharge to grassed or pervious areas. The point of discharge shall be a sufficient distance (i.e. at least 1.0 metre) to ensure the water flows away from the building. Roof drainage from apartment buildings, commercial areas, and industrial areas may discharge to the storm sewer, without the drainage crossing a sidewalk, if approved in writing by the Director of Infrastructure.

The post development runoff rates from properties shall not exceed the existing pre-development runoff rates being discharged to the storm drainage system, thus resulting in a no net increase to the storm drainage system.

Where pre-development runoff rates are considered excessive for the existing drainage system, the developer shall consider alternatives to reduce the existing runoff to a level acceptable by the Director of Infrastructure.

The developer shall provide these designs and calculations to Yellowhead County for approval.

Ponding of runoff on roofs, parking lots or landscaped areas to reduce runoff rates must be considered.

All development shall provide sump pumps to discharge weeping tile water to grassed surface areas or splash pad. Splash pads are required to insure positive drainage away from the building. Should the Geotechnical Report indicate a high water table, the County may request other alternatives to surface discharge of weeping tile.

No sump pump connections to the storm system are allowed unless approved in writing by the Director of Infrastructure.

Control shall be provided to minimize sediment discharge to the storm sewers. This shall be in the form of properly graded and surfaced streets and lanes, landscaping, sediment control structures at pond and lake inlets, or other means where appropriate.

The following criteria shall be used in the design of the minor storm sewer system:

- a) For areas less than 65 ha, the Rational Method shall be used to design the storm sewer system:

$$Q=2.78 CIA$$

Where	Q	= the design peak flow rate in litres per second
	I	= the intensity of rainfall in millimetres per hour, corresponding to the time of concentration
	A	= the contributing area in hectares
	C	= the runoff coefficient

- b) The five year rainfall intensity table shall be used as shown in either Table 5.1. or Table 5.2

- c) The following runoff coefficients shall be used for the 1-in-5 year analysis:

Parks	=	0.15
Residential	=	0.35
Industrial	=	0.75
Commercial	=	0.90
Multiple Family	=	0.70

- d) The weighted average of pervious and impervious area runoff coefficients shall be estimated from the following equation:

$$C = (C_p * A_p + C_i * A_i) / (A_p + A_i)$$

In these standards, where the subscripts "p" and "i" indicate the pervious and impervious surfaces, respectively, $C_p = 0.15$ and $C_i = 0.90$ and $A =$ Area IN Hectares

- e) The duration of rainfall used to determine the intensity is equal to the time of concentration. The time of concentration is comprised of the overland time to the storm sewer inlet and the time of travel in the conduit. The overland flow time to curbside in residential and commercial areas shall not exceed 10 minutes in duration (specific overland flow times shall be computed separately for industrial and undeveloped areas). Gutter flow time shall not exceed 5 minutes and shall be estimated based on methods outlined in "Modern Sewer Design" (AISI, 1980). The time of travel in the conduit shall be based on the pipe flow velocity.

For areas greater than 65 ha:

- a) Computer models shall be used to determine design flows and the sizing of systems that contain non-pipe stormwater management facilities (e.g. detention ponds) or systems that include a significant amount of undeveloped land.
- b) The selection of an appropriate computer model shall be based on an understanding of the principles, assumptions and limitations in relation to the system being designed.

- c) Wherever possible, the computer model shall be calibrated. In all analyses, the parameters used, the drainage boundaries, the pipe network and its connectivity shall be clearly identified on an overall drawing, computer printouts and a design summary report.
- d) The critical design rainfall hyetograph shall be selected. Both the AES Distribution (for long duration) and the Chicago Distribution (for short duration) will be evaluated.
- e) The storm duration of an event is critical for the system being designed and shall be used to determine pipe sizes. The 5 year 4-hour Chicago Distribution event shall be selected. For systems involving storage design, both short duration and longer duration events such as the AES 24 hour event should be evaluated.

TABLE 5.1

RAINFALL INTENSITIES FOR EDSON AND HINTON AREAS

Parameters	Return Frequency		
	5 -yr	10 yr	100 yr
5 min	120.0	142.8	214.8
10 min	81.0	93.6	134.4
30 min	37.2	42.6	59.4
60 min	22.2	25.2	36.6
24 hours	2.4	3.0	3.6

Intensity in mm/hr

Notes: 1. Based on AES data at Edson Airport for period 1969 to 1990(21years).

TABLE 5.2

RAINFALL INTENSITIES FOR EVANSBURG / WILDWOOD AREAS

Parameters	Return Frequency		
	5 -yr	10 yr	100 yr
5 min	98.2	120	187
10 min	67.8	82.5	129
30 min	35.1	42.6	66.2
60 min	22.7	27.5	42.5
24 hours	2.89	3.47	5.29

Intensity in mm/hr

Notes: 1. Based on AES data at Edmonton Municipal Airport for period 1914 to 1980 (66 years).

The maximum velocity within a piped system shall be 1 m/s. Where greater velocities in excess of 1 m/s are attained, special provisions shall be made to protect against displacement by erosion or impact.

Pipe sizing shall be determined by utilizing the Manning’s Formula, using an “N” value of 0.013.

Storm sewer pipe shall be designed to convey the design flow when flowing full, with the hydraulic grade line at the pipe crown. All pipe crown elevations shall match at manhole junctions.

Surface water shall not be permitted to run a distance greater than 250 metres in lanes and swales without provision of interception by the first catch basin. Within the piped drainage system, or on Collector or Arterial roadways, surface runoff shall not run a distance greater than 120 metres without interception.

Surface water shall be intercepted with a sufficient number of catch basins such that the inlet capacity is sufficient to receive the design storm water flow. Catch basin capacity shall be considered, as shown on Table 5.3, where values are given for sag conditions and on slope conditions based upon inlet grate type.

TABLE 5.3 CATCH BASIN CAPACITIES (l/s)

For design purposes, catch basin capacities in litres/second, are approximately as follows:

Norwood Model	Sump Condition*	Continuous Slope**	
		Capture	Overflow
F-51 (with side inlet)	190	30	95
F-51-G (grate only)	155	35	85
F-33	75	10	30
F-35	40	-	-
F-38	85	15	45
F-39	80	15	40
F-49	105	20	50

*based on 100mm depth of ponding

**based on 50mm depth on 1% slope

Minimum gutter grade shall be 0.50%. Cul-de-sacs and curb returns are minimum 0.6%.

Roadway ditches and swales will efficiently convey run-off through the storm drainage system. Roadway ditches and swales will not be used for stormwater detention or retention.

Storm Sewers may have to be over sizes to conform to the County’s Storm Sewer Planning.

Minimum pipe slopes shall be as follows

TABLE 5.4

MINIMUM DESIGN SLOPES FOR STORM SEWERS

Sewer Diameter (mm)	Minimum Design Slope (%)
300	0.194
375	0.145
450	0.114

525	0.092
600	0.077
675	0.065
750	0.057
900	0.045
1050	0.036
1200	0.031
1350	0.027
1500	0.023

5.2 STORM SEWER MAINS

The minimum size of storm sewer mains shall be 300mm diameter.

Pipe sizes up to and including 450mm in diameter shall be PVC. Pipe sizes greater than 450mm in diameter shall be concrete.

Pipe classes shall be determined to withstand subsequent superimposed loadings.

Various factors affecting the pipe class shall be taken into account, and pipe class shall be evaluated as per standard engineering practice.

5.2.1 Catch Basin Manholes

- a) Catch basin manhole barrels with pre-cast base and pre-cast slab top shall be:
 - 1) 900mm I.D. pipe barrel conforming to CSA-A257 2. Joints to be confined O-ring to CSA-A 257.3 using rubber gasket.
 - 2) Catch basin manholes shall be 1200mm in diameter in accordance with the Standard Drawing.

5.2.2 Catch Basins:

- a) Catch basin manholes shall be used in place of a catch basin when:
 - 1) the lead exceeds 30 metres in length or;
 - 2) one catch basin discharges into another.
- b) Catch basins are to have 450mm deep sumps.
- c) Catch basin frames and covers shall be:
 - 1) Standard frame, grate and 2 piece side inlet curb component for use with 900mm barrel equal to Norwood F-51 for straight faced curb and gutter and F33' K7 or DK7 for rolled face curb and gutter.
 - 2) Top inlet standard round top equal to Norwood F-38 for swales or lanes.
 - 3) Top inlet standard round top equal to Norwood F-39 grate for landscaped areas.

d) Catch basin leads:

- 1) The minimum size of catch basin leads shall be 250mm diameter with a minimum grade of 1.0%.
- 2) Two catch basins may be connected in series. The catch basin lead connecting to the storm sewer manhole shall be 300mm at a minimum slope of 1.0%.
- 3) The maximum length of a catch basin lead shall be 30 metres.
- 4) If a lead of over 30 metres in length is required, a catch basin manhole shall be installed at the upper end.
- 5) Catch basin leads shall have a minimum cover of 1.5 metres to obvert.

5.3 STORM SEWER INSTALLATION AND LOCATION

Mains shall be installed to provide a minimum depth to top of pipe of 1.50 metres below final finished grade.

Pipe bedding shall be provided for all mains in accordance with the Standard Drawing S-03.

5.4 MANHOLE INSTALLATION AND LOCATION

Manhole spacing on storm sewers greater than 750mm in diameter may exceed 120 metres if approved by the Director of Infrastructure.

Benching in manholes shall be provided to minimize hydraulic losses. The downstream invert in a manhole shall be a minimum of 25mm lower than the lowest upstream invert. At a change in direction, the drop shall be at least 50mm. If an influent pipe diameter is greater than 525mm and the bend is greater than 45 degrees or if the outflow pipe velocity exceeds 1.5 m/s, then minor losses shall be considered (see AISI, 1980).

Tee riser manholes may be utilized on lines 900mm diameter and larger. Tee riser manholes must be bedded in concrete to the springline of the pipe.

5.5 CONNECTIONS TO STORM SEWERS

Only catch basins and site surface drains shall be connected to a storm sewer.

5.6 CURVED SEWERS

Refer to (Sanitary Sewerage System).

5.7 INSPECTION AND TESTING

Refer to (Sanitary Sewerage System).

5.8 STORMWATER MANAGEMENT FACILITIES**5.8.1 Design Requirements Common to Stormwater Management Storage Facilities**

a) General

The use of stormwater facilities may be required to reduce peak flow rates to downstream sewer systems and/or watercourses, or to provide a temporary receiving area for peak major drainage flows. Their approximate location and size must be identified at the time of the Subdivision Outline Plan approval to avoid conflicts with adjacent land uses. The effects of the maximum pond water levels shall be considered in the design of the minor system and lot grading. If possible, the crown elevations of the pipes in the first manhole upstream of a pond shall be at or above the maximum pond level during the five-year storm event.

b) Geotechnical Considerations

Soils investigation specific to the detention facility shall be undertaken to determine the soil's permeability and salinity (or other potential contaminants), and the height of the groundwater table. Where the facility is sited above a shallow aquifer the potential for groundwater contamination must be minimized. Where the pond bottom is below the water table, weeping tile systems may be required to keep the pond bottom dry enough to support grass growth and maintenance equipment traffic.

c) Sediment Control

A sediment control plan is required as a part of the Stormwater Management Study to define measures that must be taken for the control of sediment into the pond and into the receiving stream.

5.8.2 Master Drainage Plan

- a) The Master Drainage Plan shall be prepared and used in developing and comparing alternatives, and to select the optimum storage and drainage solution for a development area. This Master Plan should provide, as a minimum, the following information:
- b) Detailed description of the development area, including proposed street layout, locations of parks, direction of overland flow, natural storage and drainage sub-catchment boundaries, etc.
- c) Identify and quantify the amount of upstream drainage entering onto the proposed development lands, including all points of entry.
- d) Identify the impact of the proposed development on the watershed.
- e) Identify all existing flow channels, drainage patterns or routes, and containment areas.
- f) Identify the point(s) of discharge from the lands, as well as the type and calculated capacity of the receiving drainage facility(s), whether natural, man-made, or a combination of both.
- g) Provide details of water quality enhancement facilities.
- h) Identify all licensing requirements as required by Alberta Environment.

- i) Post-development hydrographs for the 5-year and 100-year events to be determined at key points in the system.
- j) Delineation of flood lines for the 100-year design storm for creeks or watercourses.
- k) Minimum freeboard depth of 0.6 metre. House footings must be above freeboard elevation.
- l) Provide access for maintenance and emergency equipment.
- m) The inlets and outlets are to be fully submerged at least one metre below normal water level to crown of pipe.
- n) Design of outlet control structure to be capable of maintaining permanent pool depth and capable of draining the permanent pool for maintenance purposes.
- o) The first manhole in the minor system, the connecting or interconnecting pipe system, shall have an invert that is at or above the normal water level.
- p) The design must provide for vehicular access for maintenance and emergency purposes.
- q) Approved fencing will be required where necessary for safety purposes.
- r) Approved signage shall be installed to warn of anticipated water level fluctuations, with demarcation of maximum water levels to be expected for design conditions. Warning signs will be designed by the Developer and approved by the Director of Infrastructure.
- s) The functional requirements of the spillway, and the impact analysis for the absence of one, are to consider the possible consequences of blockage of the system outlet or overloading due to the run-off events, such that the storage capacity of the facility may be partially or completely unavailable at the beginning of a run-off event.

5.8.3 Dry Detention Ponds

- a) Dry pond (detention) storage is the storm water management method where the storm run-off is collected and the excess run-off is temporarily detained for a short period of time, and released after the storm run-off from the contributing area has ended. Generally, low flows do not enter the pond.
- b) Dry ponds should have gentle side slopes and be aesthetically contoured and landscaped to provide an attractive feature for the subdivision. Where possible, and as agreed by the Director of Infrastructure, they should be associated with municipal reserve areas to take advantage of the joint use ability of the facilities (e.g. extension of sport fields or passive park uses into the detention pond). Active park uses should not be located adjacent to the inlet/outlet facilities nor in areas that flood frequently (more than twice per year on average). The County should be contacted to provide input to the design of detention facilities from the concept stage through to detailed design and construction.

5.8.4 Safety Provisions at Inlets and Outlets

- a) All inlet and outlet structures associated with dry ponds shall have grates provided over their openings to restrict access and prevent entry into the sewers by unauthorized persons. A maximum clear bar space of 150mm shall be used for gratings.

- b) Grated outlet structures are to be designed with a hydraulic capacity of at least twice the required capacity to allow for possible plugging. Further, the velocity of the flow passing through the grating should not exceed 1.0 m/sec. Appropriate fencing and guard rails are to be provided to restrict access and reduce the hazard presented by the structure head and wingwalls.

5.8.5 Design Parameters

The following general design parameters should be considered for a dry pond in a residential subdivision:

- a) Storage capacity for up to the 100-year storm event.
- b) Detention time to be determined based on downstream capacity; recommended maximum detention time is 24 hours.
- c) Maximum active retention storage depth of 1.5 metres. The maximum water level should be below adjacent house basement footings (a greater freeboard may be required if an emergency overflow route cannot be provided).
- d) Maximum interior sideslopes of 5:1 (7:1 is recommended).
- e) Maximum exterior sideslopes of 3.5:1.
- f) Minimum freeboard of 0.6 metre above 1:100 year high water level (a greater freeboard may be required if an emergency overflow route cannot be provided).
- g) Maximum 4:1 ratio of effective length to effective width measured at 100 year high water level.
- h) Dimensions must be acceptable to the County when the bottom of the pond is to be used for recreational facilities.
- i) Minimum lateral slope in the bottom of the pond of 1.0% (2.0% is preferred) and a minimum longitudinal slope of 0.5% (1.0% is preferred),
- j) Low flow bypass for flows from minor events to be provided.
- k) Address all safety issues (particularly during operation).
- l) Storm water quality device shall be incorporated within every dry pond to provide a minimum reduction of 85% of sediments.

5.9 EMERGENCY SPILLWAY PROVISIONS

- a) The feasibility of an emergency overflow spillway is to be evaluated for each storage facility (wet or dry) design, and, where feasible, such provisions are to be incorporated in the pond design.
- b) As part of the pond design process, the probable frequency of operation of the spillway should be determined. Where it is not possible to provide an emergency spillway route, the design is to include an analysis of the impact of over-topping the pond and a significant freeboard above the 100-year level.

5.10 OUTFALLS

- a) Outfall structures shall be placed at the end of all storm sewers discharging to an open channel, watercourse, river or other receiving water body such as a lake. The purpose of the structure is to reduce velocities and prevent erosion. All outfall structures must be approved by Alberta Environment. It is the responsibility of the Developer to obtain the necessary approvals and permits from the above mentioned Authorities.
- b) The outfall structure may be a chute, spillway drop structures and energy dissipaters, stilling basin or plunge pool with head wall. A cut off wall is required at the end of the outfall apron to prevent undermining of the structure.
- c) Obverts of outfall pipes shall be at least 150mm above the 5-year flood level in the receiving stream. Inverts of outfall pipes shall be above winter ice level, otherwise outfall pipes shall be submerged below the bottom of ice level. In addition, outfalls shall be located to avoid damage from moving ice during breakup.
- d) If the downstream channel is relatively flat, the apron shall be 150mm to 225mm above the channel invert to prevent collection of debris on the apron.
- e) Rip-rap and a filter layer shall be placed downstream of the outfall structure, where required to prevent erosion. Where erosion control or bank stability work must be done, preservation of watercourse aesthetics and wildlife habitat must be considered.
- f) Weeping tile shall be placed under the structure to reduce any water pressure behind the head wall.
- g) Grills or trash bars shall be placed over all storm sewer outlets to prevent access.
- h) Railings shall be placed along the head wall and wingwalls of the outfall structure.
- i) Outfalls shall be landscaped designed with low maintenance, to aesthetically blend in with surrounding areas.
- j) Measures, such as detention ponds, should be incorporated in new developments to prevent any increase in the amount of erosion and downstream flooding to existing receiving streams.

5.11 MAINTENANCE AND SERVICE MANUAL

- a) As part of the responsibility for design of a stormwater management detention facility, the designer shall prepare and provide a Maintenance and Service Manual for the facility.
- b) Six complete copies of the manual are to be provided to the Director of Infrastructure prior to the transfer of operational responsibility to the County. The manual shall include complete equipment manufacturer's operation, maintenance, service and repair instructions and complete parts list for any mechanized or electrical equipment incorporated in the design.
- c) The manual is to include, at minimum, the following information:
 - (i) A copy of the approved engineering drawings related to the stormwater detention facility and appurtenances, updated to Record Drawings.
 - (ii) Schematic diagrams of the inlet and outlet arrangements, connections to and arrangement of upstream and downstream systems, including all controls, shutoff valves, bypasses, overflows and any other operation or control features.
 - (iii) Location plans for all operating devices and controls, access points and routes, planned overflow routes, or likely point of overtopping when the design detention volume is exceeded.
 - (iv) Head Discharge and Stage Discharge Curves with clear relationships of the stages to surrounding features.
 - (v) Stage-discharge relationships for receiving storm sewers or channels downstream of the storage outlet, with indication of backwater effects which may restrict the outflow or which shall be considered in the operation of the facilities outlet controls.
 - (vi) An outline of the normally expected operational requirements for the facility.
 - (vii) An outline of emergency operating requirements under possible abnormal situations.

5.12 SIGNAGE FOR SAFETY

SWM facilities shall include mounting provisions for adequate signage to warn of anticipated water level fluctuations, and markers indicating the design high water level. Warning signs to be provided and installed by the Developer.

END OF SECTION

6 SEWER AND WATER SERVICE CONNECTIONS

6.1 SERVICE CONNECTIONS – MINIMUM REQUIREMENTS

The attention of the Developer is also drawn to the requirements of the Utility Bylaw and the Plumbing Bylaw as amended.

The minimum size of service connections to the property line of a single-family dwelling shall be as follows:

Sanitary Sewer	150mm diameter
Water Service	25mm diameter

The minimum grade on a 150mm sewer service shall be 2.0%.

Connection to a main sewer line shall be by means of a tapped service saddle (full wrap) at the top quadrant of the main on existing mains. In-line tees may be used with prior approval of the County.

Where bends are utilized, the long radius type or a combination of 22½ degree bends and straight pipe shall be used.

For water services sized 50mm and smaller, the tapping shall be at the 2 to 3 o'clock position on the distribution main.

Water mains shall be tapped under pressure.

All water services to be direct tapped or utilize service clamps.

6.2 SANITARY SEWER SERVICE

Service pipe shall be PVC SDR 35 (minimum) building service pipe.

Service fittings shall be either in-line tees or saddle tees, complete with gasket and stainless steel straps and nuts.

6.3 SERVICE CONNECTIONS – INSTALLATION REQUIREMENTS

Where the water service is 50mm or smaller in size, the water and sanitary services shall be installed in a common trench.

The services shall be installed so that, when facing the lot being served, the water service is on the right of the sanitary service.

Where two services are installed in a common trench, they shall be installed per the Standard Drawing S-05.

The minimum depth of cover over the water and sanitary services at the property line shall be 2.7 metres and the maximum shall be 3.5 metres, per the Standard Drawing.

Where the sewer services are required to connect to mains in excess of 4.50 metres deep, risers shall be installed to within 3.50 metres of finished surface.

Corporation main stops and curb stops shall be installed in accordance with the Standard Drawing. Material to be Mueller or approved equal.

Where a water service is installed, there shall be a horizontal loop near the corporation main stop. Water service is to be goose-necked. Service shall be snaked in the trench to allow for thermal contraction.

Service box for residential service to have adjustable sliding top section, standard block iron pipe with threaded top. Top section to be 600mm in length, with a minimum ID of 35mm and a 10mm set screw. The service box shall be adjustable from 2.5 to 3.5 metres bury. The threaded steel cap shall have a slotted top with a 19mm pentagon brass plug.

The casing shall be standard block iron pipe with an OD of 33.5 mm. The rod should be T-304 stainless steel, 12.5mm diameter by 2.2 metres long, complete with standard pig tail for 25mm ID pipe and welded bottom bracket with an 8mm cored hole. Rod to be complete with a 6mm diameter cotter pin of sufficient length.

Box bottom boot to be cast or ductile iron, factory coated, with a clear opening to allow curb stop access. The boot is to attach to the casing by means of a threaded joint.

Curb stops shall be installed 300mm outside of property line or easement lines as shown on the Standard Drawing and shall be stop and drain unless approved otherwise based on site conditions.

Sewer services shall be installed at property or easement lines as shown on the Standard Drawing, and shall be properly capped or plugged to prevent the entry of earth, water or deleterious material into the pipe.

All services shall be laid on 75mm of granular bedding, and the bedding material shall be placed up to a level of 300mm above the crown of the highest service in the trench.

Painted stakes of 50mm x 100mm size shall be extended from the end of the service connections to a minimum of 0.70 metres above the ground level, per the Standard Drawing.

6.4 SERVICE CONNECTION REPORT

The Developer's Engineer shall provide detailed record drawings for all installed service connections, with such drawings providing information related to pipe dimensions, invert elevations, depth of service lines, location of services relative to property line(s), manholes and/or watermain valves.

END OF SECTION

7 ROADWAYS

7.1 GENERAL

Roadways in subdivision development areas within Yellowhead County shall typically be developed to a rural cross-section with a gravel surface and roadway ditches to accommodate storm water and snowmelt runoff.

The standards outlined herein are intended to be the minimum acceptable standard. It is the Developer's responsibility to develop the subdivision roadways to meet or exceed the standards in accordance with good engineering practices, specific site condition requirements, and as may be required by the Director of Infrastructure.

7.2 ROADWAY CLASSIFICATION

7.2.1 General

Roadway classifications in these standards are limited to the type of roadways that could typically be required to be provided by a Developer.

Roadway classification and designations in subdivision development areas shall generally follow the classification system outlined in the Alberta Transportation Highway Geometric Design Guide, Yellowhead County Rural Roads Study and Transportation Association of Canada Geometric Design guidelines.

Individual roadway classifications are further based on their functional use as established by Yellowhead County.

7.2.2 Access Road

The "access road" classification is applicable to internal country residential subdivision roads whose primary purpose is to provide property access.

The classification is also applicable to County roads that provide access to a limited number of properties, such as properties along a dead-end road or cul-de-sacs.

Typical cross-sections are illustrated in Standard Detail Drawing No. R-02.

7.2.3 Local Road

The "local road" classification is applicable to any County road that, in addition to providing property access, interconnects two or more roads or provides the main access to and from the subdivision to the County road system or other subdivisions.

Typical cross-sections are illustrated in Standard Detail Drawing No. R-03.

7.2.4 Collector Road

The "collector road" is applicable generally to the County Road that collects traffic from local roadways, including access roadways, and feeds it to arterial roadways such as secondary highways or other numbered highways, or distributes the traffic from arterial to the local roads.

Typical cross-sections are illustrated in Standard Detail Drawing No. R-04.

7.2.5 Industrial road

The "industrial road" classification is applicable to internal rural industrial subdivision roads whose main purpose is to provide property access.

A cross-section is illustrated in Standard Detail Drawing No. R-05, Typical Cross-Section Commercial/Industrial. Local road.

7.2.6 Arterial road

The “arterial road” classification is applicable generally to the County Road that collects traffic from a local or collector roadways, and feeds it to a secondary highways or other numbered highways.

A cross-section is illustrated in standard detail drawing No. R-06, Typical Cross-Section Industrial Collector road.

7.3 GEOMETRIC DESIGN STANDARDS

7.3.1 General

Road rights-of way shall be adequate width to accommodate the roadway surface and the roadside ditches complete with the required side slopes and back slopes.

Minimum right-of way requirements shall be in accordance to Table 7.1 or Table 7.2 unless otherwise approved by the Director of Infrastructure.

7.3.2 Geometric design

Geometric design standards established by the Yellowhead County Infrastructure Department, as outlined in Table 7.1, shall be incorporated into the roadway designs. Roads shall also be designed in accordance with the geometric design standards outlined in the latest edition of the Transportation Association of Canada manual “Geometric Design Standards for Canadian Roads and Streets”.

Table 7.1 Basic Design Standards for Urban Cross-Sections

Design Criteria		Local	Collector	Lanes
Drawing Reference		R-01	R-02	N/A
R.O.W.		18m or 20m	24 m	7.0 m
TAC Classification		RLU 90	RCU 90	RCU 70
Design Speed		50 km/h	60 km/h	50 km/h
Posted Speed		50 Km/h	50 km/h	50 Km/h
Finished Surface Width		10.0 m	12.0 m	10.5 m
Min. Radius of Curve		115 m	190 m	115 m
Max. Gradient (%)		6	5	6
Vertical Curve Min. “k” Value CREST		7	13	N/A
Vertical Curve Min. “k” Value SAG		6	10	N/A
Corner Cuts		6mx6m	10mx10m	6mx6m
CROWN	Gravel	3%	3%	3%
	ACP	2%	2%	-3%

Table 7.2 Basic Design Standards for Rural Cross-Sections

Design Criteria		Access	Local	Collector	Industrial	Arterial
Drawing Reference		No. R-02	No. R-03	No. R-04	No. R-05	No. R-06
R.O.W.		30 m	30 m	40 m	40 m	40 m
TAC Classification		RLU 70	RLU 90	RCU 90	RCU 70	RCU 100
Design Speed		70 km/h	90 km/h	90 km/h	70 km/h	100 km/h
Posted Speed		60 km/h	80 Km/h	80 km/h	60 Km/h	90 km/h
Finished Surface Width		8.0 m	8.0 m	9.0 m	10.5 m	10.5 m
Min. Radius of Curve		190 m	340 m	340 m	190 m	440 m
Max. Gradient (%)		6	6	5	4	3
Vertical Curve Min. "k" Value CREST		19	35	35	35	55
Vertical Curve Min. "k" Value SAG		10	15	15	10	18
Embankment Sideslopes/ Backslopes min.		3:1 2:1	3:1 2:1	4:1 3:1	4:1 3:1	4:1 3:1
Min Ditch Grade		0.5 %	0.5%	0.5%	0.5%	0.5%
Super elevation m/m		0.06	0.06	0.06	0.06	0.06
CROWN	Gravel	3%	3%	3%	3%	3%
	ACP	2%	2%	2%	2%	2%

7.3.3 Road Intersections

- a) The grades at intersections for all roadway classifications shall not exceed 2% for a minimum distance of 30 metres, measured from the shoulder edge of the receiving road.
- b) Flares at intersecting roadways shall have the following minimum radius from shoulder to shoulder:
 - Access, local road 8.0 metres
 - Collector road 10.0 metres
 - Industrial road 15.0 metres
 - Arterial road 20.0 metres
 - The minimum setback distance between intersections shall be 150 metres unless otherwise approved by the Director of Infrastructure.
- c) Minimum vehicle stacking distance length shall be 30.0 metres setback from the edge of the right-of-way prior to commencing any deflection in the horizontal geometric alignment of the roadway.

7.3.4 Dead-End Roads

- a) In residential and industrial subdivisions, all dead-end shall be provided with a cul-de-sac or turnaround consistent with the requirements outlined in Standard Details, unless otherwise approved by the Director of Infrastructure.
- b) For roadways within existing government road allowances, should a cul-de-sac not be feasible to construct, a hammer-head turnaround with a 20 metre extension of road past the last approach will be required. Opposing approaches will not be considered as an acceptable means for a hammer-head turnaround.

7.3.5 Culverts and Drainage

- a) The minimum allowable ditch grade shall be 0.5%. Ditch Grades in excess of 2.0% shall be protected against erosion through rock ditch checks, silt fences, Enviroberm fences and/or erosion control blankets. Typical ditch check installations are illustrated in Standard Detail Drawing No. R-09, Typical Rock Ditch Check.
- b) Ditch side slopes shall not be steeper than 3:1 and back slopes shall not be steeper than 2:1 and shall be in accordance with the Standard Drawings for the particular cross-section.
- c) The minimum ditch bottom width shall be 1.0 metres and shall be in accordance with the Standard Drawings for the particular cross-section.
- d) Culvert size requirements shall be determined through the storm water drainage analysis, however the minimum size culverts shall be as follows:

- Roadway cross culvert 600mm (24 inch)
 - Residential approach culvert 500mm (20 inch)
 - Industrial approach culvert 600mm (24 inch)
 - If existing culverts in drainage course exceed design minimums then new culvert installations shall match existing culvert size in same drainage course.
- e) Length of culvert is dependant on the depth of ditch and the width of the road top.
Example: for 3:1 sideslope
Culvert Length = 8.0 metre + 2 times (3 x depth of the ditch).
- f) Culverts shall be new galvanized C.S.P. (corrugated steel pipe) with a minimum wall thickness of 1.6mm, or as required by the loading criteria.
- g) All culverts shall be installed in accordance with the manufacturer's recommendations.
- h) All culverts within or adjacent to an industrial, collector or arterial road shall be installed with beveled end sections on both the inlet and outlet sides with the invert extended to the toe of the side slope.
- i) All culverts, except those in industrial developments, shall be installed to provide a minimum depth of cover of 300mm or one-half ($\frac{1}{2}$) the culverts diameter, whichever is greater. This should be measured from the finished shoulder grade of the roadway to the top of the culvert as shown in Standard Detail Drawing No R-10, Typical Culvert Installation. Culverts in industrial developments shall be installed to provide a minimum depth of cover of 500mm or one-half ($\frac{1}{2}$) the culverts diameter, whichever is greater, as measured from the finished shoulder grade of the roadway to the top of the culvert.
- j) Rip-rap shall be placed around the inlet and outlet of each culvert for industrial, collector and arterial roadways, with the rip-rap extending a minimum of 3 x culvert diameter, in length beyond the ends of the culvert. Rip-rap material shall consist of rock ranging in size from 150mm to 350mm with 50% of the rock material being larger than 200mm. A typical rip-rap installation is illustrated in Standard Detail Drawing No. R-11, Typical Rip-Rap For Culverts Size 500mm dia. – 1200mm dia.
- k) Culverts shall be buried 100mm below ditch bottom on both the upstream inlet and downstream outlet ends of culverts.

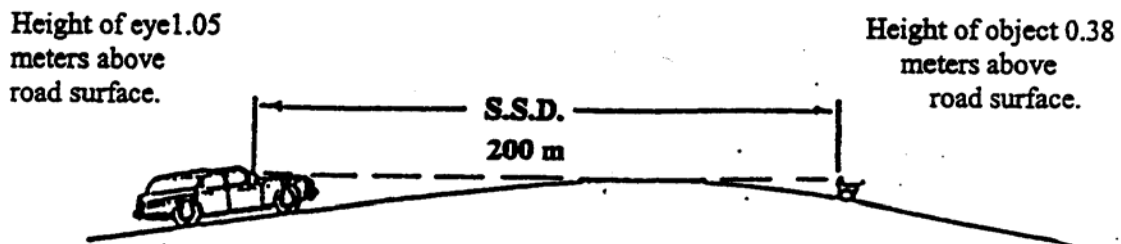
7.3.6 Road Approaches

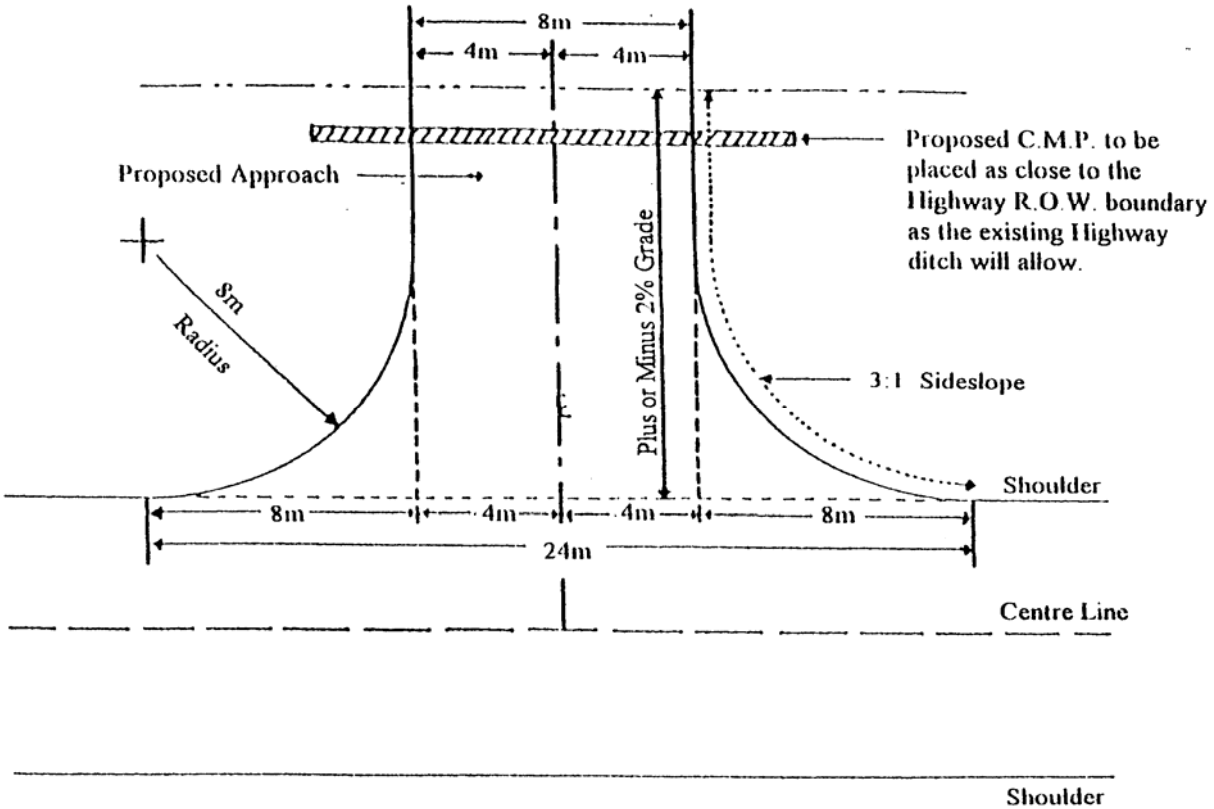
This sub-section outlines the requirements respecting the design and construction of approaches within subdivision developments as illustrated on Standard Drawing R-12.

- The approach shall typically be located to provide the best and most direct access to the building site on the lot.
- All approaches shall be constructed to the same structure as the adjoining roadways.
- Approaches with asphalt surfacing shall extend to the property line.
- All residential subdivision development shall require the Developer to construct one approach to each lot, consistent with the standard outlined herein.
- All approaches to be constructed perpendicular (90 degrees) to the roadway.

7.3.6.1 Location

- a) Minimum of 90.0 metres (295.3 feet) from an intersection to any approach that fronts onto a local, collector or arterial roadway.
- b) Minimum of 45 metres (147.6 feet) from an intersection to any approach that fronts onto an access road.
- c) The County requires a minimum of 200 metres stopping sight distance in each direction along the road.
- d) The minimum spacing required between approaches onto collectors or arterial roads on the same side of the road is 150 metres and 45 metres from any approach on the opposing side.
- e) The minimum spacing required between the intersection of any access road and an approach fronting onto a local, collector or arterial roadway shall be and on the same side of the road is 150 metres and 150 metres from any approach on the opposing side.
- f) The minimum spacing required between approaches onto access or service roads shall be based on site conditions, and approved by the Director of Infrastructure.





7.3.6.2 Approach Width

- On single approaches to Local Roads a minimum of 8 metres (26 feet).
- On dual approaches to Local Roads a minimum of 12 metres (40 feet).
- A minimum width of 12 metres (39.4 feet) and a maximum width of 15 meters (49.2 feet) for commercial or industrial approaches and flared to a minimum of 12 metres (39.4 foot) radius and a maximum 15 metres (49.2 feet) to meet the county roadway.

7.3.6.3 Side Slopes

- Minimum ratio of 3:1 for Access, and Local Roads.
(3 metres horizontal distance to a 1 metre vertical distance).
- Minimum ratio of 4:1 for Collector, Industrial and Arterial Roads.
(4 metres horizontal distance to a 1 metre vertical distance).

7.3.7 Roadway Surface Finishes

- Roadways in all subdivision developments shall be surfaced with gravel a minimum of 100mm depth of crushed gravel aggregate unless otherwise dictated by the Director of Infrastructure.
- Should an asphalt or chip sealed surface be approved, the surface shall be a minimum compacted layer of 100mm depth of 20mm crushed gravel for the interim period. All approaches shall be similarly treated. The depth or thickness of granular base course will depend upon the soil conditions and the anticipated traffic, but should typically not be less than the thickness outlined in Table 7.2
- Typical asphalt road structures shall be designed by a professional engineer to meet specific site requirements

Table 7.3 Typical Roadway Structures for Gravel Roads

Roadway	Sub Grade Prep	Surface Gravel
Access	150mm	100mm
Local	150mm	100mm
Collector	250mm	150mm
Arterial / Industrial	300mm	200mm

Table 7.4 Typical Roadway Structures for Urban Roads

Roadway	Sub Grade Prep	Base Course	Asphaltic Concrete
Local	150mm	250mm	75mm
Collector	250mm	300mm	100mm 2 lifts 60mm/ 40mm final**
Industrial	300mm	300mm	100mm 2 lifts 60mm/ 40mm final**

** NOTE: The final lift of asphaltic concrete shall be place in the second year of the maintenance period.

8 UTILITY REQUIREMENTS

8.1 GENERAL

8.1.1 Protection and/or Coordination of Utilities.

The Developer shall be responsible for the identification, location and protection of all utilities which may exist within or adjacent to the proposed subdivision. Utilities commonly encountered on lands within Yellowhead County may include, but not be limited to:

- Telephone cables,
- Power cables,
- Natural gas distribution lines,
- Oil and gas distribution lines.

The Developer shall be responsible for contacting all utility agencies and for arranging and coordinating all protection and/or modifications to the utilities during the development of the subdivision at his entire cost or as agreed upon with the specific utility company.

8.1.2 Rights-of-Way

Where required, the Developer shall provide right-of-way and easements of sufficient size and location to satisfy the above mentioned Utility Companies.

Utilities shall be located according to the Standard Drawings, or as directed in writing by Director of Infrastructure.

All easements on County property shall be registered in the name of Yellowhead County.

8.2 ELECTRICAL POWER SERVICE

The Developer shall make arrangements with Power Utilities for the installation of above ground Electrical Power within a subdivision. The installation shall be carried out in accordance with Standard Detail Drawings No. R-01 Rural Residential Subdivision Typical Utilities Layout Standard Cross Section.

- a) Where underground power is proposed within a subdivision the Developer shall be required to hire an Engineering Consultant, to design the Electrical System in accordance with requirements.
- b) The Developer shall be required to hire an Electrical Contractor to install the Electrical System in accordance with the approved electrical system design.
- c) The alignment and location of all electrical facilities within a subdivision shall be subject to the approval of the Director of Infrastructure.
- d) Acceptance of the electrical system within the subdivision shall be subject to the approval of Power Utilities and the Director of Infrastructure.
- e) Where underground power is being installed, the Developer shall make arrangements for the common installation of telecommunication cables within the underground trench.
- f) All distribution cables shall be installed in one common trench, a minimum of 300mm wide, at the required alignment.

- g) All power and communication cable trenches on the road allowance shall be at a minimum of 1.5 metres below finished grade level. The trench bottom shall be free of stones, loose earth and sharp objects.
- h) Power, telephone, or cable TV cables shall maintain a minimum distance of 3.0 metres from any valve, hydrant, catch basin, manhole, vault, watermain, sanitary main, and storm water line. A minimum clearance of 0.3 metres in all directions is to be maintained when crossing gas service lines.
- i) Extreme care must be taken when backfilling so as not to disturb any Legal survey markers. Any survey markers disturbed during installation shall be replaced at the Utility company's expense.
- j) Backfill material shall be native soil material excavated from the ditch/trench or Fillcrete, at the discretion of the Director of Infrastructure. Sand must be substituted for poor existing soils. Poor existing soils are defined as organic soils, peat, black loam, sod, clay that has hardened and stones.
- k) Backfill material shall be compacted to 95% density of the maximum density of a standard proctor compaction test within boulevards and 98% within streets under concrete, asphalt structures or lanes. All backfill material may be subject to the approval of the Director of Infrastructure.
- l) All road crossings shall be protected by a minimum 100mm diameter conduit.
- m) Underground power installation shall be carried out in accordance with Standard Detail Drawings No. R-01, Residential Subdivision Typical Utilities Layout Standard Cross-Section.
- n) A 7mm diameter nylon rope shall be pulled through each conduit with a 3.0 metre coil at each end.
- o) Conduit ends are to be extended a minimum of 2.0 metres past paved surfaces or curbs and a minimum of 1.0 metre past the Back of Walk.
- p) All conduits are to be sealed on both ends.

8.3 STREET LIGHTING

The following standards are applicable to all types of development in Yellowhead County, except for industrial developments. Standards for industrial developments shall be determined by the County during the initial planning stages of the proposed development.

Street lighting shall be installed in accordance with Standard Detail Drawings No. R-01.

8.3.1 Design

Street lighting posts with fixtures shall be steel posts, comparable to the existing posts within the neighbourhood, for the several types of streets. Wooden Poles may be permitted in existing neighbourhoods where additional lighting is being added and wooden poles presently exist.

The location and density of street lights shall provide the following minimum lighting levels:

- a) Street lighting fixtures shall be high pressure sodium type.
- b) Street lighting design shall be approved by Fortis.

8.3.2 Location

The Developer shall coordinate the location of street lights to ensure that they do not interfere with other utilities and driveways.

Street lights shall be offset from roadways and sidewalks in accordance with Standard Detail Drawings No. R-01, Standard Detail Drawings.

Street lights shall be provided for each internal park area that does not abut onto a lighted street. A street light shall be located at the point where each walkway opens out onto the park area.

All street light standards shall be galvanized in a manner comparable to the existing standards within the County.

8.3.3 Costs

Any capital contribution that the utility company may charge for installation of underground street lighting shall be paid by the Developer.

8.4 NATURAL GAS SERVICE

- a) The Developer shall make arrangements with Gas Franchise Company in the area for the installation of Natural Gas in a subdivision. The installation shall be carried out in accordance with Standard Detail Drawings No. R-01, Rural Residential Subdivision Typical Utilities Layout Standard Cross-Section.
- b) The alignment and location of all natural gas facilities within a subdivision shall be subject to the approval of the Director of Infrastructure.
- c) All gas trenches on the road allowance shall be at a minimum of 1.5 metres below finished grade level. Trenches shall be a minimum of 300mm wide. The trench bottom shall be free of stones, loose earth and sharp objects.
- d) Gas lines shall be installed in a separate trench from cable installations, and shall maintain a minimum distance of 3.0 metres from any valve, hydrant, catch basin, manhole, vault and sanitary and storm water lines. A minimum 3.0 metres clearance is required to any water lines.

8.5 PIPELINE CROSSINGS

Where transmission pipelines, such as natural gas pipelines, oil distribution pipelines, water or any other pipelines not covered elsewhere within these standards, are found to exist within the road allowance, the Developer shall be responsible for: All costs incurred in the acquiring of approvals, crossing agreements, and all construction costs connected with the lowering, modifying or realigning of a pipeline to accommodate road construction as well as any damages resulting from the road construction shall be the responsibility of the Developer, and subject to the approval of the Director of Infrastructure.

Prior to construction the Developer will be responsible for the following information prior to obtaining approval from the Director of Infrastructure.

- a) Contacting and advising the appropriate pipeline agency of the proposed road construction or reconstruction crossing its pipeline.

- b) Acquiring the necessary approvals and crossing agreements from the pipeline agency prior to road construction start.
- c) Coordinating and scheduling the road construction and any required modifications to the pipeline with the pipeline agency.
- d) Monitoring the road construction in the area of the pipeline crossing to ensure the requirements of the pipeline agency have been met.

8.5.1 Design

The following are the minimum design guidelines for all pipes crossings:

- a) A pipeline should be between 70 and 90 degrees from any existing or proposed roadway,
- b) Minimum depth of bury shall be no less than 1.5 metres below the lowest part of the ditch
- c) No bends to be permitted within 30 metres of the road right-of-way,
- d) A pipeline paralleling a roadway shall be located no closer than 30 metres from the boundary of the road right-of-way,
- e) Where utility markers exist within a road allowance identifying the location of an underground line, and the markers require relocating to accommodate road allowance widening and/or road construction, the developer shall be responsible for contacting the appropriate utility company for marker relocation.



9 TRAFFIC CONTROL DEVICES, STREET NAME SIGNS & PAVEMENT MARKINGS

Plans shall be provided to the Director of Infrastructure that depicts the locations and details of all traffic control devices (traffic signs and traffic signals), street name signs and pavement markings.

All traffic control devices and pavement markings shall be designed and installed in accordance with the manual “Uniform Traffic Control Devices for Canada” as issued and revised from time to time by the Transportation Association of Canada (TAC).

Guide and information signing shall be designed and installed in accordance with the “Urban Guide and Information Sign Manual” as issued by the Alberta Government.

Street signing shall be standard aluminum, white on green, with a minimum vertical dimension of 150mm.

9.1 MATERIALS

All signs shall utilize High Intensity reflective material to ASTM-D4956, Type III.

All rural sign posts shall be 100mm by 150mm pressure treated post unless otherwise approved in writing by the Director of Infrastructure.

All urban sign posts shall be galvanized steel posts with breakaway base supports unless otherwise approved in writing by the Director of Infrastructure.

Along arterial streets and at arterial street intersections, pavement markings shall be of a “permanent” type, thermoplastic. Painted markings are acceptable elsewhere.

9.2 INSTALLATION

All sign posts shall be horizontally located a minimum of 3.0 metres from the shoulder of the adjacent road and the bottom of the sign shall be 2.0 metres above the shoulder elevation of the road.

Or

All signs shall be mounted to provide a minimum of 0.3 metres of horizontal clearance from back of curb or back of walk. Where there is no curb or walk within the right-of-way, the sign location is to be approved by the County.

Stop and yield signs shall be positioned in line with the linear property lines of the intersecting road allowance.

9.3 MUNICIPAL ADDRESS SIGNAGE

Municipal Addressing Signs shall be constructed in accordance with the Municipal Addressing Bylaw

END OF SECTION

10 LOT GRADING

10.1 DESIGN

The grading design shall complement the overall design of both the minor and major storm drainage system. In general, the lots shall be graded and sloped in such a manner that a minimum of surface run-off water will be conducted to other properties. Where surface drainage swales direct run-off from one lot to the next, the necessary drainage easements shall be registered concurrently with the plan of subdivision.

Reserves and public lands shall be graded to drain towards roadways and/or storm water catch basins or drainage ditches.

Boulevard areas shall be graded to provide a minimum slope of 2% from property line to top of curb.

Commercial and industrial lots shall be graded to drain to on-site storm water catch basins.

In cases where the backyard slopes towards the building, provisions are required to keep the run-off at least 3.0 metres away from the building, with the possibility of draining the surface water along the lot lines onto the streets.

Where drainage swales are provided on rear property lines in laneless subdivisions, the developer shall provide an approved concrete drainage swale. The drainage swale shall be provided on one side of the property line and be placed in a drainage easement.

The maximum slope draining towards property lines shall not exceed 10% within 1.5 metres of the property line. The slope away from buildings shall meet the minimum requirements of the Alberta Building Code. Downspouts from eaves troughs and discharges hoses from sump pumps shall not discharge within 0.6 metres from the property line.

10.2 RETAINING WALLS

Where extremes in elevation of adjoining lots require the construction of a retaining wall, such shall be indicated on the proposed grading plan and no work or construction will be permitted on the building lots that are the subject of, or adjacent to, the said retaining wall until a detailed design drawing is prepared by a registered engineer and approved by the Director of Infrastructure.

END OF SECTION



Section 2: Construction Standards

1 AGGREGATES

1.1 GENERAL

This section specifies general requirements for supplying and processing of aggregates to be stockpiled or incorporated into work for structural bedding for underground utilities only. Specific requirements for physical properties of aggregates not provided in this section that are related to roadwork shall follow the most current edition of the Standard Specifications for Highway Construction as prepared by Alberta Infrastructure and Transportation.

1.1.1 Source Approval

Source of materials to be incorporated into work or stockpiled requires approval.

Inform the County of proposed source of aggregates and provide access for sampling at least two weeks prior to commencing production.

If, in the opinion of the County, materials from proposed source do not meet, or cannot reasonably be processed to meet specified requirements, produce an alternative source or demonstrate that material from source in question can be processed to meet specified requirements.

Should a change of material source be proposed during work, advise the County two weeks in advance of proposed change to allow sampling and testing.

Acceptance of a material at source does not preclude future rejection if it is subsequently found to lack uniformity, or if it fails to conform to requirements specified, or if its field performance is found to be unsatisfactory.

1.1.2 Production Sampling

Aggregate will be subject to continual sampling during production.

Provide the County with ready access to source and processed material for purpose of sampling and testing.

The developer will bear the cost of sampling and testing of aggregates in order to meet design gradations and specifications supplied by an approved Professional engineer.

1.2 PRODUCTS

1.2.1 General

All imported backfill, granular material, gravel and screened rock shall be suitable for the uses intended.

Aggregate shall be sound, hard, durable material free from soft, thin, elongated, or laminated particles, organic material, or other deleterious substances.

Flat elongated particles are those whose greatest dimension exceeds five times their least dimension.

Fine aggregates satisfying requirements of applicable section shall be one, or a blend of following:

- a) Natural sand.
- b) Manufactured sand and/or fines.
- c) Screenings produced in crushing of quarried rock, boulders, gravel or slag.

Course aggregates satisfying requirements of applicable section shall be one of following:

- a) Crushed rock or slag.
- b) Gravel composed of naturally formed particles of stone.

1.2.2 Materials

Gradation: To be within the limit and for the types of materials specified below, when tested to ASTM C117 and ASTM C136, and having a smooth curve without sharp breaks when plotted on a semi-log grading chart to ASTM E11.

Production of Manufactured Fines: Manufactured fines are defined as that portion of the material passing the 5,000 sieve size which is produced by the crushing process.

In the event the manufactured fines in the total combined aggregate do not meet the requirement for the specified Asphaltic Concrete Mix, extra manufactured fines shall be produced by screening the pitrun material so that the screened material contains no more than 5% material passing a 5,000 sieve. This screened material shall then be crushed so that 100% passes the 10,000 sieve and a minimum of 95% passes the 5,000 sieve. All material produced by this crushing process shall be placed in a separate stockpile and designated as manufactured fines.

Moisture Content: As specified in specific sections.

Bedding Sand: Bedding sand shall be free from organic material and meet the following gradation:

Sieve Size (mm)	% Passing by Mass
12.500	100
5.000	90-100
1.250	55-85
0.315	10-35
0.080	0-5

The liquid limit shall not exceed 25 and the PlastiMD Index shall not exceed 6.

Granular Material (imported Sand): Imported sand shall be free from rubbish, rubble, organic material, vegetation, clay lumps and meet the gradation of bedding sand.

Granular Material (Imported Gravel): Imported gravel shall be a well graded mixture of sand and gravel meeting the following gradation:

Sieve Size (mm)	% Passing by Mass
80.000	100
50.000	80-100
25.000	50-75
5.000	25-55
0.080	2-10

Screened Rock: Screened rock shall be composed of sound, hard uncoated particles free from clay lumps, flaky particles, soft shale, friable materials, roots, vegetable matter and frozen lumps meeting the following gradation:

Sieve Size (mm)	% Passing by Mass
50.000	100
40.000	95-100
20.000	5-10
10.000	0-5
5.000	0-5

1.3 EXECUTION

1.3.1 Processing

Process aggregate uniformly using methods that prevent contamination, segregation, and degradation.

Split and combine aggregates if required to obtain gradation requirements specified. Use approved methods and equipment. Do not blend in stockpiles.

Blending to increase percentage of crushed particles or decrease percentage of flat and elongated particles is permitted.

Wash aggregates, if required to meet specifications. Use only equipment approved by the County.

1.3.2 Handling

Handle and transport aggregates to avoid segregation, contamination and degradation.

1.3.3 Stockpiling

Stockpile aggregates on site in location indicated or designated. Do not stockpile on completed pavement surfaces where damage to pavement may result.

Stockpile aggregates in sufficient quantities to meet project schedules.

Stockpiling sites shall be level, well drained, and of adequate bearing capacity and stability to support stockpiled materials.

Except where stockpiled on acceptably stabilized areas, provide a compacted sand base not less than 300mm in depth to prevent contamination of the aggregate or, if permitted, stockpile aggregates on ground but do not incorporate bottom 300mm of pile into work.

Separate aggregates by substantial dividers or stockpile far enough apart to prevent intermixing. Reject intermixed or contaminated materials. Remove and dispose of rejected materials as directed within 48 hours of rejection.

Stockpile materials in uniform layers of thickness as follows:

- a) Max 2m for fine aggregate and subbase materials.
- b) Max 1.5m for other materials.

Complete each layer over entire stockpile area before beginning next layer.

Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.

Coning of piles or spilling of material over edges of pile will not be permitted. Stacking conveyors will not be permitted for stockpiling road base and graded seal coat aggregates.

During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

1.3.4 Stockpile Cleanup

Leave stockpile site in a tidy, well drained condition, free of standing surface water.

Remove any unused aggregates as directed.

END OF SECTION

2 TRENCHING AND BACKFILLING

2.1 GENERAL

Trenching and backfilling to be carried out in accordance with Alberta Occupational Health and Safety Regulations: Part 32. Excavating and tunnelling, Schedule 9 Shoring Components Dimensions.

2.1.1 Work Included

Provide all labour, products and equipment for trenching and backfilling for utilities, including but not limited to:

- a) watermains
- b) sanitary sewers
- c) storm sewers
- d) manholes, valve boxes
- e) lot service connections
- f) shoring, sheet piling
- g) dewatering

2.2 EXECUTION

2.1.2 Excavation

Excavate to lines and to design depth shown or as required by the Consultant to provide satisfactory bearing. Excavate unsuitable soil from trench bottoms as required by the County. Backfill with screened rock material specified to the required level and compact to provide uniform bearing.

Level and clean excavation bottoms free from loose material and debris.

Where excavation is made below depth shown through error, fill to required depth with 20 MPa compressive strength concrete or screened rock.

Provide firm undisturbed earth or rock bearings for granular bedding below pipelines and structures.

Excavate for structures to widths sufficient for formwork construction. Place no concrete or masonry until the Consultant has inspected excavation.

Where concrete is to be placed, thaw excavation bottom if frozen, and protect from further freezing.

Maximum lengths for open trenches are 30 meters ahead of pipe laying crew and 200 meters behind, unless otherwise permitted by the Consultant.

Where pipelines are constructed through fills and embankments, surface elevations will generally at least be 250mm above top of pipeline prior to excavation.

Where trenches are excavated in existing pavements, saw cut the pavement to neat lines.

2.1.3 Rocks and Boulders

Remove boulders to provide 150mm minimum clearance under pipes. Backfill with granular and compact at required level to provide suitable bearing, if boulders are less than 0.4 cubic meters.

Boulders larger than 0.4 cubic meters and material which cannot be removed with pick and bar will be classified as rock. Notify the Consultant when rock is encountered for classification and measurement.

Excavate rock to provide 150mm minimum clearance on each side and under pipes. Backfill with granular and compact at required level to provide suitable bearing.

Prior to commencing blasting operations, obtain written approval from authorities having jurisdiction and from the Consultant. Employ licensed workers only.

2.1.4 Shoring, Bracing and Sheet Piling

Provide all shoring, bracing and sheet piling required for support and protection of earth banks at excavations.

Erect all shoring, bracing and sheet piling independent of utilities and structures.

Shore and brace sides of trenches and excavations shall be in accordance with Workers' Compensation Board Regulations and shall be approved by a Professional engineer prior to using.

Maintain during backfilling and remove in stages as backfilling progresses or as approved by the Consultant.

Remove all shoring, bracing and sheet piling. If shoring is allowed to remain, cut off to a level at least 600mm below finish grade.

Pre-fabricated cages or shields may be used, at the discretion of the Consultant, to supplement or replace conventional shoring provided they conform with all applicable safety regulations, and permit the proper placing and tamping of bedding material under and around utility pipes.

2.1.5 Backfilling - General Requirements

Bedding of pipes and utilities and backfill to 300mm above top of pipes and utilities is included in other sections.

Backfill trenches and excavations with excavated earth material. Remove all rocks larger than 200mm in diameter from earth backfill.

Place and compact all backfill in maximum 300mm deep loose layers, prior to compaction.

Compact site material used as trench backfill in all areas from 300mm above top of pipe to 300mm below bottom of granular base for roads to a density not less than 98% of Standard Proctor Density, as defined herein, and carried out at a moisture content of within 3% of optimum moisture content. Remove any free water in the trench prior to placing additional lifts. Note that if moisture content is too high and densities not initially attainable the contractor will make every reasonable attempt to dry the material by whatever means available (ie. discing, spreading, etc.) should the County deem the material to be "unworkable" the use of imported granular backfill may be required. Compact the final 300mm below road or lane granular base to not less than 100% of Standard Proctor Density.



Compaction results will be based on a minimum of one density test per 150 lineal meters of trench for each 1.5 meters of depth. If a density test indicates insufficient compaction at any depth, then two more densities, which are proportionally representative of trench length will be taken at that depth. Then, if the average of the three tests is below the required density, the contractor will re-excavate and re-compact to meet the specified density.

Place and compact evenly around structures to prevent damage or displacement. Grade surface to direct water away.

Stockpile spread or remove excess excavated earth material where directed by the Consultant.

Where additional pipes are to be, or have been laid, crossing the trench being backfilled and at a higher elevation, take special care to ensure the backfill is compacted to a minimum of 97% of Standard Proctor Density from the lower pipeline up to the overt elevation of the higher pipeline.

Where imported material is called for by written direction of the Consultant, place the specified depth of granular material to the elevations provided and compact to specified Standard Proctor Densities.

Where filter fabric is called for by written direction of the Consultant, place fabric to the overall dimensions specified.

Do not place backfill in freezing weather without written permission of the County.

2.1.6 Settlement

The Developer shall be responsible for all settlement of backfill that may take place during a period of two (2) years after date of completion certificate.

When notified of any such settlement, promptly repair same, or make arrangement for others to do so at the Developer's expense. Failure to do so will result in making appropriate arrangements at the Developer's expense.

END OF SECTION

3 ROADWAY CONSTRUCTION

3.1 REFERENCE MATERIAL

All roadwork construction undertaken in Yellowhead County shall be in accordance with the latest edition of the Standard Specifications for Highway Construction in use by Alberta Infrastructure and Transportation.

4 GEOTEXTILE

4.1 GENERAL

This Section specifies requirements for the supply and installation of non-woven and woven geotextile filter fabric.

Non-woven geotextile filter fabric shall be used as a separate membrane for rip-rap or hydraulic filter for drainage systems.

Woven geotextile filter fabric shall be used when in the opinion of the County the foundation conditions are considered soft and unstable.

4.1.1 Mill Certificates

At least one week prior to the commencement of Work the Developer shall submit a sample of the geotextile filter fabric to be used in the Work with copies of mill test data and Manufacturers Certificate of Compliance that the geotextile filter material delivered to the job site meets the requirements of this section.

4.1.2 Approval

The Developer shall obtain written approval of the Consultant for the geotextile filter fabric material to be used in the Work.

4.1.3 Delivery And Storage

During delivery and storage, protect the geotextile filter fabric from direct sunlight, ultraviolet rays, mud, dirt, dust, moisture, debris and rodents.

4.2 PRODUCTS

4.2.1 Material

The geotextile filter fabric shall be rot-proof, unaffected by the actions of oil or salt water and not subject to attacks by insects or rodents.

The geotextile filter fabric shall be supplied in rolls of minimum width of 3.0 metres and minimum 50 metre lengths.

4.2.2 Physical Properties

The non-woven and woven geotextile filter fabric shall meet the specifications and physical properties in accordance with the following table of minimum average roll value properties (MARV's) for each.

Specifications and Physical Properties		
	Non- Woven	Woven
Grab Strength	650 N	1275 N
Elongation (Failure)	50%	15%
Puncture Strength	275 N	275 N
Burst Strength	2.1 MPa	3.6 MPa
Trapezoidal Tear	250 N	475 N
Minimum Fabric Lap to be	300mm	1000mm

4.3 EXECUTION

Where geotextile fabric is specified, the sloped or horizontal surface shall be graded to provide a smooth, uniform surface. All stumps, large rocks, brush or other debris that could damage the fabric shall be removed. All holes and depressions shall be filled so that the fabric does not bridge them. Loose soils shall be replaced.

The fabric shall be laid parallel to the slope direction in one continuous length from toe of slope to upper extent of fabric. It shall be placed in a loose fashion, however creases, folds, wrinkles and tensile stresses shall be avoided. Adjacent strips of fabric shall be overlapped as specified, except where placed underwater, the minimum lap width shall be 1 metre. Overlaps shall be pinned using 6mm diameter steel pins fitted with washers and spaced at 1 metre intervals along the overlaps.

The top edge of the filter fabric shall be anchored by digging a 300mm deep trench, inserting the top edge of the fabric and backfilling with compacted soil.

Rip-rap placement shall commence at the base of the filter fabric area and proceed up the slope. The height of drop of rip-rap shall be limited to 1.0 metre or less, and the rip-rap shall not be allowed to roll down the slope. Heavy equipment will not be permitted to operate directly on the geotextile.

4.4 PROTECTION

After installation the filter fabric shall be covered with overlaying layer within 3 days of placement.

Do not permit passage of any vehicle or equipment directly on geotextile at any time.

Protect geotextile material from displacement and damage until and during placement of the rip-rap, granular material or the gabion mat.

Care shall be taken to prevent puncturing or tearing the geotextile. Any damage shall be repaired by use of patches that extend at least 1 metre beyond the perimeter of the tear or puncture.

Remove and replace damaged or deteriorated geotextile, as directed by the Consultant.

END OF SECTION

5 RIP-RAP

5.1 GENERAL

5.1.1 Definition

Rip-rap is a protective covering consisting of hand-laid or randomly deposited rock, sacked concrete or sacked cement stabilized material which is placed on exposed surfaces for protection against erosion and wave action.

5.1.2 Work Included

Work of this Section consists of supplying, hauling, and placing of rip-rap as specified and as shown on Drawings.

Class 1M Riprap (Nominal Diameter of 175 mm)	Equivalent Diameter (mm)	Percentage (by weight of Riprap Greater than Equivalent Diameter)
	300	0%
	200	20% to 50%
	175	50% to 80%
	125	100%

Note: Sizes are equivalent spherical diameter, and are for guidance only.
The minimum dimensions of any single rock shall not be less than one third of its minimum dimension

Percentages are by mass. Sizes are equivalent spherical diameters, and are for guidance only.

5.2 EXECUTION

5.1.3 Preparation

Prepare surfaces to receive rip-rap to lines and grades as shown on the Drawings.

5.1.4 Inspection

Do not place rip-rap until foundation to receive it has been approved by the Consultant.

5.1.5 Installation

The rock rip-rap shall be placed on a non woven geotextile filter fabric unless otherwise noted on the drawings or in the specifications.

The hand-laid rock rip-rap erosion protection shall be placed in the areas indicated on the drawings or as designated by the County.

Place rip-rap by suitable mechanical equipment so that no intermixing of foundation material and rip-rap is allowed to occur during placing and that minimum breakage of rock fragments will occur and that the mass is stable.

Rip-rap need not be compacted but shall be dumped and graded off to same regular surface and in such manner that larger rock fragments are uniformly disturbed and smaller rock fragments fill voids between larger pieces.

Hand placing will be required only to extent to secure results specified above in the areas where mechanical equipment cannot operate adequately.

The rip-rap stones shall be placed on the surface to be covered as shown by the plans or as directed by the Consultant, on slopes not exceeding 1½ H:1V starting with the larger stones on the bottom row. Rip-rap shall be placed on the prepared surface such that the weight of the stone is carried by the subgrade and not by the underlying stones. Rip-rap shall be placed proceeding upward from the bottom. Voids between rip-rap shall be filled with broken rock fragments.

Care shall be taken not to puncture the geotextile filter fabric when placing the rip-rap. Any damaged filter fabric shall be repaired or replaced as requested by the Consultant.

END OF SECTION

6 WATERMAINS

6.1 GENERAL

6.1.1 Work Included

Provide all labour, products and equipment required for the work, including but not limited to:

- a) bedding under and over pipe
- b) watermains and appurtenances
- c) testing watermains
- d) flushing and disinfecting watermains
- e) connection to existing systems
- f) thrust blocks

6.1.2 Quality Standards and Assurances

Products, workmanship and testing shall conform to standards specified in this section.

All products and workmanship may be subject to inspection by the County.

Perform all tests required by the specification and by authorities having jurisdiction.

Notify the County and authorities in ample time before testing to permit inspection and allow tests to be witnessed.

Remove or repair defective products or work which fails to meet specified requirements as directed by the County.

6.2 PRODUCTS

6.2.1 Polyvinyl Chloride (PVC) Water Pipe

Polyvinyl chloride water pipe shall be equivalent to cast iron pipe outside diameter meeting CAN3-B.137.3 M86 (AWWA C900).

Pipe shall be Class 150 (dimension ratio 18) and pipe must be blue in color.

Pipe joints shall be integral gasketed bell ends. Couplings shall be permitted only for closures or special connections.

Gaskets shall conform to AWWA C111.

An affidavit of compliance shall be provided if requested.

6.2.2 Pipe Fitting

Cast iron or ductile iron fittings shall meet the requirements of AWWA Specification C110-77. Pressure rating shall be 1.1 MPa.

Joints on fittings shall be the same as specified for pipe.

Fittings shall be externally and internally coated with bituminous material approved for waterworks service.

PVC fittings shall be to CAN3-B.137.3, pressure Class 150, which are designed to accommodate the pipe for which they are used.

PVC fittings shall be gasketed bell end type similar to pipe except where adaptors are required in which case flanged or threaded joints may be permitted subject to approval by the County. Gaskets to conform to AWWA C111.

Cast ductile iron couplings to be robar couplings or approved equal complete with ANSI 303 stainless steel nuts & bolts compatible with outside diameters of pipes to be joined in locations approved or specified by the County.

6.2.3 Gate Valves (NRS)

Valves shall be iron body, bronze mounted, double disc or solid-wedge, with full 360 degree rubber to cast iron resilient seat gate valves approved for potable water use, meeting AWWA Specification C509-80 and the following:

Valves to be bronze mounted with a grade of bronze completely resistant to de-zincification by water having a ph of 9.0.

Valve ends shall be consistent with the type of joint used for pipe and fittings except where otherwise detailed.

Valves to be supplied with either bronze or type 304 stainless steel stems.

Working pressure 1035 kPa.

Valve interior to be epoxy coated for corrosion protection.

Valves shall close by turning clockwise and be a non-rising stem type and be equipped with a 50mm square operating nut. Valve stem shall be equipped with "O-Ring" type seals.

Exterior to be factory coated.

All exterior bolts and nuts must be T304 or type 3145.5 stainless steel.

6.2.4 Valve Boxes

Valve boxes shall be Norwood Foundry Type A, or equal. Valve box shall consist of a cast iron bonnet of sufficient size to fit over the valve, and an adjustable cast iron top box with lid.

Valve boxes shall be of suitable length for depth of bury specified for mains with possible adjustment of 300mm up or down from this length.

Valve box extensions shall be cast iron suitable for use with the valve box to be installed.

All cast iron surfaces to have a bituminous coating for corrosion resistance.

6.2.5 Hydrants

Hydrants are to be of the post type, dry barrel hydrant with compression shut-off conforming to AWWA Specification C502-80, having the following features:

Working pressure of 1035 kPa.

Two hose connections at 180 deg., 63mm ID with threads to Alberta Mutual Standard.

One pumper connection, 100mm OD, outlet nozzles to be fastened by a thread connection.

150mm riser barrel, 125mm bottom valve.

Minimum distance from flange to bonnet will be 600 mm.

Main connection to be 150mm ductile iron size rubber gasketed bell end joint.

Self Draining hydrants or plugged as determined by site conditions.

Number 6 operating nut with five sides.

Hydrant to open counterclockwise.

All hydrants will be painted Tremclad Yellow (No. 270-97X).

Ground line breakway system: 3.10 metres from invert to flange, including a 300mm minimum top extension spool section or, as required to meet, surface grading requirements with hydrant rod coupled at extension.

Minimum 710mm from top of operating nut to bottom of base flange.

All exposed nuts and bolts to be T304 or type 3145.5 stainless steel.

Interface between removable parts of main valve and hydrant body shall be bronze to bronze.

Hydrants shall be of the same type and make as presently used in Yellowhead County (Canada Valve, Century, Clow or Terminal City.).

6.2.6 Watermain Plugs

Watermain plugs shall be of standard manufacture to suit type of pipe and pipe joint specified.

6.2.7 Air Relief Valve & Flushing Chamber

Valve and chamber shall conform to the detail drawing W-07.

6.2.8 Bedding Pipes

Excavate trenches to widths not less than 300mm greater than pipe diameter. Maximum width at top of pipe zone shall not exceed outside pipe diameter plus 600mm, plus allowance for timbering, if required.

Excavate below bottom of trench at joints as required to provide working space. Body of pipe to rest on minimum 100mm firmly compacted sand bedding throughout its length.

Place sand bedding for PVC pipe as per trench bedding and installation and backfill Class B granular surround as detailed in the structural drawing attached. If site material meets bedding sand specification requirements, it may be used to replace the top 300mm of bedding sand.

For trench in rock, bed pipe on minimum of 150mm of compacted sand.

6.2.9 Laying and Jointing Pipe

At all hydrants, plugs, tees, crosses, bends of 22 degrees or more and all other points of concentrated thrust, provide reaction blocking as detailed to prevent movement. Place reaction blocking against solid undisturbed ground. Details are based on soil load values of 7323 kg per square meter, or more. Where soil will not provide this load value, provide bands and clamps to take reaction. Refer also to special thrust block details. Place blocking to provide access to pipe and fittings for repairs or extensions of line.

Install slip type rubber gasket joints to manufacturer's directions. If requested, provide copies of manufacturer's directions on site for reference and obtain technical assistance from manufacturer or representative.

Ensure that valve box can be adjusted up or down at least 300mm. It is intended that valve boxes installed at this time to finished crushed gravel elevation, will be raised at the time of paving without having to supply a new upper extension.

6.2.10 Setting and Jointing Valves

Check and ensure stuffing glands on valves are properly packed before installation.

Set valves accurately in position, set valve box carefully over hood with shaft vertical and cap at proper level plus or minus 50mm from elevations provided by the Consultant.

Anchor valves to prevent movement under unbalanced pressure conditions when recommended by pipe manufacturer.

Check operation of valves in presence of the County before testing and after testing.

6.2.11 Setting and Jointing Hydrants

Set hydrants and hydrant valves on pressure treated timber blocking as per the details.

Ensure hydrant stock and valve box are truly vertical.

Locate hydrants and valves as per the drawings within the following tolerances: 50mm horizontal, 15mm vertical.

Face pumper nozzles to roadway with hose nozzles parallel to roadway. No portion of the hydrant or nozzle cap shall be within 150mm of the sidewalk.

Concrete thrust blocks will be required at hydrants and hydrant valves as detailed.

6.2.12 Thrust Blocks

Cement to be sulfate resistant Portland cement.

Place concrete thrust blocks between undisturbed ground, tees, plugs, caps, bends, reducers, hydrants, and fittings.

Keep joints and couplings free of concrete.

Do not backfill over concrete within 24 hours after placing.

6.2.13 Testing Watermains

Watermain testing may be carried out when all the following conditions have been met:

- a) section of watermain not exceeding 365 meters in length has been completed.
- b) the section has been carefully filled with water and allowed to sit for at least 24 hours.
- c) reaction or thrust blocking within the section has reached 15.0 MPa design strength.

If all the conditions have been met, apply a constant pressure of 1035 KPa for a minimum of two hours to mains, hydrants, valves and services. Ensure all water service connections are turned off at curb stops to avoid damage to private plumbing.

Conduct leakage tests after completion of pressure testing. Conduct leakage tests at 1035 KPa in accordance with AWWA C600-82 procedures. Allowable leakage will be calculated using the following formula:

$$\text{Allowable leakage} = N \times D \times P^{0.5} \div 128320 = \text{Litres per hour}$$

Where N = Number of joints; D = nominal diameter of pipes (mm); and P = average test pressure (kPa).

If test leakage in any section is greater than permitted by AWWA Standards, locate and repair defective pipe joints until leakage is within permitted allowance. Test pipelines in sections not exceeding 365 metres in length.

Provide all equipment and labour for tests.

6.2.14 Flushing and Disinfecting Watermains

After completing satisfactory hydrostatic tests and before placing into service, flush all mains to remove as much foreign matter as possible from system. Flush at minimum velocity of 0.8 meters per second as required by AWWA C651-99 procedures (250mm line requires 2 - 50mm openings to provide the required flushing velocity).

After flushing, disinfect mains by pumping chlorine solution into mains through a special main cock at beginning of line near source of water. Do not use hydrants at point of application for disinfectant.

Introduce disinfectant according to AWWA C651-99 and to approval of the County and Provincial Ministry of Health.

Conform to AWWA C651-99 for quantity of disinfectant, method of distribution throughout system and final flushing.

After final flushing and before placing watermain in service, the Developer will collect samples in sterile bottles from an approved sampling point. The sampling is to be witnessed by local authorities as necessary. Samples will be submitted to Provincial Ministry of Health for testing and test results forwarded to Local Authorities. Heterotrophic plate counts will be provided.

If initial disinfection fails to produce satisfactory results, repeat disinfection until satisfactory samples are obtained.

Dechlorination of the chlorinated water will be required in all circumstances before discharging the water to the environment in order to meet the regulatory requirements of Yellowhead County or Alberta Environment. Dechlorination is to be performed by adding neutralizing chemicals (AWWA C651-86, Appendix B) to the chlorinated water as it is flushed from the system and before it enters the receiving environment.

6.2.15 Markers

A 50mm by 100mm stake, from 1000mm below ground to 600mm above ground level shall be placed at each water valve, the top 600mm to be painted blue.

END OF SECTION

7 SANITARY SEWER MAINS

7.1 GENERAL

7.1.1 Work Included

Provide all labour, products and equipment required for the work, including but not limited to:

- a) bedding under and over piping
- b) sanitary sewers and appurtenances
- c) manholes and appurtenances
- d) cleaning sewers
- e) testing sewers
- f) connection to existing systems

7.1.2 Quality Standards and Assurances

Products, workmanship and testing shall conform to standards specified in this section.

All products and workmanship are subject to inspection by the County.

Perform all tests required by the specifications and by authorities having jurisdiction.

Notify the County and authorities in ample time before testing to permit inspection and to allow tests to be witnessed.

Remove or repair defective products or work which fails to meet specified requirements as directed by the County.

7.2 PRODUCTS

7.2.1 Sewer Pipe

To be type called for in the schedule of quantities or shown on drawings and meet the requirements noted in subsequent clauses of this section.

Non-reinforced pipe and fittings to CAN/CSA-A259.1 Class 3, designated for flexible rubber gasket joints to CAN/CSA-A257.3.

Reinforced concrete pipe meeting ASTM Specification C76- CSA-A257.2-M92.

PVC pipe and fittings - DR 35 meeting ASTM Specification D3034 and CSA-B182.2 and CSA-B182.1 may be utilized for mains up to and including 375mm diameter with prior approval of the County.

Cement - sulfate resisting Portland for all concrete pipe, meeting Type 50 CSA-A5.

7.2.2 Pipe Joints

For all sewers - as recommended by pipe manufacturer, to produce watertight joints with infiltration within specified limits.

Concrete pipe - rubber gasket to ASTM C443, and CAN/CSA A257.3-M92.

PVC - rubber gasket to ASTM 03212 or ASTM F477.

7.2.3 Pre-cast Concrete Manhole Units

To meet requirements of ASTM C478 and CSA A257.4 to dimensions shown on drawings.

Cement - sulfate resisting Portland, CSA A5, Type 50.

Manhole steps shall be 20mm diameter, galvanized iron safety rungs spaced at a maximum distance of 400mm center to center for full height.

Pre-cast bases to be minimum 25.0 MPa concrete.

7.2.4 Concrete Blocks and Bricks

Solid concrete, conforming to CSA A165.1 and 165.2 and ASTM C139, not less than 128mm thick for block, standard dimensions for brick, true to shape, free from cracks and surface defects, compressive strength not less than 25.0 MPa, absorbing not more than 8% water by weight during 24 hours immersion test performed after drying.

Cement - sulfate resisting Portland CSA A5, Type 50.

7.2.5 Mortar

For pipe joints and all other parts of the work, one part sulfate resisting Portland cement to two parts clean sand, by volume.

7.2.6 Cast Iron Frame, Covers and Grates

For manholes and catch basins, close-grained grey cast iron, meeting ASTM A48, Class 20, true in form and dimension, free from faults, sponginess, cracks, blowholes and other defects. Cast steel to conform to ASTM A27, grade 70-36. Substitution of ductile iron meeting ASTM A445 for cast iron or cast steel shall be subject to approval of County.

Machine or grind frames, covers and grates to even non-rocking bearing surfaces.

Hot dip in asphaltic varnish.

Manhole covers and frames:

- a) Sanitary - Norwood Foundry Model F-39, or approved equal.

7.2.7 Manhole Steps

Safety type, 20mm diameter solid steel bar, hot dip galvanized after fabrication.

7.2.8 Safety Platforms

Safety platforms shall be aluminum grates to MSU Mississauga or approved equal.

To be installed according to manufacturer's recommendations.

To be installed on manholes greater than 5.0 meters in depth when measured from the top of the frame to the lowest invert.

7.2.9 Concrete

Ready-mixed concrete, sulfate resisting, Portland cement CSA A5, Type 50, 25 MPa compressive strength at 28 days of age, to CSA A23.1.

7.2.10 Reinforcing Steel

CSA G30.12 or G30.13, 34.5 MPa minimum yield, Grade 50 all deformed except where noted otherwise. Use Grade 40 for ties.

7.2.11 Sewer Pipe Tests and Rejection

Pipe will be accepted, based on certified factory tests, provided they are done under supervision of an independent testing agency. All pipe tests shall be performed in accordance with ASTM Specifications.

The County may require submission of a manufacturer's report verifying satisfactory random testing of the pipe designated for this project.

7.3 EXECUTION

7.3.1 Bedding Sewers

Excavate trenches to widths not less than 300mm greater than pipe diameter. Maximum width at top shall not exceed outside pipe diameter plus 600 mm.

Bed pipe per trench bedding and initial backfill Class "B" granular surround conditions for plastic pipe and Granular Foundation from concrete pipe, as detailed in the standard drawings attached.

7.3.2 Laying and Jointing Pipe

Commence laying at lower end of line, lay pipes and specials true to line and grade, socket ends up grade, joints close and evenly butted all around pipe. Take special care to prevent sagging of spigot end in hub and provide true, even invert surface throughout entire length of sewer. Excavate at end of each pipe to provide rest for socket, sufficient to permit proper jointing. Clean pipe interior, remove all dirt, mud and other extraneous materials.

7.3.3 Infiltration /Exfiltration Testing

Total infiltration of groundwater into whole of system or exfiltration, shall not exceed 5.0 liters per mm of internal pipe diameter per kilometer per day including manholes, for PVC pipe, and 20 liters per mm of internal pipe diameter per km per day including manholes for concrete and clay tile pipe. Where such leakage is exceeded, repair sewer mains so total infiltration is within specified limits.

During construction and immediately on completion of a manhole, measure infiltration at new manhole. If amount exceeds specified limit, make necessary repairs immediately to reduce infiltration to allowable limit. Failure to comply with this requirement will be sufficient cause for the County to stop sewer laying work until repairs have been made.

7.3.4 Cleaning Sewer Mains

On completion of construction of mains and services, flush and string, (in readiness for TV inspection) all mains until all deposits of earth or other material are removed. If new system connects to an existing system, plug outgoing line at manhole at junction and remove dirt and debris at that manhole. Do not permit debris from new construction to enter existing system. Pay all costs for repairs where damages occur due to negligence. Pay all costs of water from the municipal authority.

During flushing operations, check all manholes. If depth of flow in any manhole is greater than should be anticipated, bucket main and remove obstructions in pipe line. Pay all costs for required repairs.

Whenever practicable, flush out in runs not over 250 meters. Remove all foreign material from each run before proceeding with next.

7.3.5 Testing

If required by the County, perform pig test after cleaning sewer mains. Through each section of main, pull wood or metal ball with diameter 50mm less than inside pipe diameter. If the pig does not readily pull through, uncover pipe and repair defective section.

Pig test is not required on lines 216mm diameter and larger if they are visually inspected in a satisfactory manner.

TV Testing - the Developer, at his cost will carry out a TV inspection of all sanitary and storm water mains. All defects identified by the TV inspection shall be corrected by the contractor at the contractor's expense. The contractor shall be responsible for the cost of flushing and stringing the mains prior to TV inspection. If additional TV inspection is required to verify correction of defective work, it will be at the Contractor's cost. The Contractor shall provide a copy of the video tape recordings and a written report to the County for record purposes.

7.3.6 Manholes

Construct manholes as shown on drawings, unless otherwise permitted in writing by the County.

For cast-in-place concrete for manholes, conform to CSA A23.1.

Place manholes accurately, plumb, in alignment and at exact plan location.

Construct manholes watertight and complete, including finishing flow bottoms, as work proceeds. Do not lay pipe in advance more than two manholes ahead of last completed manholes.

Shape bottoms accurately for necessary flows as shown on drawings or as directed by the County. In manholes with sewers 610mm in diameter and smaller, form invert through manhole with half-round pipe. In manholes containing lot services, shape bottoms to provide slopes required to ensure no build up of sewage occurs in manholes.

Place stubs for future lines accurately and plug watertight. Shape flow bottoms to suit future lines.

At all bends through manholes, provide 50mm drop in invert from inlet to outlet.

Support pipes at manholes to prevent shearing or settlement. Where not detailed use concrete fill, concrete or timber beam, or suitably compacted gravel.

During construction, plug pipes at manholes to prevent entry of concrete and mortar. Remove plugs immediately after construction is completed.

Set covers accurately within 15mm of correct grade. On sloping streets, set covers to match slopes.

Set all precast concrete sections, bricks, blocks and frames in mortar. Tool joints smooth and point all voids after setting.

All sanitary manhole barrels are to be sealed with rubber neck to prevent infiltration.

END OF SECTION

8 STORM WATER MAINS

8.1 GENERAL

8.1.1 Work Included

Provide all labour, products and equipment required for the work, including but not limited to:

- bedding under and over piping
- storm water mains and appurtenances
- manholes, catchbasins and appurtenances
- cleaning sewers
- testing sewers
- connection to existing systems

8.1.2 Quality Standards and Assurances

Products, workmanship and testing shall conform to standards specified in this section.

All products and workmanship are subject to inspection by the County.

Perform all tests required by the specifications and by authorities having jurisdiction.

Notify the County and authorities in ample time before testing to permit inspection and to allow tests to be witnessed.

8.2 PRODUCTS

8.2.1 Storm Sewer Pipe

To be type called for in the schedule of quantities or shown on drawings and meet the requirements noted in subsequent clauses of this section.

Non-reinforced pipe and fittings to CAN/CSA-A259.1 class 3, designated for flexible rubber gasket joints to CAN/CSA-A257.3.

Reinforced concrete pipe meeting ASTM Specification C76-70 CSA-A257.2-M92.

PVC pipe and fittings - DR 35 meeting ASTM Specification D3034 and CSA-B182.2 and CSA-B182.1 may be utilized for mains up to and including 375mm diameter with prior approval of the County.

Ribbed PVC pipe and fittings to meet CSA B182.4, ASTM F794 with pipe stiffness of 320 kPa as measured in accordance with ASTM D2412. Maximum long term deflection is less than 7.5%.

Cement - sulfate resisting Portland for all concrete pipe, meeting Type 50 CSA-A5.

8.2.2 Pipe Joints

For all storm sewers - as recommended by pipe manufacturer, to produce watertight joints with infiltration within specified limits.

Concrete pipe - rubber gasket to ASTM C443 and CSA A257.3.

PVC - rubber gasket to ASTM 03212 or ASTM F477.

8.2.3 Pre-cast Concrete Manhole Units

To meet requirements of ASTM C478 and CSA A257.4 to dimensions shown on drawings.

Cement - sulfate resisting Portland, CSA A5, Type 50.

Manhole steps shall be 20mm diameter, galvanized iron safety rungs spaced at a maximum distance of 400mm center to center for full height.

Pre-cast bases to be minimum 25.0 MPa concrete.

8.2.4 Concrete Blocks and Bricks

Solid concrete, conforming to CSA A165.1 and 165.2 and ASTM C139, not less than 128mm thick for block, standard dimensions for brick, true to shape, free from cracks and surface defects, compressive strength not less than 25.0 MPa, absorbing not more than 8% water by weight during 24 hours immersion test performed after drying.

Cement - sulfate resisting Portland CSA A5, Type 50.

8.2.5 Catch Basins

To meet requirements of ASTM C478 and CSA A257.2, 910mm diameter reinforced concrete riser, reinforced pre-cast concrete base slab, to details shown on drawings.

Cement - sulfate resisting Portland CSA A5, Type 50.

8.2.6 Catch Basin Lead Pipes

Catch basin lead pipes shall be:

- a) PVC pipe DR 35 to meet ASTM D3034 or approved equivalent.

Pipe diameter shall be 250mm diameter for single catch basins and 300mm diameter for twinned catch basins with a minimum grade of 2%.

8.2.7 Mortar

For pipe joints and all other parts of the work, one part sulfate resisting Portland cement to two parts clean sand, by volume.

8.2.8 Cast Iron Frame, Covers and Grates

For manholes and catch basins, close-grained grey cast iron, meeting ASTM A48, Class 20, true in form and dimension, free from faults, sponginess, cracks, blowholes and other defects. Cast steel to conform to ASTM A27, grade 70-36. Substitution of ductile iron meeting ASTM A445 for cast iron or cast steel shall be subject to approval of the County.

Machine or grind frames, covers and grates to even non-rocking bearing surfaces.

Hot dip in asphaltic varnish.

Manhole covers and frames:

- a) Storm - Norwood Foundry Model F-49, or approved equal.

Catch basin covers and frames:

- a) Rolled monolithic curb and gutter - Norwood Foundry Model F-33.
- b) Round Top Catch Basin - Norwood Foundry Model F-49.
- c) Side inlet - Norwood Foundry Model F-51.

8.2.9 Manhole Steps

Safety type, 20mm diameter solid steel bar, hot dip galvanized after fabrication.

8.2.10 Safety Platforms

Safety platforms shall be aluminium grates to MSU Mississauga or approved equal.

To be installed according to manufacturer's recommendations.

To be installed on manholes greater than 5.0 meters in depth when measured from the top of the frame to the lowest invert.

8.2.11 Concrete

Ready-mixed concrete, sulfate resisting, Portland cement CSA A5, Type 50, 25 MPa compressive strength at 28 days of age, to CSA A23.1.

8.2.12 Reinforcing Steel

CSA G30.12 or G30.13, 34.5 MPa minimum yield, Grade 50 all deformed except where noted otherwise. Use Grade 40 for ties.

8.2.13 Storm Sewer Pipe Tests and Rejection

Include all costs for testing, supply and delivery of specimens to testing laboratory and replacing defective material.

The County reserves the right to select, either on site or at the manufacturer's stockpile, 0.5% of total length of each category of pipe for testing, minimum number of lengths as follows:

- a) for each category of over 100 lineal meters - 4 lengths
- b) for each category of over 50 lineal meters and less than 100 lineal meters - 2 lengths
- c) for each category of less than 50 lineal meters - 1 length.

Where the County has selected full sized pipe specimens for load tests, deliver these specimens to an approved testing laboratory. Results of the tests shall be mailed directly to the County in triplicate. Pipe will be accepted, based on certified factory tests, provided they are done under supervision of an independent testing agency. All pipe tests shall be performed in accordance with ASTM Specifications.

Should any specimens fail to meet test requirements, test two additional selected specimens for each failure. Pipe will be acceptable only if all re-test specimens meet requirements. Should test results be unsatisfactory, all or part of pipe supplied may be rejected and acceptance withheld until satisfactory tests of pipe in place are conducted.

Inspect pipe on delivery and reject any that fails to meet specified requirements. Replace rejected pipe with satisfactory pipe without delay. Mark all rejected pipe plainly as "Rejected" and immediately remove from site.

The County may require submission of a manufacturer's report verifying satisfactory random testing of the pipe designated for this project.

8.3 EXECUTION

8.3.1 Bedding Sewers

Excavate trenches to widths not less than 300mm greater than pipe diameter. Maximum width at top shall not exceed outside pipe diameter plus 600 mm.

Bed pipe per trench bedding and initial backfill Class "B" granular surround conditions for plastic pipe and granular foundation for concrete pipe, as detailed in the standard drawings attached.

- a) obtain the County's approval for all materials to be used in the pipe bedding zone.

8.3.2 Laying and Jointing Pipe

Commence laying at lower end of line, lay pipes and specials true to line and grade, socket ends up grade, joints close and evenly butted all around pipe. Take special care to prevent sagging of spigot end in hub and provide true, even invert surface throughout entire length of sewer. Excavate at end of each pipe to provide rest for socket, sufficient to permit proper jointing. Clean pipe interior, remove all dirt, mud and other extraneous materials.

8.3.3 Infiltration /Exfiltration Testing

Total infiltration of groundwater into whole of system or exfiltration, shall not exceed 5.0 liters per mm of internal pipe diameter per kilometer per day including manholes, for PVC pipe, and 20 liters per mm of internal pipe diameter per km per day including manholes for concrete and clay tile pipe. Where such leakage is exceeded, repair sewer mains so total infiltration is within specified limits.

During construction and immediately on completion of a manhole, measure infiltration at new manhole. If amount exceeds specified limit, make necessary repairs immediately to reduce infiltration to allowable limit. Failure to comply with this requirement will be sufficient cause for the County to stop sewer laying work until repairs have been made.

8.3.4 Cleaning Sewer Mains

On completion of construction of mains and services, flush and string, (in readiness for TV inspection) all mains until all deposits of earth or other material are removed. If new system connects to an existing system, plug outgoing line at manhole at junction and remove dirt and debris at that manhole. Do not permit debris from new construction to enter existing system. Pay all costs for repairs where damages occur due to negligence. Pay all costs of water from the municipal authority.

During flushing operations, check all manholes. If depth of flow in any manhole is greater than should be anticipated, bucket main and remove obstructions in pipe line.

Whenever practicable, flush out in runs not over 250 meters. Remove all foreign material from each run before proceeding with next.

8.3.5 Testing

If required by the County, perform pig test after cleaning sewer mains. Through each section of main, pull wood or metal ball with diameter 50mm less than inside pipe diameter. If pig does not readily pull through, uncover pipe and make good defects.

Pig test is not required on lines 216mm diameter and larger if they are visually inspected in a satisfactory manner.

TV Testing - the Contractor, at his cost will carry out a TV inspection of all sanitary and storm water mains. All defects identified by the TV inspection shall be corrected by the contractor at the contractor's expense. The contractor shall be responsible for the cost of flushing and stringing the mains prior to TV inspection. If additional TV inspection is required to verify correction of defective work, it will be at the contractor's cost. The Contractor shall provide a copy of the video tape recordings and a written report to the County for record purposes.

8.3.6 Manholes

Construct manholes as shown on drawings, unless otherwise permitted in writing by the County.

For cast-in-place concrete for manholes, conform to CSA A23.1-04/A23.2-04 Concrete Materials and Methods of Concrete Construction/ Methods of Tests and Standard Practices for Concrete.

Place manholes accurately, plumb, in alignment and at exact plan location.

Construct manholes watertight and complete, including finishing flow bottoms, as work proceeds. Do not lay pipe in advance more than two manholes ahead of last completed manholes.

Shape bottoms accurately for necessary flows as shown on drawings or as directed by the County. On manholes with sewers 610mm diameter and smaller, form invert through manhole with half-round pipe. At manholes containing lot services shape bottoms to provide slopes required to ensure no build up of sewage occurs in manholes.

Place stubs for future lines accurately and plug watertight. Shape flow bottoms to suit future lines.

At all bends through manholes, provide 50mm drop in invert from inlet to outlet.

Support pipes at manholes to prevent shearing or settlement. Where not detailed use concrete fill, concrete or timber beam, or suitably compacted gravel.

During construction, plug pipes at manholes to prevent entry of concrete and mortar. Remove plugs immediately after construction is completed.

Set covers accurately within 15mm of correct grade. On sloping streets, set covers to match slopes.

Set all precast concrete sections, bricks, blocks and frames in mortar. Tool joints smooth and point all voids after setting.

All storm manhole barrels are to be sealed with rubber neck to prevent infiltration. Gaskets for storm manholes only, may be omitted at the discretion of the County.

END OF SECTION

9 LOT SERVICE CONNECTIONS

9.1 GENERAL

9.1.1 Work Included

Provide all labour, products and equipment required for the lot service connections, including but not limited to:

- a) water service piping
- b) sewer service piping
- c) corporation cocks, connection to main
- d) curb stops, service boxes, service markers

9.1.2 Quality Standards and Assurances

Products and workmanship shall conform to applicable municipal and provincial standards and to specifications.

All products and workmanship will be subject to inspection by the County.

Perform all tests required by authorities having jurisdiction. Test water and disinfect services with mains.

Notify the County and authorities in ample time before testing to permit inspection and to allow tests to be witnessed.

Remove or repair defective products or work which fails to meet specified requirements as directed by the County.

9.2 PRODUCTS

9.1.3 Water Service Pipe, Fittings

All water service piping, lining, fittings and valves shall be certified to NSF Standards 14 and 61 as applicable for drinking water system components, whenever possible.

Products are specified to be in accordance with a recognized standard such as AWWA, CSA, ASTM or ANSI.

Main or corporation cocks – Compression type AWWA thread.

Curb stops – Copper to copper ball valve with a drain. Curb stops 38mm or larger shall be ball bearing type.

Couplings – Standard Brass Compression type.

Service Boxes – Epoxy coated extension type for a maximum extension of 3.5 metres, complete with stainless steel operating rod, brass clevis and key. Service box to be supported on a cast iron piece nailed to a pressure treated preserved wood plank.

Service Clamps – Bronze double strap conforming to Smith-Blair 323 or approved stainless steel AWWA Boss.

Service boxes to be adjustable from 2.4 metres to 3.0 metres bury, unless otherwise noted on drawings.

9.1.4 Sewer Service Pipe

PVC, SDR 28 conforming to CSA B182.1 with push on joints. Sanitary services to be either white or green in color.

9.1.5 Sewer Saddles

Manufactured tee saddles, gasketed joints secured with double steel clamps.

9.1.6 Sand Bags

Bags to be new material. Sand to be clean and free from debris, conforming to imported sand requirements as specified in subsection 1.2.2 Materials of the Construction Standards Section 1 Aggregates.

9.1.7 Rigid Foamed Urethane Insulation

Density (ASTM D1622) not less than 28.8 kg/cubic meter. (Nominal 32.0 kg).

Closed cell content (ASTM D2856) not less than 90%.

Water absorption (ASTM D2842) not greater than 0.34 kg/square meter.

Initial thermal conductivity (ASTM D2326) (K Factor) not greater than watts/meter degree Celsius.

Dimensional stability (ASTM D2126).

Compressive strength (ASTM D1621) not less than 206.8 kPa at 10% deflection.

9.3 EXECUTION**9.1.8 Water Services**

Use tapping machine to drill, tap and thread corporation main stop into main. Use special care to prevent cuttings falling into main. Wherever possible, tap main under pressure and obtain written approval from the County to do otherwise.

Lay water service pipe to designated location and connect to existing service lines. Service connections shall be tapped into the upper portion of the watermain at an angle of at least 45 degrees from the horizontal. Tappings shall have a minimum spacing of at least 600mm. Attach curb stop and set service box to grade where required.

Brace boxes securely to keep plumb during backfilling. Test for operation both before and after pressure test.

Where curb stop is located under sidewalk, concrete slab or other structure, set top of extension service box flush with surface and fill hole around pipe neatly with concrete.

Use service clamps on all services tapped into 150mm mains and on 25mm and larger services tapped into 200mm to 300mm lines. In all other cases, use service clamps where size of main stop is larger than recommended for size of main.

Place water service lines at least 2.7 metres below final finished grade elevations, unless otherwise directed.

Lay water service lines in same trench with sewer service line. Install sanitary services on left side of water service as viewed from main towards property line. Paint last 1 metre of sanitary

service pipe red. Paint last storm service pipe green. Make all connections to existing services using appropriate couplings.

Lot service connections to residential lots shall be installed inside property line to easement line for lane servicing; and to property line, or easement line if an easement exists, for street servicing (as shown on the drawings). Water services connections to residential lots (R.1 and R.2) shall be 0.15 metres short of the easement line for lane servicing and 0.30 metres outside property line or easement line if an easement exists, for street servicing.

9.1.9 Sewer Services

Connect services to mains with manufactured tee or wye fittings placed in mains, or by cutting into mains and installing manufactured tee saddles or wye saddles and 45 degree bends. A 150mm x 100mm reducer shall be installed at property line to transition from the 150mm connection at the main to the 100mm Lot Service Pipe. Take care to avoid cracking pipe and remove all cuttings from pipe. Secure joint between saddle and main with mortar or other means acceptable to the County.

Do not allow spigots or other obstructions to project into main. Lay service pipe to an even gradient as directed.

Install service lines as detailed, at locations and to grade designated by grade sheet provided in field. Install services at right angle to main, unless otherwise specified.

Bends permitted only at three locations – 45 degree bend with wye or 22.5 degree bend with tee connection at main, 45 degree bend at top of riser and 22.5 degree bend maximum at property line for house service connection between these points.

Support service lines adequately to prevent dislocation, buckling or settlement. When water lines must be laid below sewer lines, ensure that backfill over water lines is adequately compacted to prevent settlement or dislocation of sewers.

When a connection cannot be made directly to a house service line, plug end of sewer service to prevent entry of water and dirt.

Install service risers only where noted on the lot grading plan. Ensure adequate support for the riser section utilizing sandbags or screened rock.

9.1.10 Markers

A 50mm by 100mm marker stake, from invert elevation to 600mm above ground level shall be placed at the end of each water service line, the top 600mm to be painted blue. Place a 100mm diameter white PVC pipe over the water service box from 600mm below ground to 600mm above ground.

END OF SECTION

10 ADJUSTMENT OF APPURTENANCES

10.1 GENERAL

10.1.1 Work Included

The work described in this section pertains to the adjustments of all appurtenances.

10.2 EXECUTION

10.2.1 Valve and Curb Boxes Adjustments

Valve box tops and curb box tops shall be adjusted so that the top of the box is set exactly to the required elevation. The Contractor shall shorten or lengthen the boxes and stems as required and block the boxes to prevent any settlement. The adjustments shall be made so that the boxes are plumb and the valves operate effectively. The rock guard and operating nut are to be located no closer than 300mm below the proposed finished grade.

10.2.2 Manhole and Catch Basin Adjustments

Manhole and catch basin frames shall be adjusted so that the top of the cover is set exactly to the required elevation. Where it is necessary to raise manhole frames it shall be done with approved precast rings or blocks meeting the requirements of the current issue of ASTM C478. Joints between slab top blocks, and frame shall be mortared, and the joints finished flush and smooth. Joints between slab top, precast rings, and frame shall be made watertight utilizing preformed bituminous gaskets or other approved sealant. Under no circumstances shall the depth from the rim of the manhole to the first ladder rung be more than 800mm.

10.2.3 Damaged Appurtenances

The Contractor shall replace any appurtenances damaged by his work or forces. Any existing damaged appurtenances found within the proposed work zone shall be replaced by the Contractor as approved by the County at an agreed lump sum price.

10.2.4 Final Adjustment Elevations

The tops of valve boxes, manholes, and catch basins shall be set to the design elevations, or as approved by the County. Generally, the following shall apply for setting the final elevations of the tops of the appurtenances.

- a) in asphaltic pavement, 5mm below the finished surface elevation for manhole frames.
- b) in concrete curb & gutter, 10mm below gutter elevation for catch basin frames.
- c) in gravel roadways/lanes, 50mm below the surface.
- d) in landscape areas, 50mm above the final surface, providing a smooth transition to match the surrounding areas.

END OF SECTION

11 CULVERTS

11.1 REFERENCE MATERIAL

All culvert construction undertaken in Yellowhead County shall be in accordance with the latest edition of the Standard Specifications for Highway Construction in use by Alberta Infrastructure and Transportation.

11.2 EXECUTION

Trench shall be properly drained and free of unsuitable material prior to placing and compaction of bedding material.

11.1.1 Trenching and Excavation

The excavation for the culvert base shall be carried to a depth of not less than 150mm below the invert grade and shall be of sufficient width to permit pipe assembly and to accommodate operation of compaction equipment on either side of the culvert.

11.1.2 Culvert Bedding

Place minimum 150mm thick layer of compacted granular material on bottom of excavation. Place material in uniform layers not exceeding 150mm thickness, and compact each layer to at least 95% Standard Proctor Density before placing succeeding layer. Any soft and yielding or other unsuitable material below this level shall be removed to the depth required by the County and backfilled with approved granular material compacted to a uniform density of 95% of Standard Proctor Density throughout the entire length of the culvert.

The base for culverts installed along main water courses or through yielding areas shall consist of gravel bedding compacted to the excavated depth and extending over a width of three (3) times the diameter of the pipe. The depth of this base shall be not less than 300mm. An impervious compacted bedding material shall be provided for a minimum length of 3 metres or three (3) times the diameter of the pipe, whichever is greater, at the inlet end of the culvert to achieve a seal against seepage.

11.1.3 Laying Corrugated Steel Pipe Culverts

Commence pipe placing at downstream end on the prepared granular bedding with separated sections securely joined together by means of a coupling band.

The couplers are to match thickness and corrugations of the pipe.

Corrugations of pipes and couplers must mate before tightening and joints shall be tapped with a mallet during tightening to ensure proper seating of couplers.

Do not allow water to flow through pipes during construction except as permitted by the County.

All culverts shall be laid so that the horizontal seams fall at the sides of the culverts.

The pipe shall be laid true to line and grade and the pipe shall be carefully handled to prevent damage to the galvanized coating. Damaged pipe sections shall be immediately repaired and replaced. Damaged protective coating shall receive two coats of galvanized rich paint.

Centreline of culvert shall not vary from the designated horizontal alignment by more than 75mm. Invert grade shall not vary from the designated invert grade elevation by more than 12mm provided positive flow is maintained.

11.1.4 Culvert Backfill

After assembly of the culvert on the bedding, the culvert shall be backfilled with approved granular and random backfill. Backfill shall be brought up on both sides of the culvert simultaneously in 150mm lifts and shall be compacted with a method approved by the County to a minimum density of 95% Standard Proctor.

The backfill shall be spread and compacted in 150mm layers and special care shall be taken to ensure proper filling and compacting under the haunches and within the culvert corrugations. Heavy equipment shall not be allowed over the culvert until a minimum of 0.5 metres of fill is obtained above the crown of the pipe.

11.1.5 Rock Rip–Rap

The ends of the culvert shall be finished with the placement of rock rip–rap as shown in the detailed sketches.

11.1.6 Adjustment and Cleaning

Inlet and outlet ends and waterway through the pipe shall be kept free from debris or foreign matter, to prevent restriction to flow of water through the culvert.

11.1.7 Removal, Salvage and Reinstallation of Existing Culverts

Where removal and salvage of existing culverts or drainage structures from the roadbed, ditches, or other waterways is specified, the Contractor shall carefully excavate, remove and store the material at locations suitable to the Consultant. Salvaged materials shall be reinstalled in accordance with these specifications.

11.1.8 Removal and Disposal of Existing Culverts.

Where removal and disposal of existing culverts or drainage structures from the roadbed, ditches, or other waterways is specified, the Contractor shall remove and dispose of the material at locations acceptable to the consultant.

11.1.9 Culvert Installation and Removal on Roadways in Service

Where culvert installation or removal must take place on roadways that remain in service during construction, the Contractor shall carry out his installation and removal by either building and maintaining a detour or by working on one half of the roadway while maintaining flag person controlled and adequately signed traffic flow on the other half. Details of all proposed traffic accommodation methodologies shall be provided in the Contractor's Traffic Accommodation Strategy.

11.1.10 Grouting Abandoned Culverts

Where directed by the County or at the locations shown on the Drawings, the Contractor shall completely fill existing culverts with permanent cementitious fill material with a minimum compressive strength of 0.5 MPa to prevent future collapse of the culverts.

Filling the culverts shall be carried out using methods and materials acceptable to the Consultant. The Contractor shall take precautions during filling operations to ensure that no blowouts or disruptions of the existing roadway occur.

When a replacement culvert is being installed, the replacement culvert shall be in operation before the grouting of the abandoned culvert begins.

END OF SECTION

12 CURB, GUTTER & SIDEWALKS

12.1 GENERAL

Products, Concrete Materials, Execution and Methods of Concrete Construction shall be in accordance with CSA CAN3-A23.1 or as modified in this section.

12.1.1 Work Included

The work described in this section pertains to the construction of concrete curbs, gutters, sidewalks, crossings and paving stones.

12.2 PRODUCTS

12.2.1 Portland Cement

Portland cement shall meet the requirements of CSA Standard Portland A5-M cement and shall be Type 10 normal, or type 50 sulfate resistant, as required by the County.

12.2.2 Aggregates

The fine and coarse aggregate used in the concrete mix shall conform to the latest version of CSA Standard A23.1.

12.2.3 Admixtures

All admixtures used to enhance the concrete shall conform to the following specifications:

- a) Air Entrainment: ASTM C260
- b) Chemical: ASTM C494

The use of calcium chloride shall not be used without approval by the County, but in no case will the amount added be greater than 2% of the cement weight. It shall not be used when the air temperature is above 4°C.

- a) Fly ash shall not exceed 10% by weight of cement, and it shall conform to the requirements of CAN/CSA-A23.5. Only approved compatible superplasticizing admixtures and air entraining agents shall be used with the fly ash. The County may require characteristic data for fly ash to prove conformance to the standards. After September 1st no portion of the specified cement content may be replaced with fly ash unless approved in writing.

12.2.4 Reinforcing Steel

Reinforcing bars shall be deformed bars in accordance with CSA Standard Specification G30.12-M1977.

Cold drawn wire or welded wire fabric for concrete reinforcement shall be 150x150 and conform to the requirements of CSA Standard Specification G30.3-1972.

12.2.5 Expansion Joint Filler

Joint filler shall conform to CGSB Standard Specification for polyurethane sealing compound #19-GP-15 or ASTM Standard Specification for SIKA FLEX 1A.

12.2.6 Membrane Curing Compound

Resin-base impervious curing compound shall conform to ASTM Standard Specification C309 Type 1D-Type B. The curing compound shall contain white fugitive dye.

12.2.7 Preformed Expansion Joint Filler

Preformed expansion joint filler shall conform to ASTM Standard Specification D-1752.

12.2.8 Concrete

Concrete mixes shall be designed by a qualified testing laboratory engaged by the Contractor. The mix design shall be submitted to the County for approval a minimum of 10 days prior to delivery of any concrete to the site. The specified compressive strength at 28 days shall be 30 Mpa. The strength level of 30 Mpa shall be considered to be achieved if averages of all sets of 3 consecutive strength tests equal or exceed the specified strength, and no individual strength test is less than 20 Mpa.

The concrete shall contain not less than 315 kg of Portland Cement per cubic metre of concrete produced.

The air content of the concrete shall be maintained between the limits of 6-8%.

The minimum slump permissible will be that which will allow the concrete to be placed efficiently and provide a homogeneous mass. The maximum allowable slump shall be 70mm +/- 10mm for all hand-poured concrete and 40mm +/-10mm for all machine-poured concrete.

Concrete placed after October 15th shall have a minimum compressive strength of 27 MPa after 7 days and shall be provided with cold weather protection in accordance with clause 12.2.3 CSA-A23.1M.

12.2.9 Retempering With Air

If, due to a low air entrainment percentage, as specified, the Consultant feels it is necessary to add an approved air-entraining agent on site, placement of concrete shall stop to allow the concrete truck's drum to turn at mixing speed for a minimum of 3 minutes. Should the air content of the concrete not conform to specifications after retempering, then the concrete shall be rejected.

The County has the right to withdraw permission to add an air-entraining agent to the mix and reject the concrete if this practice is being abused.

12.2.10 Retempering With Water

If, due to a low slump as specified, the Consultant feels it is necessary to add water to the mix, it shall be injected into the drum under such pressure and direction of flow that it conforms to the specifications in ASTM C-94, Appendix XI. Placement of concrete shall stop at that point to allow the concrete truck's drum to turn at mixing speed for a minimum of 3 minutes. Should the slump of the concrete not conform to specifications, after retempering, then the concrete shall be rejected.

Introduce additional water into the drum mixer in an amount not exceeding 12 litres/m³, to bring the slump to within required limits.

The County has the right to withdraw permission to add water to the mix and reject the concrete if this practice is being abused.

12.3 EXECUTION

12.3.1 Placing Concrete

Concrete shall not be placed until the subgrade, sub-base and base course materials have been completed, and approved by the County. The base shall be sufficiently moist to prevent absorption of water from the concrete, and free from mud or water pondage.

The concrete shall be placed within 90 minutes of initial mixing at the plant, or before the drum on the concrete truck has turned 300 revolutions. Complete discharge of concrete shall not exceed 2 hours. The concrete shall be transported by methods which will prevent segregation and deposited on the subgrade so that as little handling as possible is required.

Concrete shall be placed continuously until a complete section between expansion joints has been poured.

The concrete shall be thoroughly consolidated against and along the faces of the forms. Hand spreading shall be done with shovels, not with rakes, in order that the concrete will not be segregated. Precautions should be taken to prevent overworking of the concrete.

Concrete shall be handled from the mixer to the place of final deposit as rapidly as practicable by methods which shall prevent the separation or loss of the ingredients. It shall be deposited in the forms as near as practicable to its final position to avoid rehandling.

The sequence of concrete placement shall be arranged so that concrete which has partially hardened shall not be subjected to injurious vibration.

The vertical free fall height of concrete shall not exceed 1.0 metre. For falls greater than 1.0 metre chutes or tremies shall be used.

During placement, concrete shall be sufficiently tamped or vibrated with suitable equipment to secure a close bond with the reinforcement, eliminate entrapped air voids and ensure a homogeneous structure with adequate consolidation.

The rate of delivery of mixed concrete shall be such that the interval between the placing of successive truck loads shall not exceed 30 minutes. If the time exceeds 30 minutes, then a construction joint shall be formed.

After the initial set of the concrete, neither the forms or the concrete structure shall be jarred and no strain shall be placed on the ends of projecting reinforcement.

Construct all pararamps and crossings monolithically to the dimensions and at locations specified.

12.3.2 Joints

Curb, gutter and sidewalk contraction joints shall be constructed at 3.0 metre intervals and as detailed on the standard drawings, and shall not be less than 50mm deep. Contraction joint widths shall not be greater than 5mm.

Midway between each contraction joint on the sidewalk, a surface joint, 13mm deep, shall be constructed. These joints shall not extend into curb and gutter.

A surface joint shall be constructed longitudinally at the location shown on the standard drawings and shall continue through all driveways and lane crossings.

A construction joint shall be formed at the end of every pour. This joint shall be constructed in a "V" shape, and using 10mm rebars 600mm long, spaced every 500mm.

10mm bars at 500mm on centre shall be dowelled and epoxied into the back of the existing curb prior to placing concrete.

12.3.3 Finishing

Sidewalk surfaces, either separate or monolithic with curb and gutter, shall be struck off and screeded to the slope, cross-section and elevation shown on the drawings or as directed by the County. The surface shall be consolidated and smoothed using a wood float. Light-steel trowelling shall be used followed by a uniform brush finish. Sidewalk shall be edged at all joints to prevent chipping of the concrete.

The exposed surfaces of concrete curbs and gutters, either separate or monolithic with sidewalks, shall be finished by means of a wood floating, light-steel trowelling and uniform brushing, and all edges shall be rounded to the required radius. No patching will be allowed.

Pararamps, and crossings to lanes and private property shall be struck off and screeded to the required slope and cross-section. The finished surface shall be brushed as specified above.

All edges, including contraction or surface joints, shall be tooled for a width of 50mm and rounded to a radius of 6mm. The brush grooves shall be transverse on the sidewalk and longitudinal on the curb and gutter. The finished surface shall have no exposed aggregate or honeycomb.

If there is evidence of excess water on the concrete surface, finishing shall be delayed until the excess water has evaporated.

Surface grooves made by the broom shall not be more than 3mm deep. Before brushing, all surplus water shall be removed from the brush.

12.3.4 Curing

Immediately after finishing, the concrete surface shall be protected by applying a membrane curing compound. After finishing and removal of forms if necessary, all exposed surfaces shall be wetted with water and then thoroughly sprayed with membrane curing compound. The membrane curing compound shall be applied in accordance with the manufacturer's instructions with an approved pressurized spray.

The curing compound shall be applied in such a manner as to cover the entire surface thoroughly and completely with a uniform film at a rate which shall depend on the roughness of the surface of the concrete, but in no case at less than 0.25 litres per square metre of concrete surface.

12.3.5 Backfilling

Unless otherwise directed by the County, the Contractor shall backfill along the back of the curb edges, to the top of the concrete, within 3 to 7 days of the placing of the concrete. The backfill shall be mechanically tamped in maximum lifts of 150mm, to a minimum of 95% Standard Proctor Density and to a distance of 300mm from the back of the walk or curb.

Where landscaping is to be carried out immediately after completion of the walks or curbs and gutters, the backfilling shall be left 100mm low to allow for the topsoil.

12.3.6 Forming

Forms shall be steel or wood of sufficient strength to resist the pressure of wet concrete, and the supply shall be sufficient to permit their remaining in place until hydration has occurred, or longer if the County considers it necessary. The Contractor shall remove all face forms to allow

for a smooth brush finish. The use of bent, twisted, battered or worn-out forms will not be permitted. Forms will be checked for alignment and elevation by the Consultant before concrete is poured, and shall be cleaned and oiled before each use.

Where required, reinforcement shall be secured in the location shown on the standard drawings and shall be free from mill scale, grease and rust prior to placing concrete. Forms shall be held securely by approved methods to prevent movement and bulging when the concrete is placed. Forms must be approved by the Consultant before concrete is poured.

Curbs having a radius of less than 40 metres shall be constructed with flexible forms. A sufficient length of form (not less than 50 metres) shall be placed and checked before concrete is poured to ensure true line and grade. The forms shall be well staked, braced or otherwise held rigidly true to the established line and grade. The County may, at any time, reject the use of any forms considered unsatisfactory.

Forms are to be loosened within 24 hours after placing for the purpose of spraying water between the concrete and form.

12.3.7 Mechanical Extruding Machines

Slip-form paving machines or concrete, extruding machines may be used for placing concrete provided they have received the approval of the County prior to commencement of the work and meet the following requirements:

- a) The vibrators on the equipment shall be capable of producing a dense mass with a smooth surface, free of honeycombing.
- b) The equipment shall include automatic grade and line controls which shall be used at all times.

Commence placement of concrete only after the subgrade has been prepared and approved by the Consultant.

Any special grading or preparation of the base required by the Contractor to accommodate equipment shall be the responsibility of the Contractor, and shall restore the roadway and boulevards to their original condition within 3 to 7 days of the initial disturbance.

The extruded concrete shall be checked for alignment and elevation by the Consultant while the concrete is being placed. All incorrectly placed or misaligned work shall be immediately removed while the concrete is still wet, and the work redone to the proper specifications using whatever means are required.

Whenever possible, the forming and placing of concrete by conventional hand pouring methods (as may be required at corners, crossings and catch basins) shall be carried out in conjunction with the extruding machine operation. Where this procedure is not practical, the "tie-ins" shall be completed within 3 days of construction of the adjacent extruded section, using 10mm rebar at all joints. All "tie-ins" shall be completed in 1 continuous pour.

12.3.8 Consolidation

The concrete shall be consolidated by means of an approved vibrating screed or, in the case of curb and gutter only, by means of a poker or pencil vibrator not exceeding 50mm in diameter.

Particular care shall be given to placing and tamping along the faces of the forms to ensure a dense, smooth surface.

Vibrations shall be of sufficient duration to thoroughly compact the concrete but not long enough to cause segregation. Vibrators shall not be used for moving concrete.

12.3.9 Inspection

All exposed concrete surfaces shall be checked by the Contractor with a 3 metre straight-edge, and any water pockets or deviations in line or grade exceeding a total of 6mm shall be corrected immediately.

Differences in elevation at any given point from that given by the design shall not exceed 13mm, and the maximum variation shall not be greater than 13mm.

Deviations in horizontal alignment at any given point from that given by the design shall not exceed 25mm, and the fluctuations in the horizontal alignment shall not be greater than 25mm.

Concrete not meeting the above criteria shall be replaced.

12.3.10 Field Tests

Testing shall be performed by a qualified CSA testing laboratory in accordance with the following:

- a) Samples of concrete shall be obtained in accordance with CSA Test Method A23.2-1C for sampling plastic concrete.
- b) Test cylinders shall be made and stored in accordance with CSA Test Method A23.2-3C. No less than 1 strength test shall be made from samples from each 150 cubic metres of concrete placed, and in no case shall there be less than 1 test from each day's pour. Each strength test shall consist of 3 test cylinders, 1 tested at 7 days and 2 at 28 days.
- c) Air content determinations shall be made in accordance with CSA Test Method A23.2-7C, air content of plastic concrete by the volumetric method.

During construction start-up, every load or batch of concrete shall be tested until such time as satisfactory control of the air content has been established. Air content tests taken with the test cylinders will be sufficient once satisfactory control has been established. Whenever a test falls outside the specified limits, the testing frequency shall revert to 1 test per load or batch until satisfactory control is re-established. Any concrete that falls outside specified air control levels shall be rejected from use.

Slump tests made in accordance with CSA Test Method A23.2-5C, Slump of Concrete, shall be made in conjunction with each strength test.

12.3.11 Clean-up

As the work progresses, the Contractor shall clean up the site, and all areas in which work has been done shall be left in a neat and presentable condition. All gutters and street drainage ditches that have been blocked as a result of the Contractor's operation shall be restored or repaired.

The Contractor shall dispose of all surplus excavated material, organic soil, rock, boulders and pieces of concrete and masonry at an approved location.

12.3.12 Protection

The Contractor shall be responsible for keeping all animals and pedestrians off the newly constructed sidewalks or curb until completely set. The Contractor shall also be responsible for keeping all vehicles off the work for a period of 3 days after the concrete has been finished.

12.3.13 Deficiency Penalty

Where there are variations from specified design strength, the following Deficiency penalty shall be assessed based on the 28-day, laboratory-cured cylinders.

- a) When the concrete strength of any set exceeds 95% of design strength, no deficiency penalty will be administered.
- b) When the concrete strength of any set is greater than 80% but less than 95% of design strength, the deficiency penalty will be administered as follows:

$$Q \left[P \times \frac{(A - B)}{A} \right]$$

- Where
- P = unit price
 - A = specified strength
 - B = average 28 day cylinder strength
 - Q = quantity of deficient concrete

- c) If the concrete strength of any set is less than 80% of design strength, the work represented by that set of cylinders will be rejected and replaced by the Contractor.

END OF SECTION

13 REGULATORY ROADWAY SIGNS

13.1 GENERAL

13.1.1 Design Requirements

Sign supports and appurtenances to be capable of withstanding summation of following loads:

- a) Wind and ice loading specified to be consistent with anticipated loads in locality of installation. Refer to National Building Code of Canada and/or applicable provincial building code.
- b) Dead load of signboards, sign supports and appurtenances.
- c) Ice load on one face of signboards and around surface of all structural members and appurtenances.

Structural deflections and vibration in accordance with American Association of State Highway and Transportation Officials (AASHTO), "Specifications for the Design and Construction of Structural Supports for Highway Signs".

13.1.2 Shop Drawings

Submit shop drawings for signage structures indicating product data and design.

13.2 PRODUCTS

13.2.1 Sign Supports

Steel posts: to CAN_G40.21, 3.1 metres long flanged "U" shaped in cross section, measuring 65mm wide by 30mm deep. Metal thickness: 4.5mm. Hot dipped galvanized: to CAN/CSA_G164.

Base plates for mounted signs: to ASTM B209M.

Fasteners: bolts, nuts, washers and other hardware for roadside signs to be cast aluminium alloy, or galvanized steel.

13.2.2 Signboards

Aluminium sheet shall be tension levelled, sign grade aluminium and conform to ASTM B209M, Alloys 6061-T6 or 5052-H38 pre-cut to required dimensions. Minimum thickness to be 1.6mm for signboards up to 750mm wide. Minimum thickness to be 2.0mm for signboards 750 to 1200mm wide.

Connecting straps and brackets to ASTM B209M.

Reflective sheeting shall meet or exceed the minimum requirements specified in ASTM-D4956 Performance Requirements Type III, High Intensity Retro Reflective Sheeting.

13.2.3 Fabrication

- a) Signboards:

Aluminium blanks: Degrease, etch and bonderize with chemical conversion coating. Clean surfaces with xylene thinner. Dry. Aluminium signboards are to be painted before installation. Spray and bake face of signboards with two coats of enamel in accordance with CAN/CGSB_1.104.

b) Sign identification:

Apply sign number and date of installation with 25mm high stencil painted black letters on lower left back face of each signboard.

13.3 EXECUTION**13.3.1 Installation****a) Sign Support:**

- 1) Erect supports as indicated. Where separate concrete footings have been placed, erect posts with base plates resting on aluminum nuts and restrained with nuts and washers.
- 2) Coat underside of base plate with corrosion protective paint before installation.
- 3) Close open aluminum tubes and posts with aluminum cap.
- 4) Erect posts plumb and square to details as indicated.
- 5) Single channel steel posts are to be driven to required depth without damage to posts. If rock or concrete is encountered, auger hole to required depth and set post in sand.
- 6) In finished concrete or asphalt surfaces, backfill with concrete or grout. Protect from adverse conditions until cured.
- 7) Wooden post installations are to be excavated with an auger. Compact bottom of hole to provide firm foundation. Set post and backfill in 150mm layers with excavated material. Compact each layer before placing each subsequent layer.
- 8) Permissible tolerance is ± 12 mm departure from vertical.

b) Signboard:

- 1) Fasten signboards to supporting posts and brackets as indicated.
- 2) Use strapping with crimped or bolted connections where signs fastened to utility poles.

13.3.2 Protection

Place temporary covering on signboards where required. Covering to be capable of withstanding rain, snow and wind and be non-injurious to signboard. Replace deteriorated covering and remove covers as reviewed by the County.

13.3.3 Correcting Defects

Correct defects, identified by the County, in consistency of reflectivity, colour or illumination.

14 LANDSCAPING

All roadway ditch bottoms, sideslopes, backslopes, and open areas disturbed during construction shall be uniformly topsoiled with salvaged topsoil and be seeded to grass following preparation of the seed bed.

- a) The seedbed shall consist of minimum 50mm of topsoil capable of supporting good vegetation growth. The topsoil shall be placed and graded evenly and shall be free of rock, root, stumps, weeds and other deleterious material.
- b) The seed mixture shall be as follows

For low density residential/commercial/industrial development.

- 40% Pubescent Wheat Grass
- 22% Dahurian Wildrye
- 30% Sheep Fescue
- 8% Perennial Rye

All Seed shall be certified, with a minimum of Canada #1. Seed certificates are to be submitted to the County, prior to planting.

- c) The rate of application of seed shall be 56 kg per hectare by mechanical applicators. An application of 112 kg per hectare of starter fertilizer (17-20) shall also be applied at the time of grass seeding.
- d) All seeded areas will be accepted following consistent germination and carrying out of first cut following 50mm of growth.

15 CONSTRUCTION TRAFFIC ACCOMODATION

15.1 COORDINATION OF TRAFFIC

Wherever it is considered necessary by the Director of Infrastructure to accommodate the passage of traffic during construction or reconstruction of a County road, the Developer shall be responsible for providing a Traffic Accommodation strategy and ensuring that his Contractor adheres to makes all necessary provisions for such traffic, whether pedestrian or vehicular, over or around the work being performed and that he supplies and maintain such signs, barriers, fences, lights, and flag persons as may be required for this purpose. No construction shall start until all necessary construction signs are in place and a Traffic Accommodation strategy is in place

15.1.1 Construction Signs

- a) All construction signs and barricades shall be fully reflective and shall conform to the latest Transportation Association of Canada (RTAC) edition of the manual "Uniform Traffic Control Devices for Canada" and "Traffic Accommodation in Work Zones".
- b) Any required oversize signs or special signs for specific circumstances shall be of a design meeting with the approval of the Director of Infrastructure.
- c) The type and spacing of construction signage shall conform to the requirements construction signage developed by Alberta Transportation except where otherwise specified by the Director of Infrastructure.
- d) When work is not in progress, regulatory and construction signs not essential for the protection of the public shall be removed or covered to reduce inconvenience to a minimum. All construction signs shall be removed as soon as possible after the project is completed.
- e) A Daily Record of Temporary Construction Signs must be filled out and submitted to the consultant at the end of each work day.

15.1.2 Existing Signs

All existing signs and guide posts that must be removed to carry out the work shall be carefully salvaged and turned over to the Director of Infrastructure. Certain essential existing signs such as railway crossing, intersection warning or stop signs shall be maintained on the work for the duration of the project.

15.1.3 Flag Persons

Flag persons, if required, shall be instructed in the proper traffic control procedures applicable to the work and shall be dressed in light coloured clothing with fluorescent orange hard hats, safety vests and armllets for maximum visibility. Flag persons shall be provided with standard traffic control sign paddles and where it is necessary to have a flag person at both ends of the work, they shall be provided with the ability to communicate with each other.

15.1.4 Detours

Detouring of traffic around the work off the road allowance or along other roadways must receive the prior approval of the Director of Infrastructure.

Where the Director of Infrastructure approves the use of a detour route, the Developer's Contractor shall provide and maintain such signs, barriers, lights and flag persons as may be considered necessary by the Director of Infrastructure to divert the traveling public over the



CONSTRUCTION STANDARDS

detour. The Contractor shall acceptably maintain the detour route, and upon completion of its use he shall leave it in a condition as good as previous to its use as a detour.

15.1.5 Traffic Assistance

Where traffic is required to use a route over or around the work which is of lower standard than was available before the work commenced, the Developer's Contractor shall continuously provide assistance to traffic as might be required on a 24 hour per day and 7 days per week basis, particularly during periods of inclement weather.

END OF SECTION

16 CABLE DUCTS

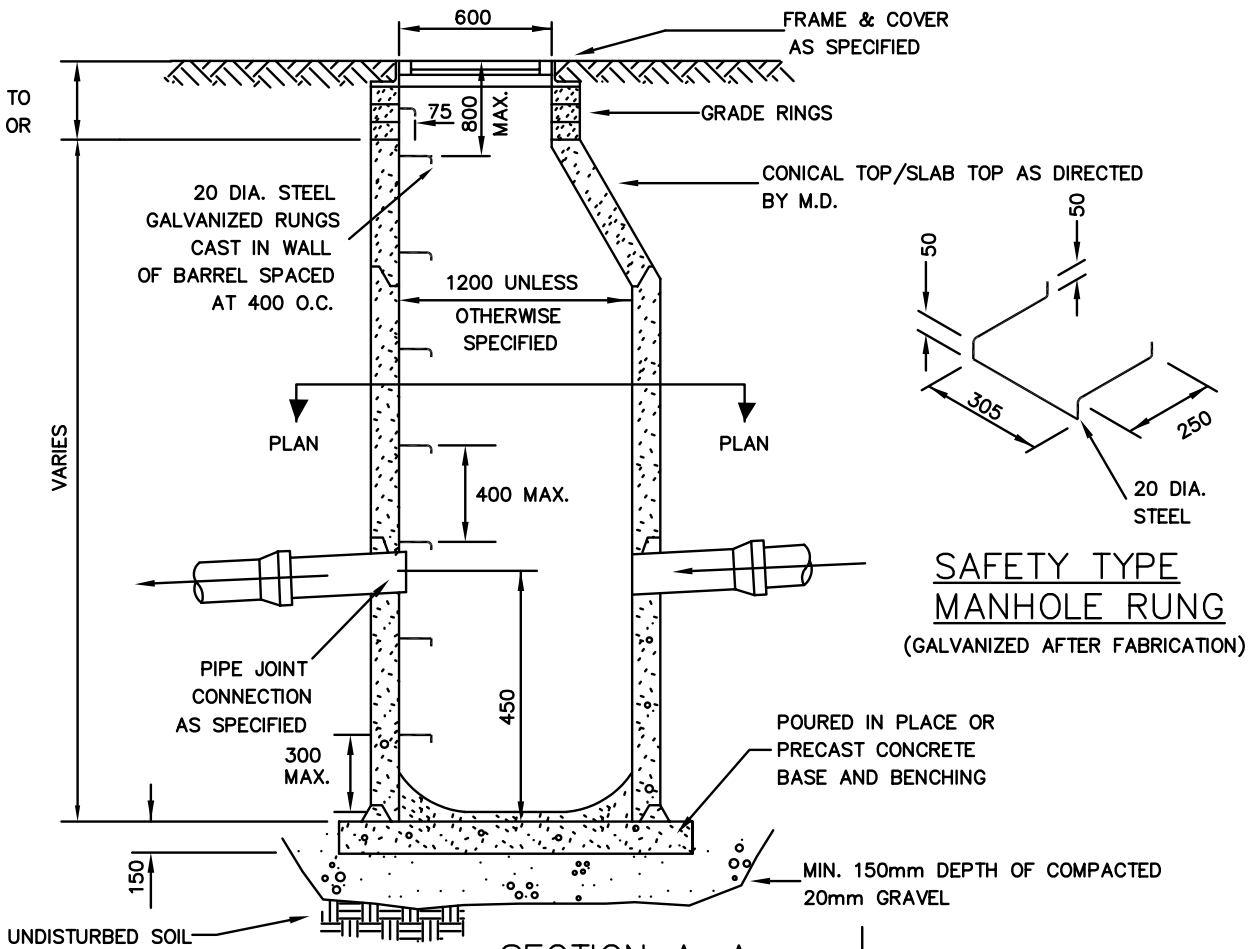
16.1 EXCAVATION – INSTALLING CABLE ROADWAY CROSSING

- a) All cable crossings under roadways shall be installed in minimum 50mm PVV raceways, with a minimum of 300mm of sand above to top of conduits. Spare conduits shall be left only as noted on the engineering drawings.
- b) Cable conduits shall be laid end-to-end in straight lines with no conduit cross overs to facilitate pulling-in of cables. The conduit lengths shall be joined together with approved couplings ie) solvent-welded joints only. After being exposed by the trencher, road crossing , pole and power pedestal conduits shall be cut off square to remove all jagged edges.



Section 3: Detailed Drawings

450 MAX FROM FINISHED GRADE TO TOP OF CONE OR SLAB TOP



NOTES:

1. ALL PRE-CAST MANHOLES MUST CONFORM TO A.S.T.M. SPECIFICATIONS C478.
2. POURED-IN-PLACE CONCRETE SHALL HAVE A 28 DAYS COMPRESSIVE STRENGTH OF AT LEAST 25 MPa.
3. ALL JOINTS TO BE SET WITH RUBBER GASKETS AND SET WITH NON-SHRINK GROUT, INSIDE AND OUT, FOR THE FULL CIRCUMFERENCE.
4. FORM FLOW TROUGH IN PARTIALLY SET CONCRETE AND TROWEL SMOOTH.
5. PIPES TO BE FLUSH WITH WALL.
6. MAX. DIST. FROM RIM TO TOP RUNG IS 800 mm.
7. BACKFILL AROUND MH. WITH SELECT NATIVE MATERIAL AND COMPACT TO 98% S.P.D.
8. FLAT TOP SECTION TO BE USED FOR MANHOLES UP TO 1.8 m BURY.
9. ALL JOINTS TO BE WATERTIGHT. METHODS TO BE CONSISTENT WITH SITE CONDITIONS.
10. FOR MANHOLES 5.0 m IN DEPTH OR GREATER, A SAFETY PLATFORM SHALL BE INSTALLED.
11. MANHOLES TO MEET REQUIREMENTS OF MANHOLE DETAILS AND SPECIFICATIONS.
12. DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.
13. CHANNELING AND BENCHING TO BE FINISHED TO TROWEL SMOOTHNESS.
14. SAFETY STEPS TO BE PROVIDED, SPACED AT 400 MAX. FIRST STEP 150 MAX. BELOW FRAME, LAST STEP 300 MAX. ABOVE BASE.



TITLE:

CATCH BASIN MANHOLE

STANDARD DETAILS

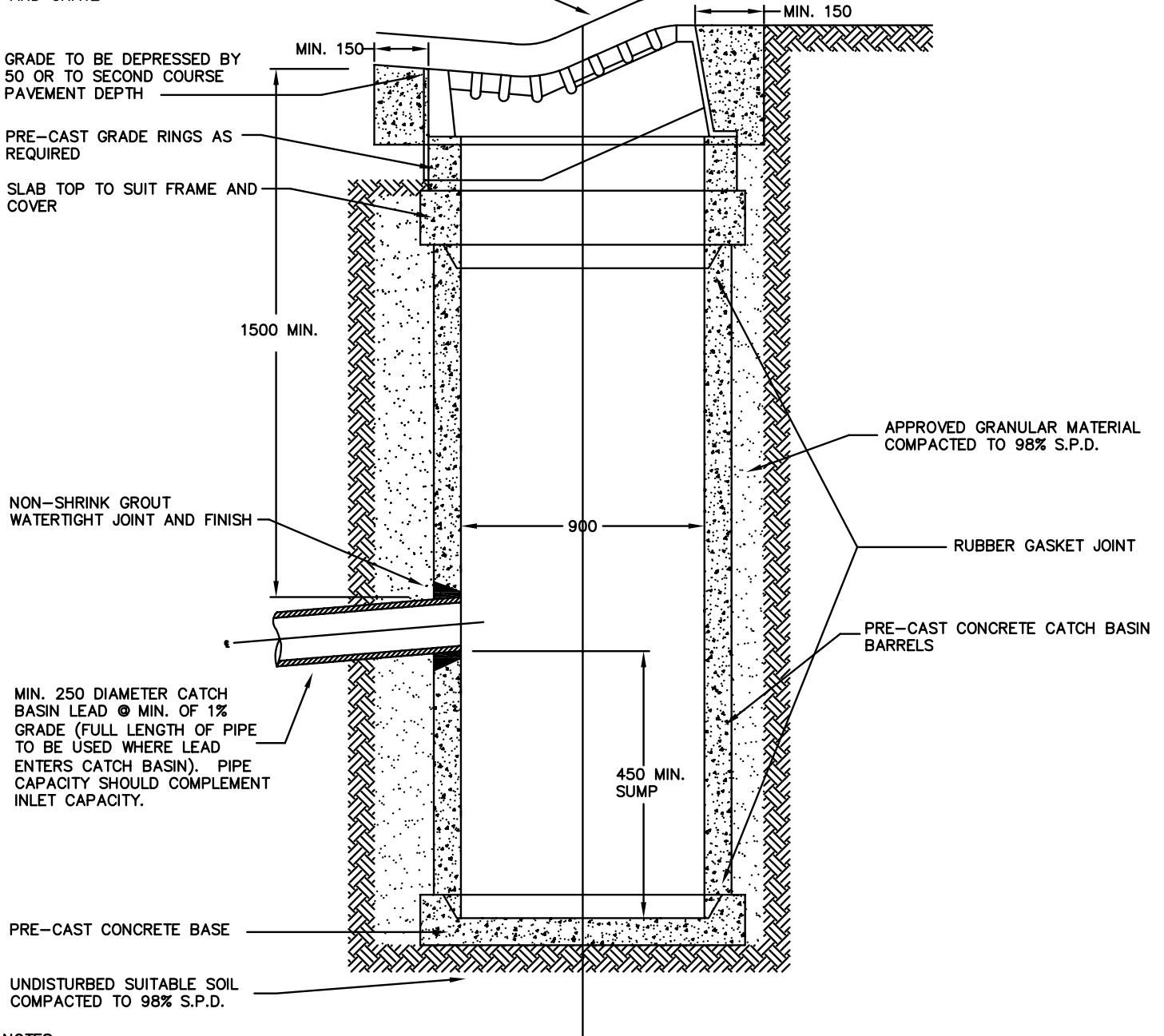
SCALE: N.T.S.

DATE: JAN 2007

STD. DWG NO.

D-01

F33, F36A, OR K-2 TYPE CATCH BASIN DOUBLE FRAME AND GRATE



NOTES:

1. PRE-CAST CONCRETE COMPONENTS TO MEET CURRENT A.S.T.M. C478 STANDARDS.
2. CAST-IN-PLACE- CONCRETE TO BE 25 MPa AT 28 DAYS.
3. ALL JOINTS TO BE WATERTIGHT; SET WITH RUBBER GASKET WITH NON-SHRINK GROUT INSIDE AND OUTSIDE FOR THE FULL CIRCUMFERENCE. THIS INCLUDES JOINTS BETWEEN GRADE RINGS, GRADE RINGS AND FRAMES, AND BETWEEN GRADE RINGS AND SLAB TOPS.
4. PRE-CAST CONCRETE BASE THICKNESS AND REINFORCEMENT MUST BE DESIGNED FOR THE SPECIFIC CATCHBASIN DEPTH AND SOIL CONDITIONS.
5. JOINTS BETWEEN GRADE RINGS, GRADE RINGS AND CONES, AND RINGS AND FRAMES MUST BE WATERTIGHT. RAM NECK MATERIAL FINISHED WITH NON-SHRINK GROUT MAY BE USED IF WATERTIGHT JOINTS CAN BE ACHIEVED.
6. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.



TITLE:

CATCH BASIN
TYPICAL 900 mm

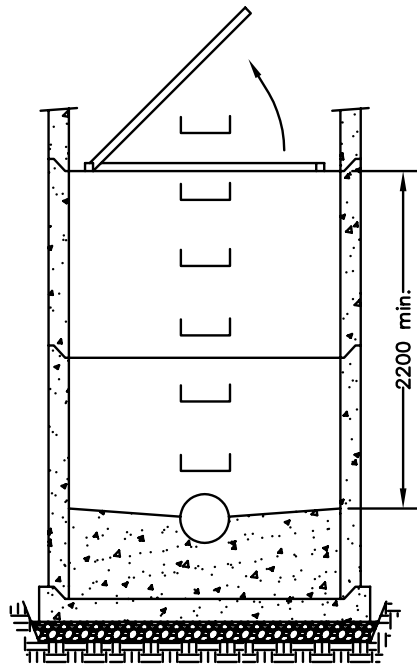
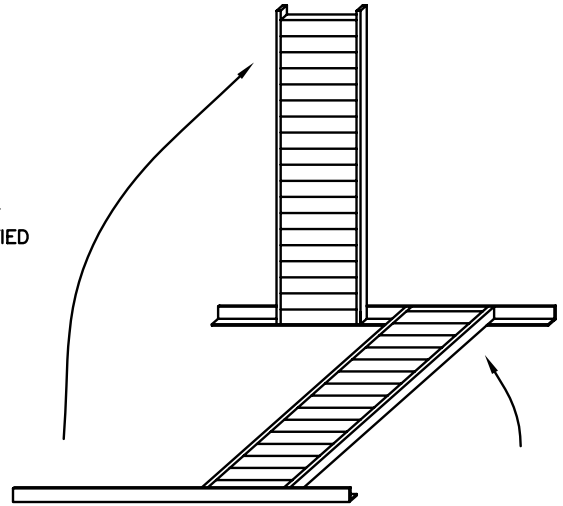
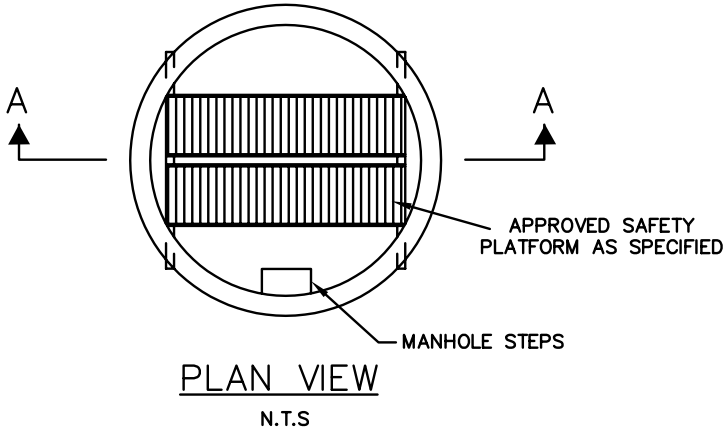
STANDARD DETAILS

SCALE: N.T.S.

DATE: JAN 2007

STD. DWG NO.

D-02



NOTES:

1. TO BE INSTALLED ON MANHOLES GREATER THAN 5.0m DEEP.
2. MAXIMUM SPACING BETWEEN PLATFORMS TO BE 5.0m.
3. ALUMINUM GRATES TO BE MSU MISSISSAUGA OR APPROVED EQUAL.
4. TO BE INSTALLED ACCORDING TO MANUFACTURER'S RECOMMENDATIONS.



TITLE:

MANHOLE SAFETY PLATFORM

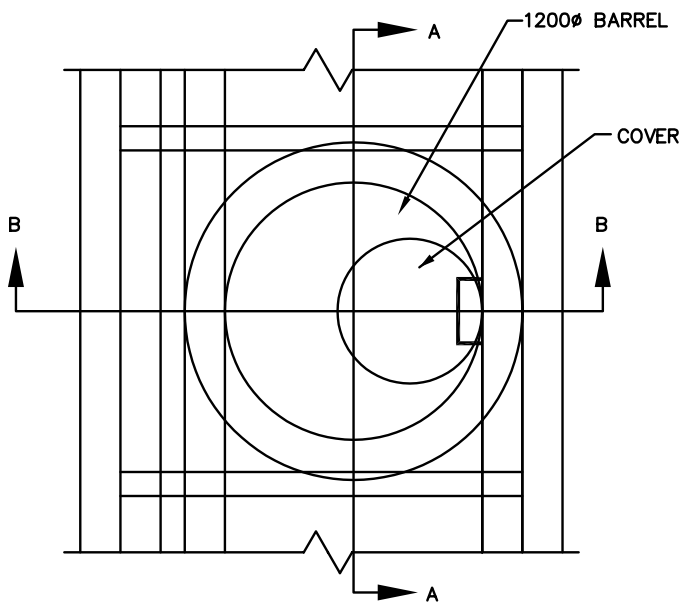
STANDARD DETAILS

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DATE: JAN 2007

STD. DWG NO.

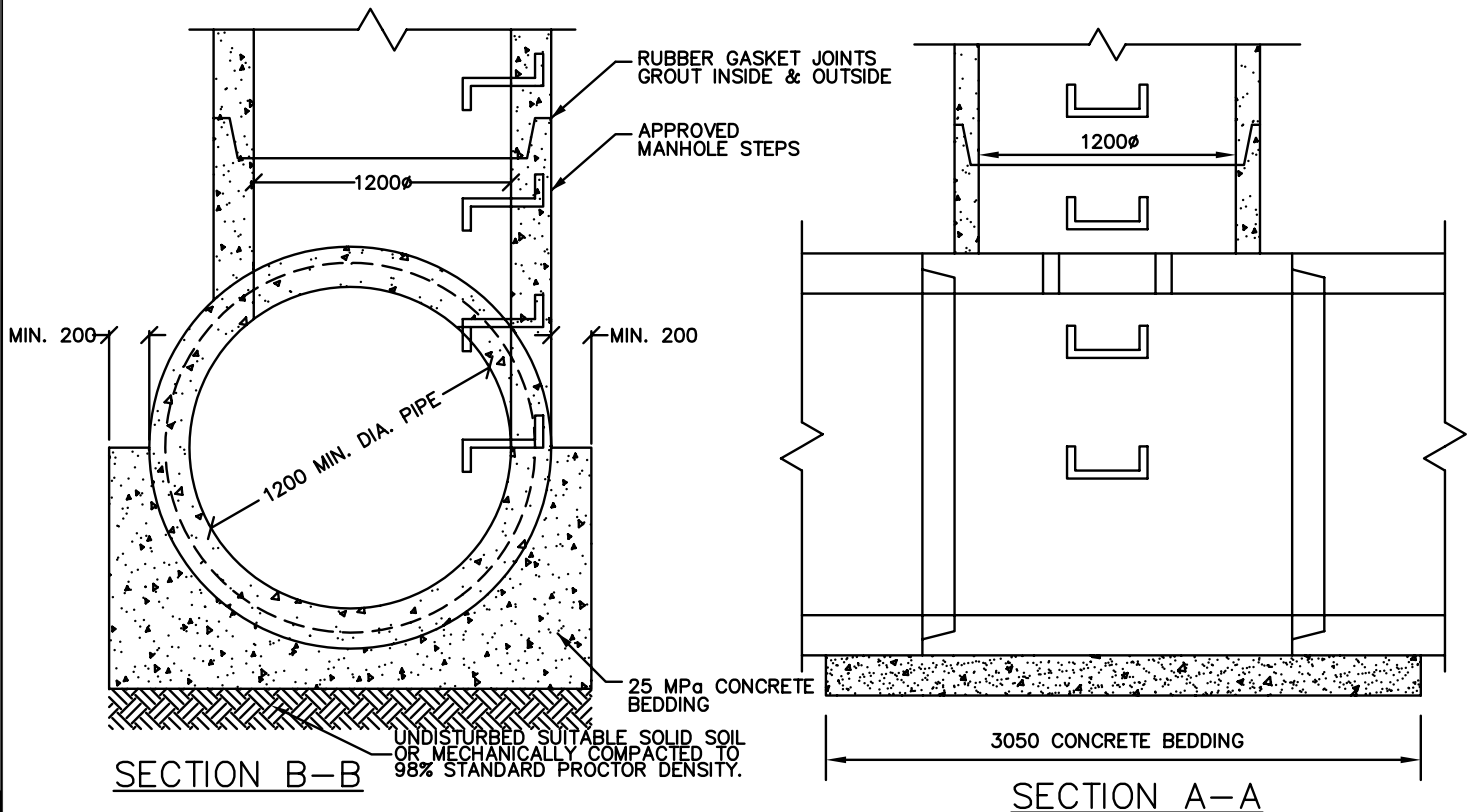
D-03



PLAN

NOTES:

1. THIS TYPE OF MANHOLE IS TO BE BUILT ONLY ON MAINS OF 1200 mm DIAMETER OR LARGER AND WHERE THERE IS NO CHANGE IN DIRECTION OF FLOW.
2. ALL PRE-CAST MANHOLES MUST CONFORM TO A.S.T.M. SPECIFICATIONS C478.
3. POURED-IN-PLACE CONCRETE SHALL HAVE A 28 DAYS COMPRESSIVE STRENGTH OF AT LEAST 25 MP α .
4. ALL JOINTS TO BE SET WITH RUBBER GASKETS AND SET WITH NON-SHRINK GROUT, INSIDE AND OUT, FOR THE FULL CIRCUMFERENCE.
5. FORM FLOW TROUGH IN PARTIALLY SET CONCRETE AND TROWEL SMOOTH.
6. ALL DIMENSIONS GIVEN IN MILLIMETRES UNLESS OTHERWISE STATED.
7. MAX. DIST. FROM RIM TO TOP RUNG IS 800 mm.
8. BACKFILL AROUND MH. WITH SELECT NATIVE MATERIALS AND COMPACT TO 98% S.P.D.
9. ALL JOINTS TO BE WATERTIGHT. METHODS TO BE CONSISTENT WITH SITE CONDITIONS.
10. FOR MANHOLES 5.0 m IN DEPTH OR GREATER, A SAFETY PLATFORM SHALL BE INSTALLED.
11. MANHOLES TO MEET REQUIREMENTS OF MANHOLE DETAILS AND SPECIFICATIONS.
12. SEE DETAIL C-4 FOR TOP OF MANHOLE AND STEP DETAILS.
13. SAFETY STEPS TO BE SPACED AT 400 MAX. DISTANCE. FIRST STEP TO BE 150 MAX. BELOW FRAME, LAST STEP TO BE MAX. 500 ABOVE BENCHING.



TITLE:

T-RISER MANHOLE
FOR PIPES 1200 mm AND LARGER

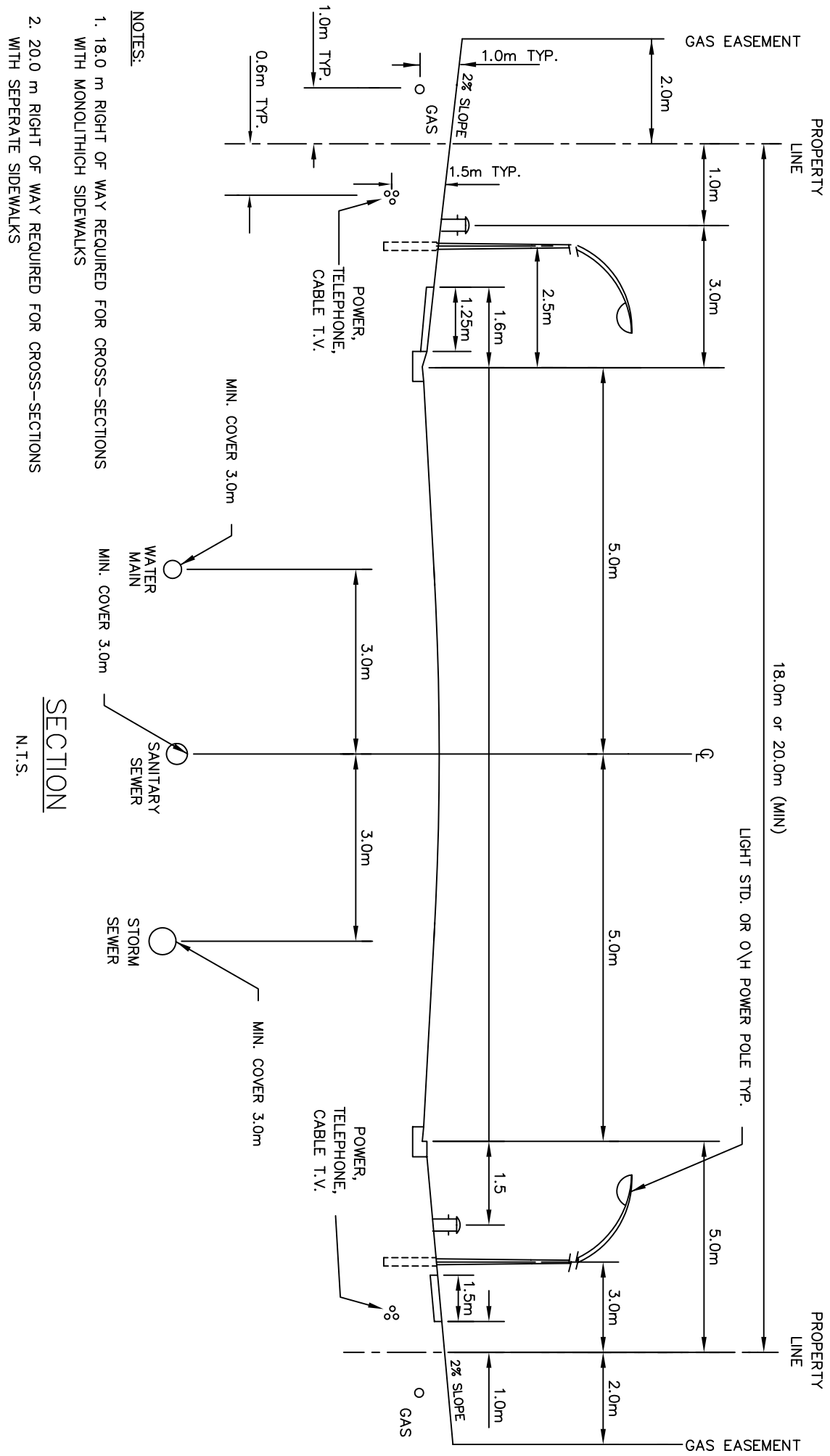
STANDARD DETAILS

SCALE: N.T.S.

DATE: JAN 2007

STD. DWG NO.

D-04



- NOTES:**
- 18.0 m RIGHT OF WAY REQUIRED FOR CROSS-SECTIONS WITH MONOLITHIC SIDEWALKS
 - 20.0 m RIGHT OF WAY REQUIRED FOR CROSS-SECTIONS WITH SEPERATE SIDEWALKS

SECTION
N.T.S.

TITLE:

URBAN RESIDENTIAL SUBDIVISION
TYPICAL UTILITIES LAYOUT
STANDARD CROSS-SECTION

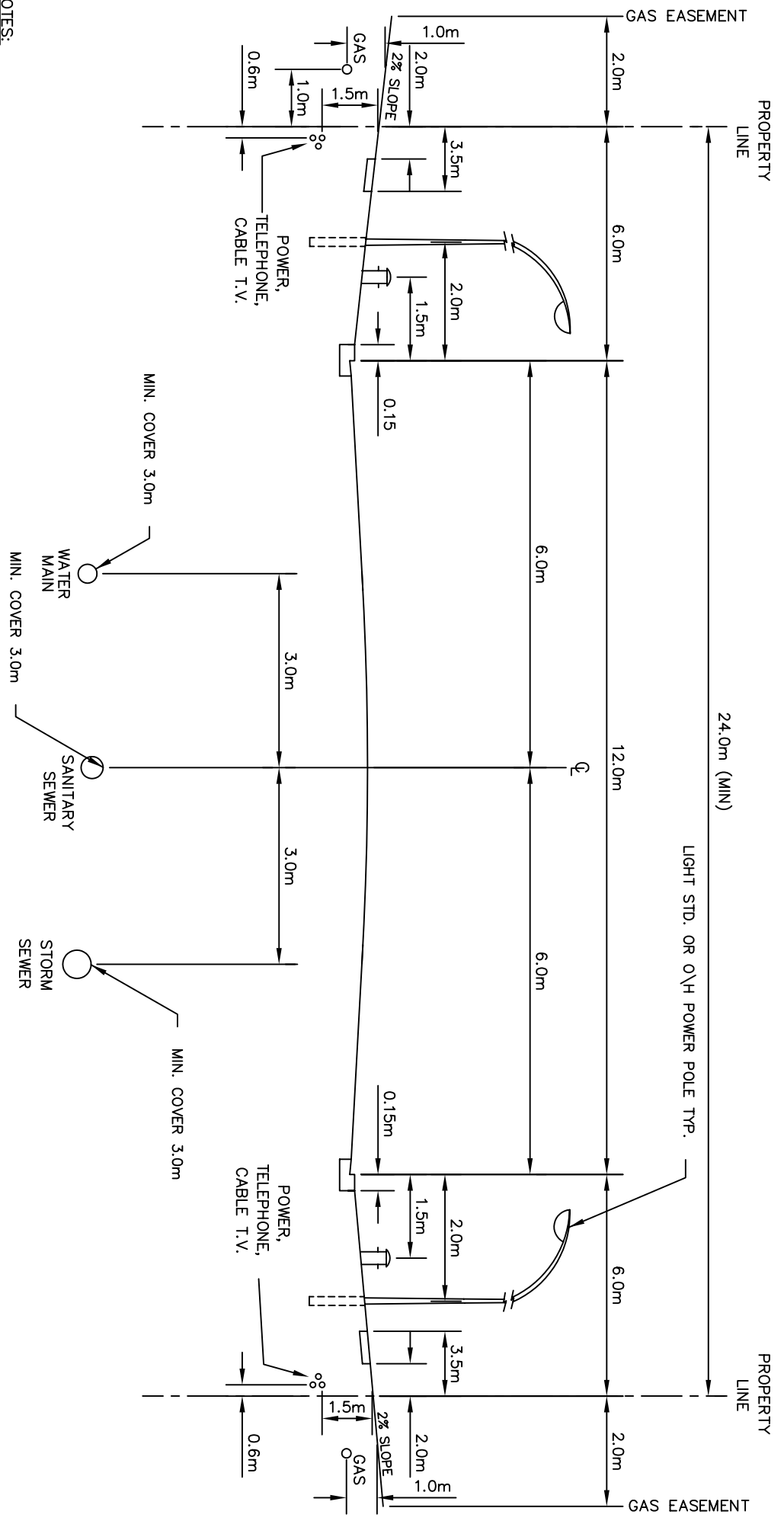


STANDARD DETAILS

SCALE: N.T.S.

DATE: JAN 2007

STD. DWG NO. R-01



NOTES:

SECTION

N.T.S.

TITLE:

URBAN COLLECTOR
TYPICAL UTILITIES LAYOUT
STANDARD CROSS-SECTION

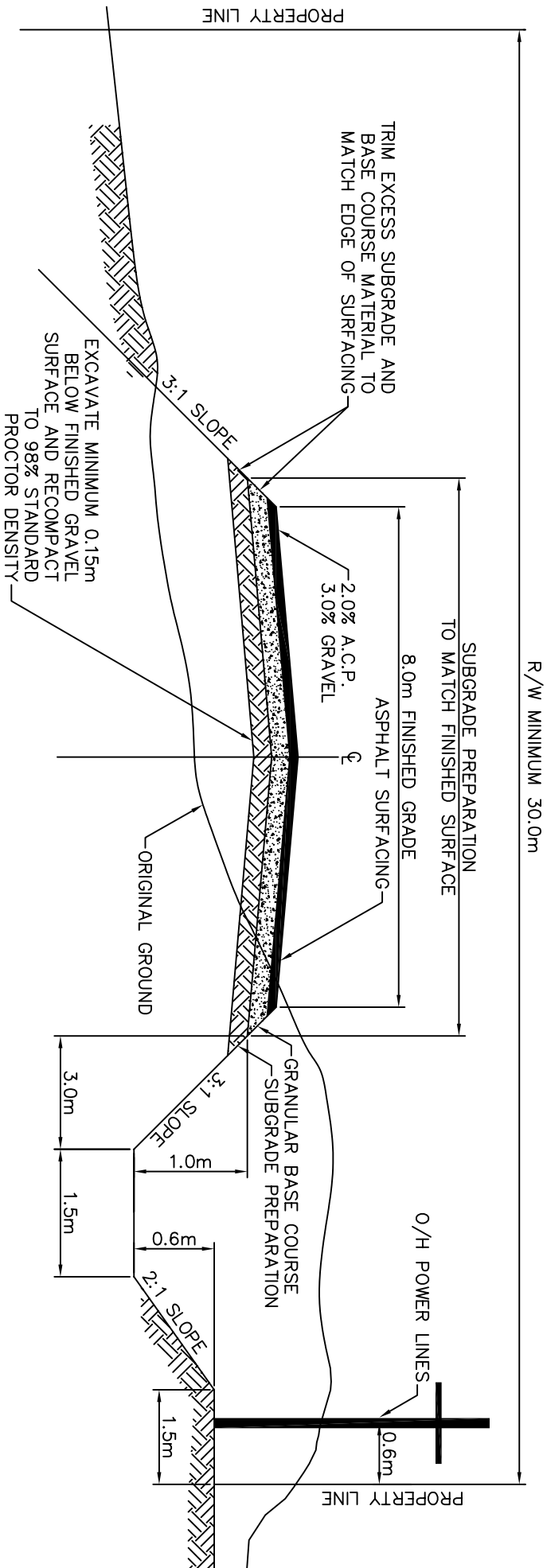
STANDARD DETAILS

SCALE: N.T.S.

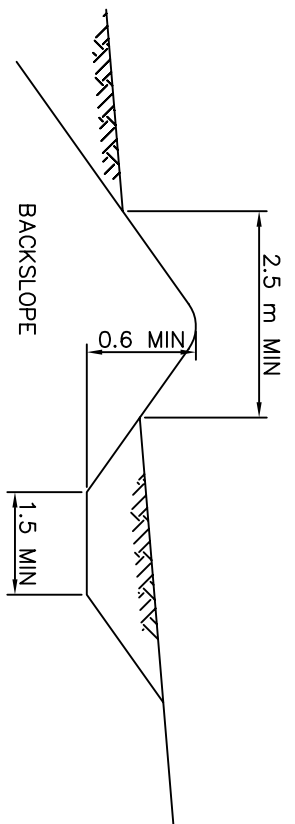
DATE: JAN 2007

STD. DWG NO. R-02

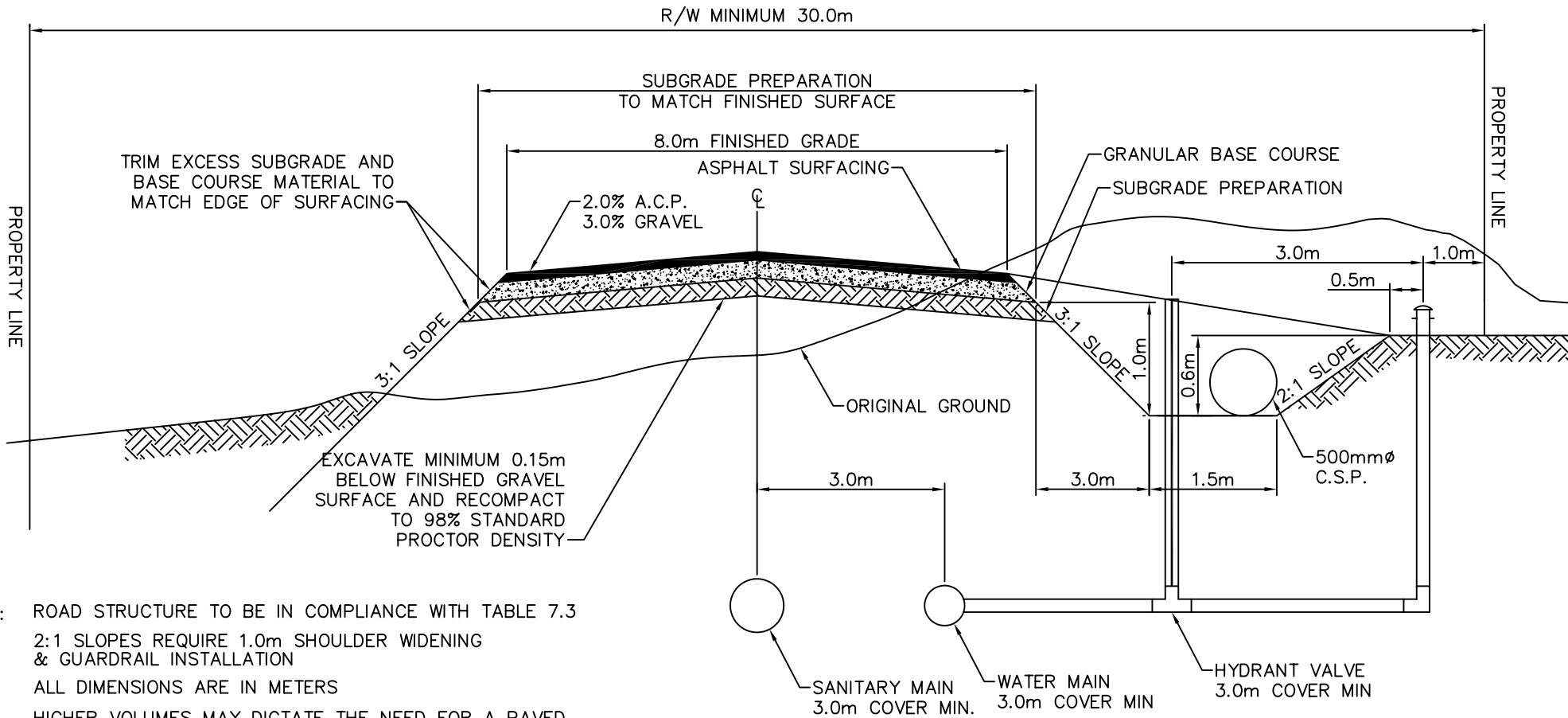




NOTE: ROAD STRUCTURE TO BE IN COMPLIANCE WITH TABLE 7.3
 2:1 SLOPES REQUIRE 1.0m SHOULDER WIDENING & GUARDRAIL INSTALLATION
 ALL DIMENSIONS ARE IN METERS
 HIGHER VOLUMES MAY DICTATE THE NEED FOR A PAVED SURFACE AND/OR A WIDER ROADWAY AS PER NORMAL DESIGN PRACTICE

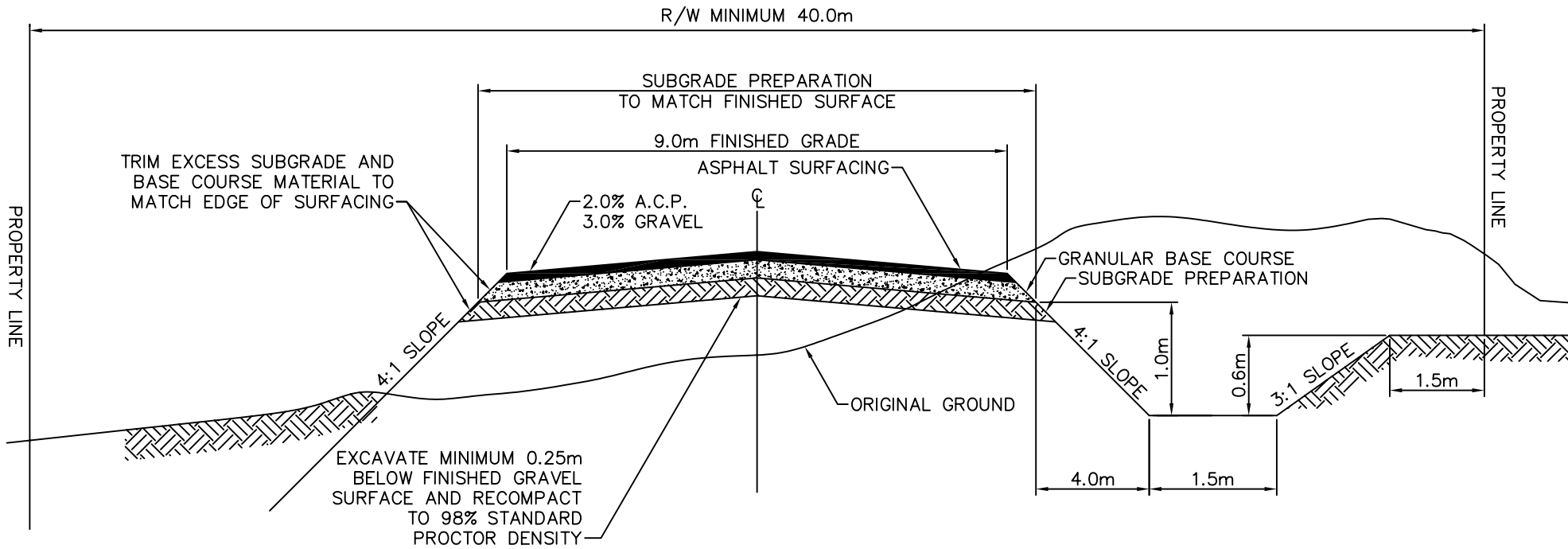


	
TITLE: TYPICAL RURAL CROSS-SECTION RESIDENTIAL ACCESS/LOCAL ROAD	
STANDARD DETAILS	
SCALE: N.T.S.	
DATE: JAN 2007	
STD. DWG NO.	R-03

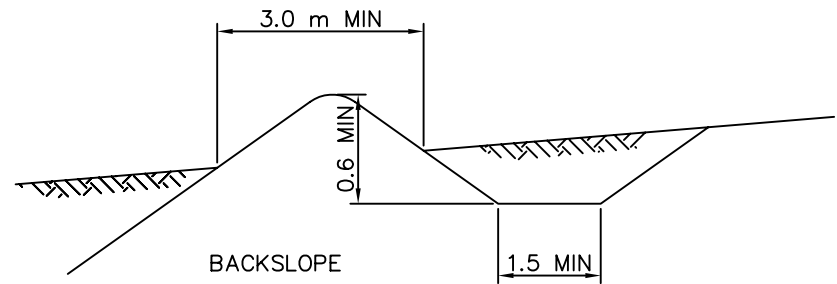


NOTE: ROAD STRUCTURE TO BE IN COMPLIANCE WITH TABLE 7.3
 2:1 SLOPES REQUIRE 1.0m SHOULDER WIDENING & GUARDRAIL INSTALLATION
 ALL DIMENSIONS ARE IN METERS
 HIGHER VOLUMES MAY DICTATE THE NEED FOR A PAVED SURFACE AND/OR A WIDER ROADWAY AS PER NORMAL DESIGN PRACTICE

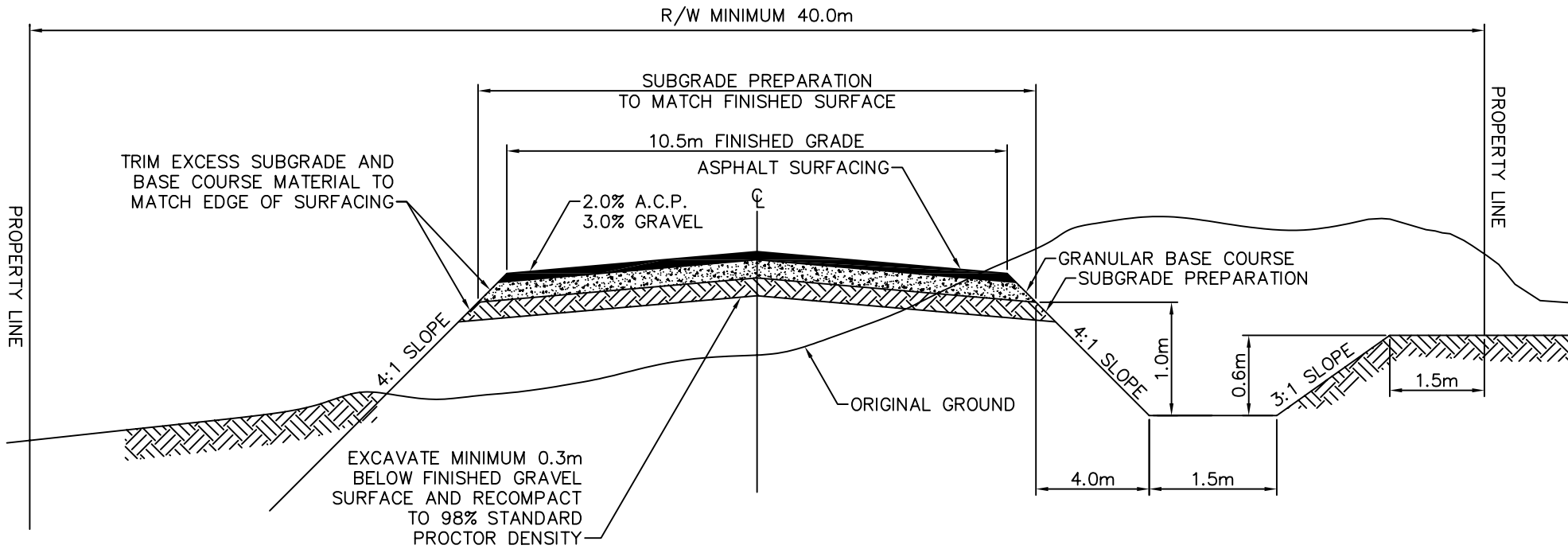
	TITLE:	STANDARD DETAILS	
		TYPICAL RURAL CROSS-SECTION RESIDENTIAL ACCESS/LOCAL ROAD WITH UTILITIES	
		SCALE: N.T.S.	
		DATE: JAN 2007	
		STD. DWG NO. R-03-1	



NOTE: ROAD STRUCTURE TO BE IN COMPLIANCE WITH TABLE 7.3
 2:1 SLOPES REQUIRE 1.0m SHOULDER WIDENING & GUARDRAIL INSTALLATION
 ALL DIMENSIONS ARE IN METERS
 HIGHER VOLUMES MAY DICTATE THE NEED FOR A PAVED SURFACE AND/OR A WIDER ROADWAY AS PER NORMAL DESIGN PRACTICE

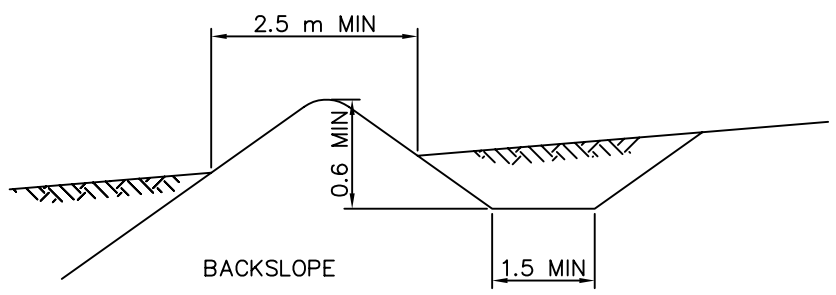


	TITLE:	STANDARD DETAILS	
		TYPICAL CROSS-SECTION COLLECTOR ROAD	
		SCALE: N.T.S.	
		DATE: JAN 2007	
	STD. DWG NO.	R-04	

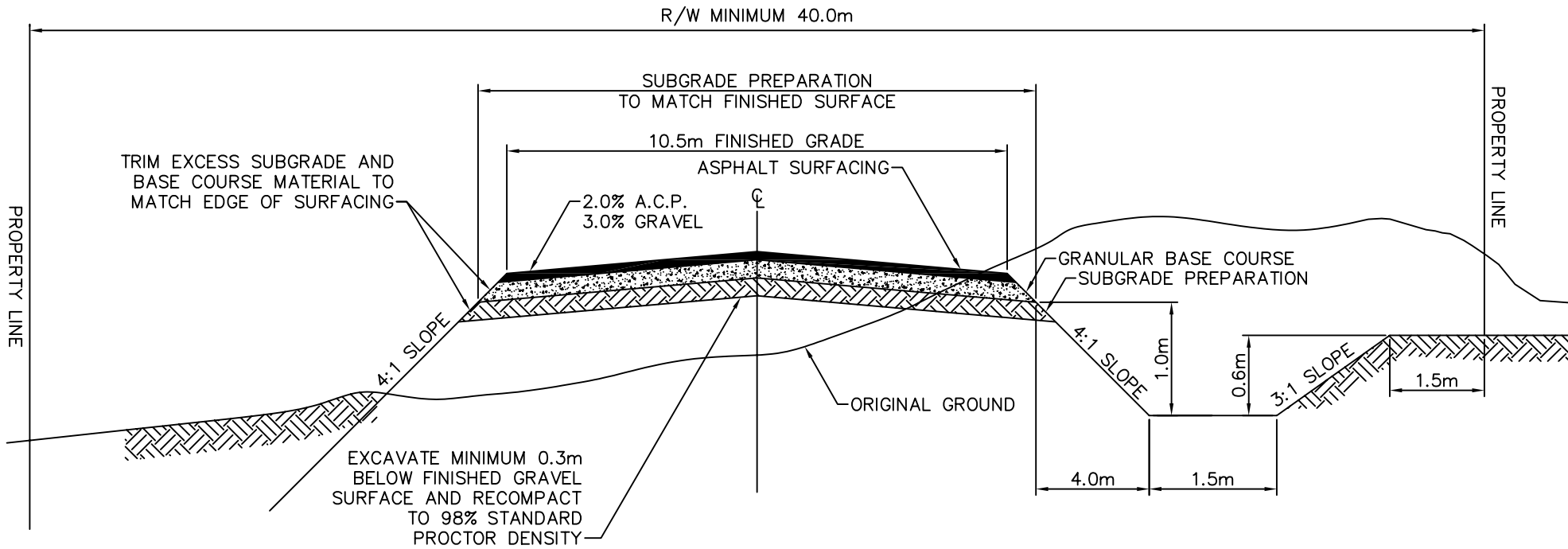


NOTE: ROAD STRUCTURE TO BE IN COMPLIANCE WITH TABLE 7.3
 2:1 SLOPES REQUIRE 1.0m SHOULDER WIDENING & GUARDRAIL INSTALLATION
 ALL DIMENSIONS ARE IN METERS

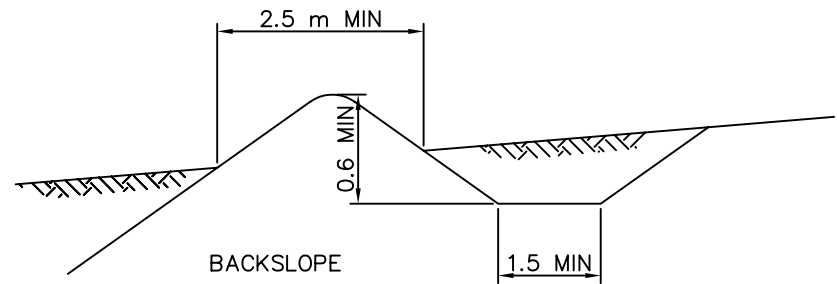
HIGHER VOLUMES MAY DICTATE THE NEED FOR A PAVED SURFACE AND/OR A WIDER ROADWAY AS PER NORMAL DESIGN PRACTICE



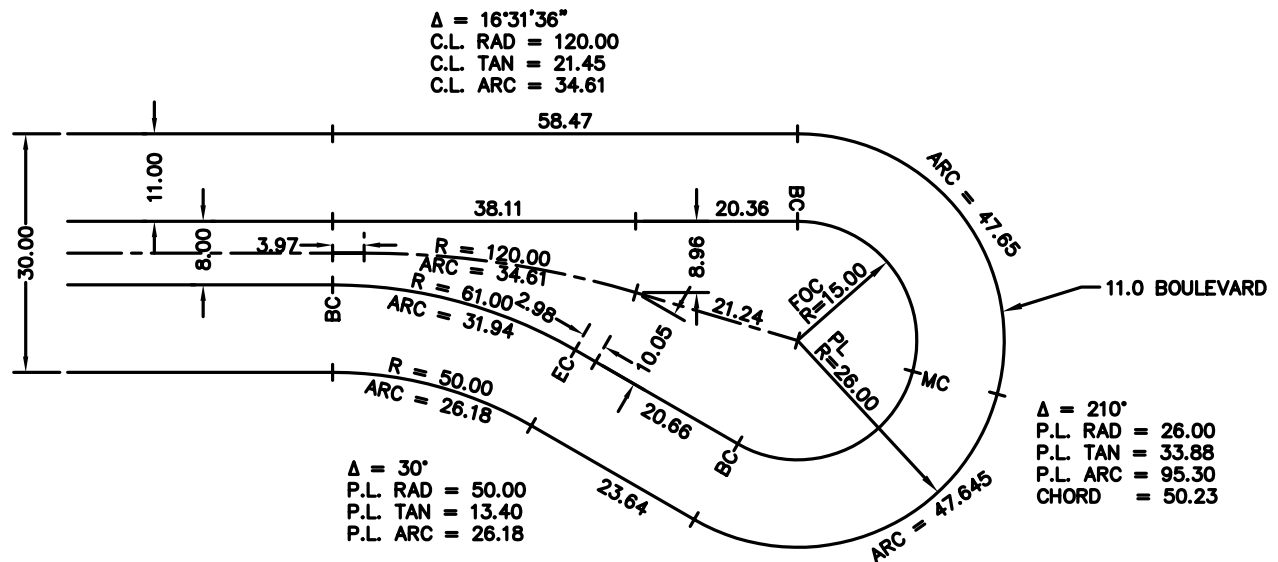
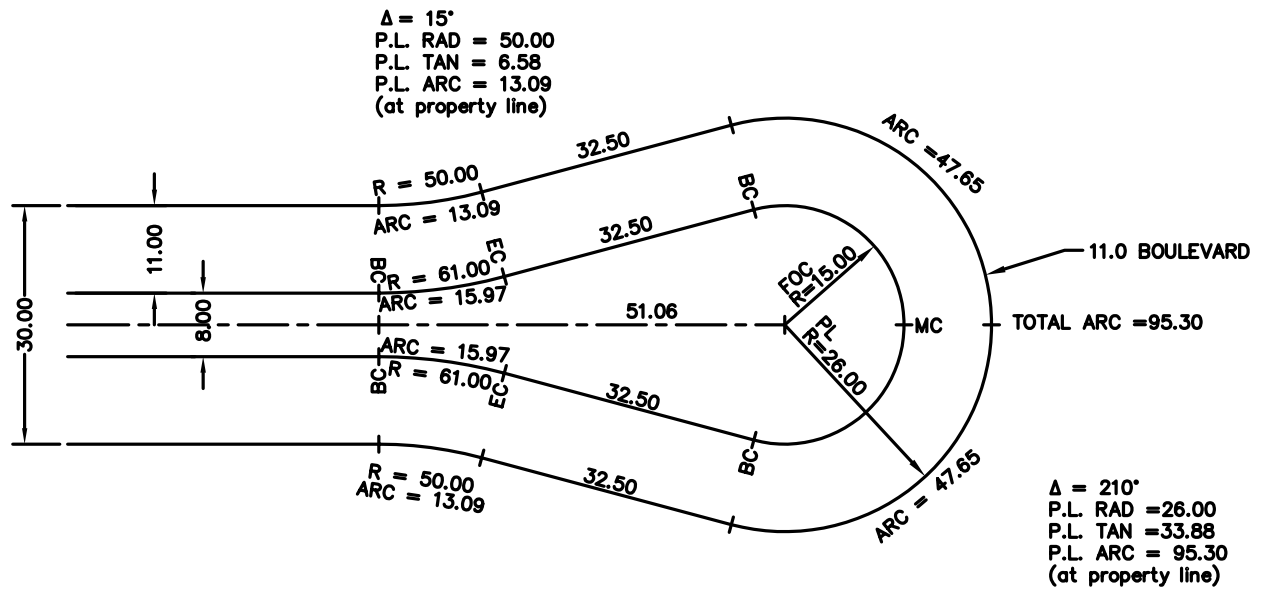
	TITLE:	STANDARD DETAILS	
	TYPICAL CROSS-SECTION COMMERCIAL / INDUSTRIAL ROAD		
	SCALE: N.T.S.	DATE: JAN 2007	
	STD. DWG NO.	R-05	



NOTE: ROAD STRUCTURE TO BE IN COMPLIANCE WITH TABLE 7.3
 2:1 SLOPES REQUIRE 1.0m SHOULDER WIDENING & GUARDRAIL INSTALLATION
 ALL DIMENSIONS ARE IN METERS
 HIGHER VOLUMES MAY DICTATE THE NEED FOR A PAVED SURFACE AND/OR A WIDER ROADWAY AS PER NORMAL DESIGN PRACTICE



	TITLE:	STANDARD DETAILS	
		TYPICAL CROSS-SECTION RURAL ARTERIAL ROAD	
		SCALE: N.T.S.	
		DATE: JAN 2007	
	STD. DWG NO.	R-06	



TITLE:

RURAL
CUL - DE - SAC

STANDARD DETAILS

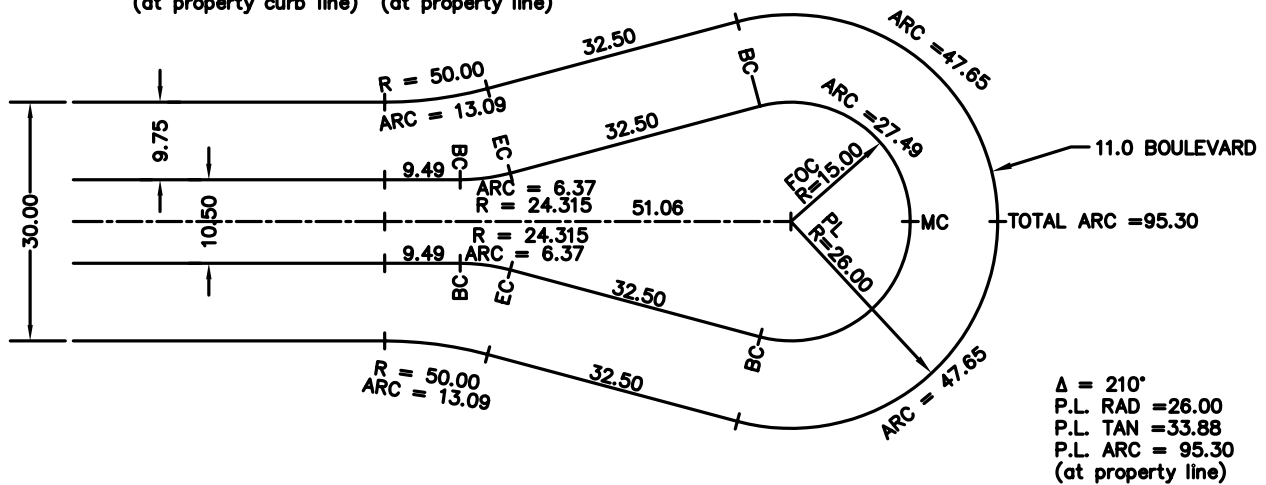
SCALE: N.T.S.

DATE: JAN 2007

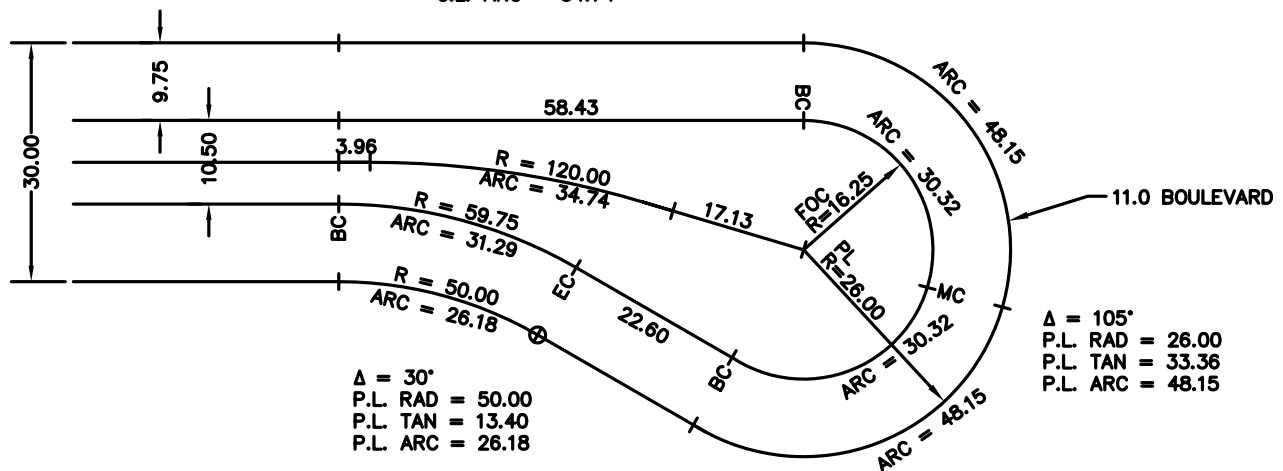
STD. DWG NO.

R-07

$\Delta = 15^\circ$ $\Delta = 15^\circ$
 P.L. RAD = 24.315 P.L. RAD = 50.00
 P.L. TAN = 3.20 P.L. TAN = 6.58
 P.L. ARC = 3.37 P.L. ARC = 13.09
 (at property curb line) (at property line)



$\Delta = 16^\circ 35' 06''$
 C.L. RAD = 120.00
 C.L. TAN = 21.45
 C.L. ARC = 34.74



TITLE:

URBAN INDUSTRIAL
 CUL - DE - SAC
 CURB AND GUTTER

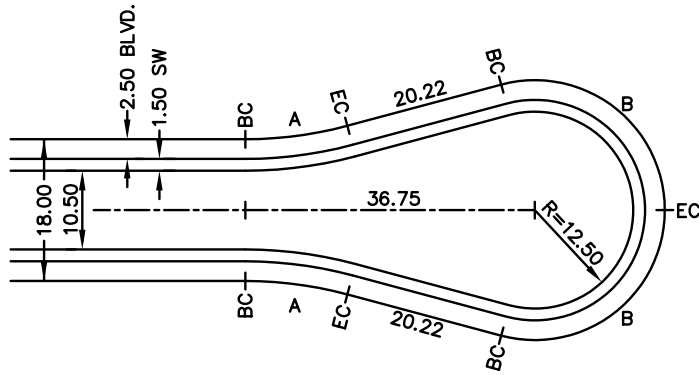
STANDARD DETAILS

SCALE: N.T.S.

DATE: JAN 2007

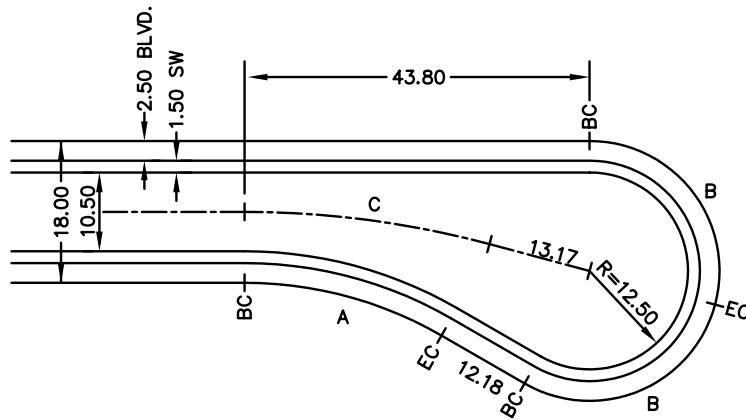
STD. DWG NO.

R-08



CURVE "A"
 $\Delta = 15^{\circ}00'00''$
 $R = 50.00$
 $ARC = 13.09$
 $TAN = 6.58$
 (at property line)

CURVE "B"
 $\Delta = 105^{\circ}00'00''$
 $R = 16.5$
 $ARC = 31.44$
 $TAN = 21.51$
 (at property line)



CURVE "A"
 $\Delta = 30^{\circ}00'00''$
 $R = 50.00$
 $ARC = 26.18$
 $TAN = 13.40$
 (at property line)

CURVE "B"
 $\Delta = 105^{\circ}00'00''$
 $R = 16.5$
 $ARC = 30.24$
 $TAN = 21.51$
 (at property line)

CURVE "C"
 $\Delta = 15^{\circ}00'00''$
 $R = 120.09$
 $ARC = 31.44$
 $TAN = 15.81$



TITLE:

URBAN LOCAL
 CUL - DE - SAC
 CURB AND GUTTER

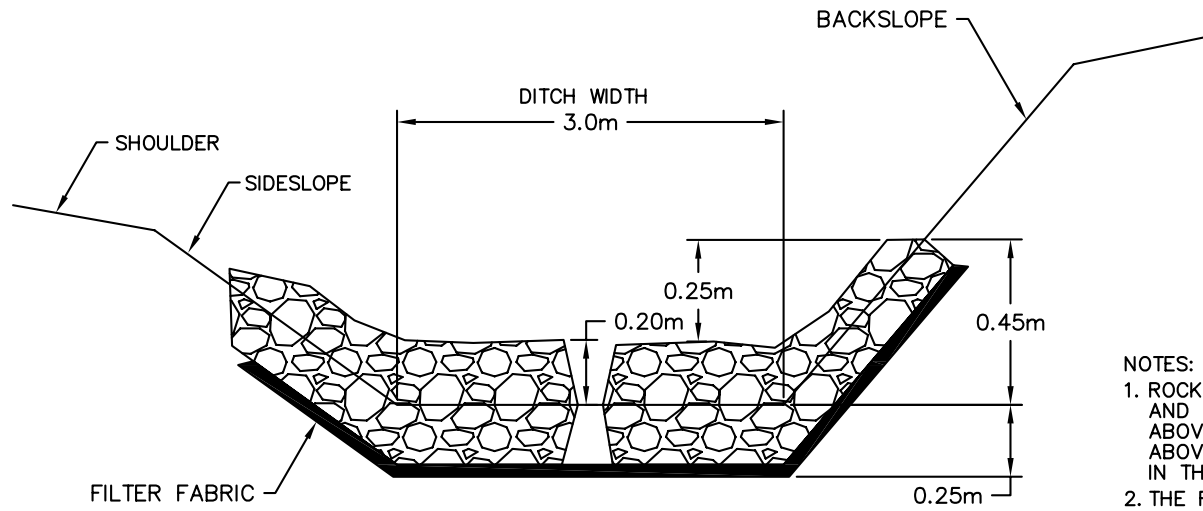
STANDARD DETAILS

SCALE: N.T.S.

DATE: JAN 2007

STD. DWG NO.

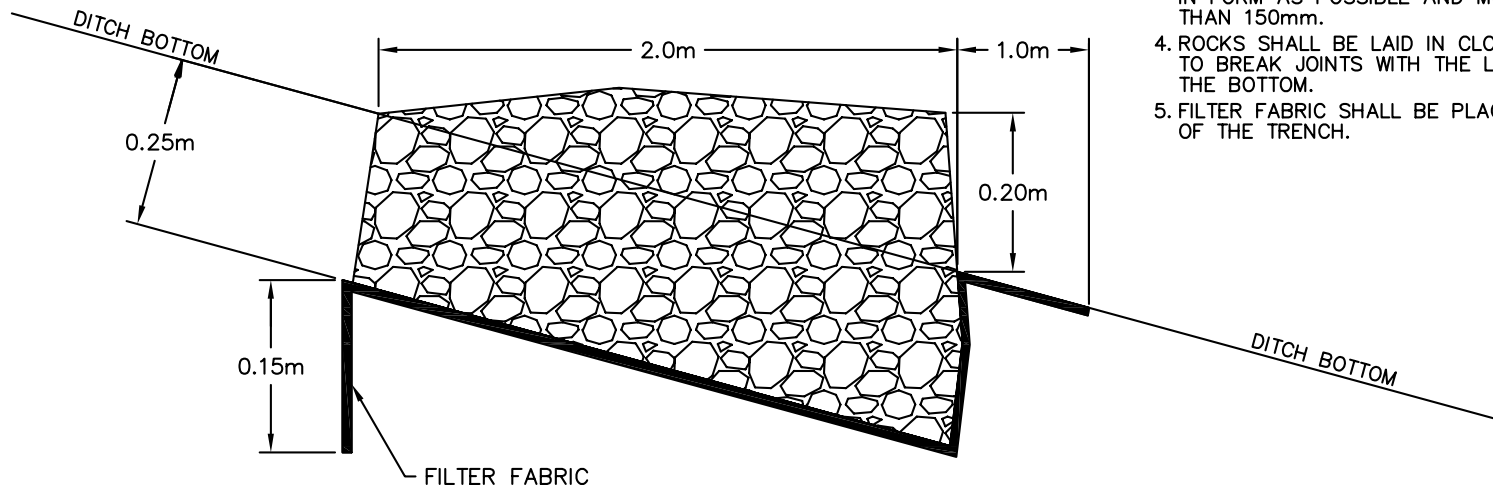
R-08-1



CROSS SECTION

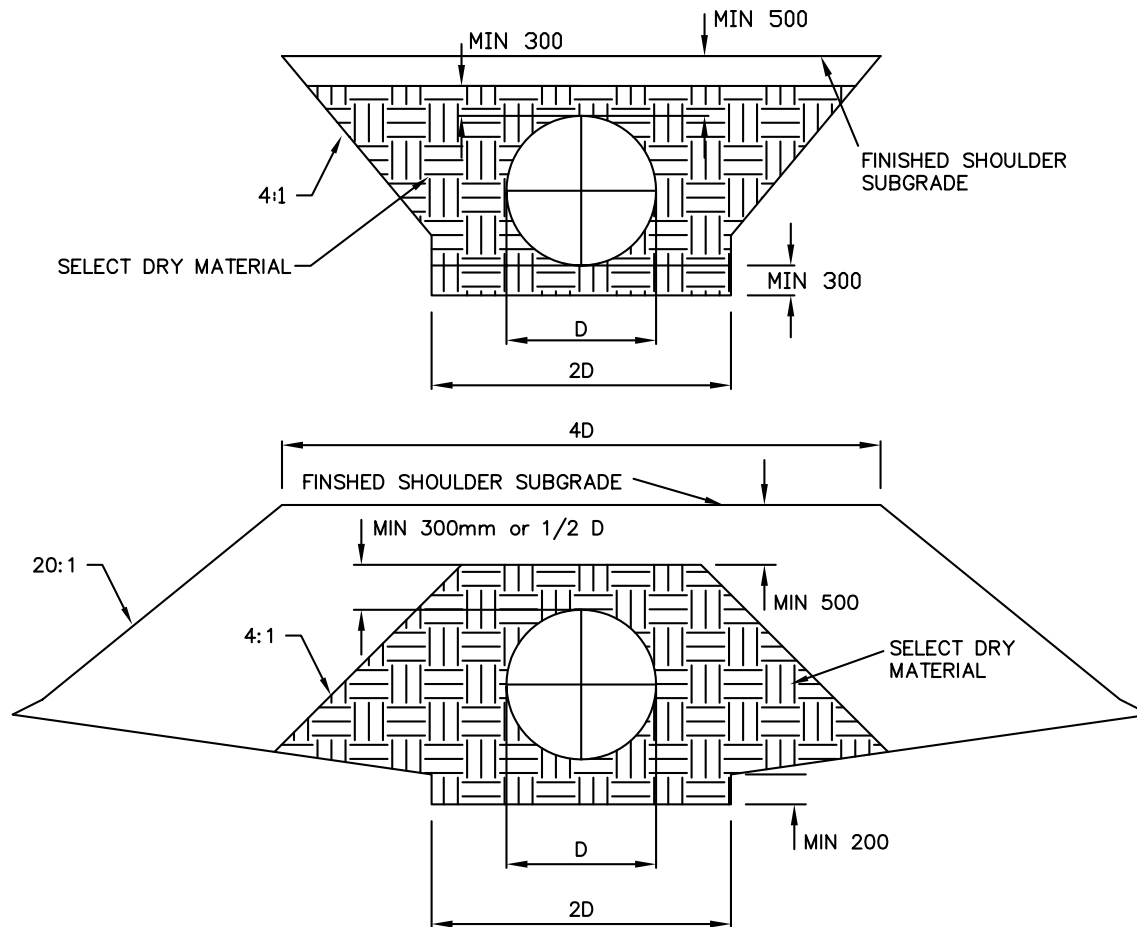
NOTES:

1. ROCK SHALL BE TRENCHED INTO THE SIDESLOPE AND BACKSLOPE AT A POINT AT LEAST 450mm ABOVE THE DITCH BOTTOM AND AT LEAST 250mm ABOVE THE LOW POINT OF THE SURFACE OF ROCK IN THE DITCH.
2. THE ROCK SHALL BE TRENCHED INTO THE DITCH BOTTOM AND SLOPED A MIN. OF 250mm. THE LOWEST POINT OF THE DITCH CHECK MUST BE A MIN. OF 100mm TO A MAX. OF 150mm ABOVE THE DITCH BOTTOM.
3. ROCKS TO BE USED SHALL BE AS NEARLY CUBICAL IN FORM AS POSSIBLE AND MUST NOT BE SMALLER THAN 150mm.
4. ROCKS SHALL BE LAID IN CLOSE CONTACT SO AS TO BREAK JOINTS WITH THE LARGER STONES ON THE BOTTOM.
5. FILTER FABRIC SHALL BE PLACED IN THE BOTTOM OF THE TRENCH.



PROFILE

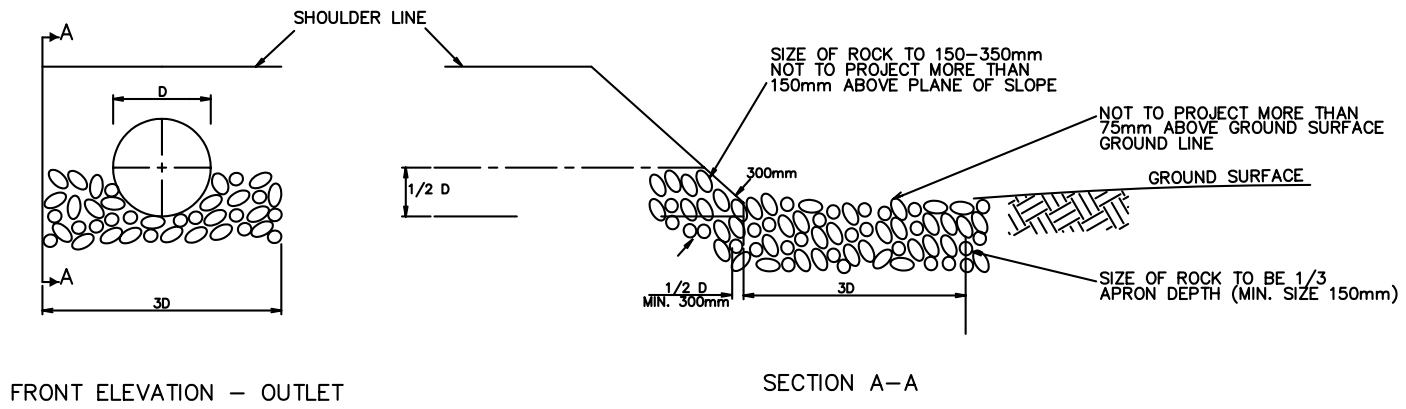
	TITLE:	TYPICAL ROCK DITCH CHECKS		STANDARD DETAILS	
				SCALE: N.T.S.	
		DATE: JAN 2007			
		STD. DWG NO. R-09			



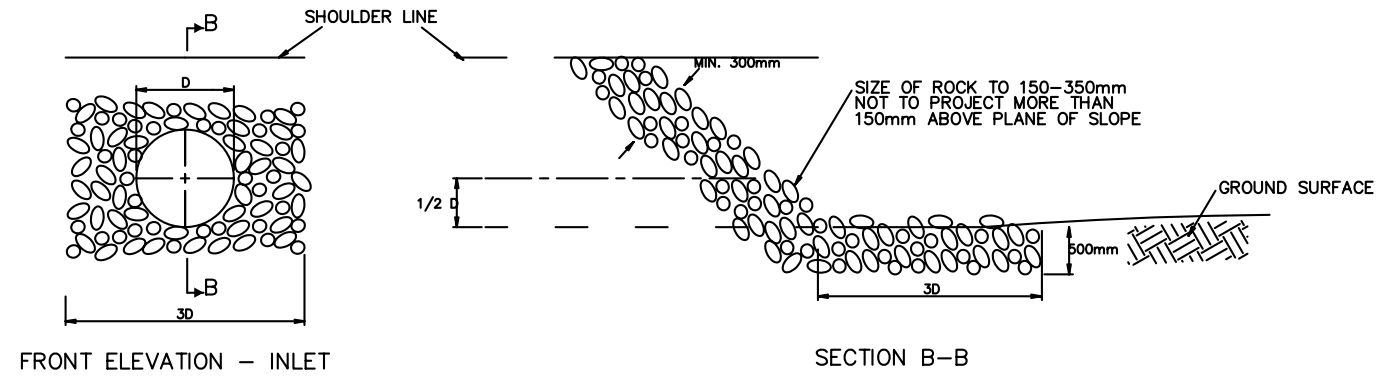
NOTES:

1. SELECT DRY MATERIAL SHALL BE PLACED IN 150mm COMPACTED LIFTS. IF SAND BACKFILL IS USED A 600mm CLAY PLUG SHALL BE PLACED ON INLET & OUTLET ENDS OF THE PIPE.
2. IN SOFT WET AREAS (IE MUSKEG) DEPTH OF SUBCUT BELOW THE PIPE WILL BE DETERMINED BY THE DEVELOPERS ENGINEER AS APPROVED BY THE DIRECTOR OF INFRASTRUCTURE.
3. WHEN PIPES ARE PLACED PRIOR TO EMBANKMENT CONSTRUCTION, A MINIMUM OF 1000mm OF MATERIAL SHALL BE PLACED OVER TOP OF PIPES FOR PROTECTION DURING CONSTRUCTION.
4. ALL CULVERT INVERTS WILL BE STAKED IN THE FIELD BY THE DEVELOPERS ENGINEER.

	TITLE:	STANDARD DETAILS		
	TYPICAL CULVERT INSTALLATION		SCALE: N.T.S.	
			DATE: JAN 2007	
			STD. DWG NO.	R-10




OUTLET



INLET

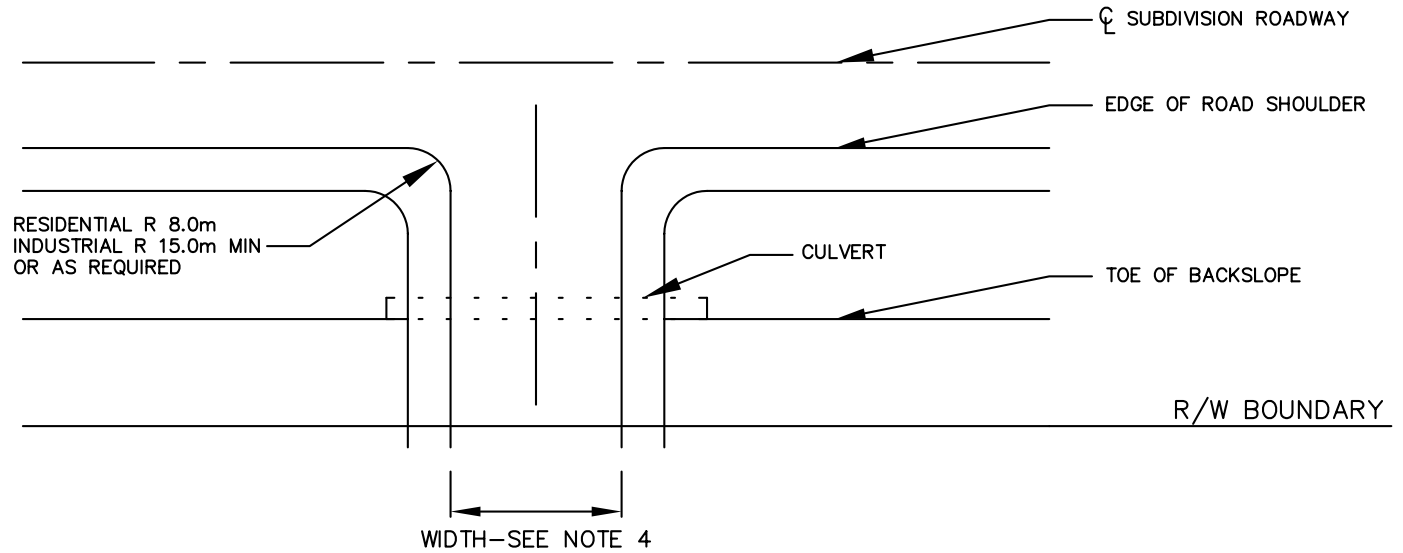
D	500	600	700	800	900	1000	1200
APRON DEPTH	500			600			

NOTE: ALL DIMENSIONS ARE IN MILLIMETERS

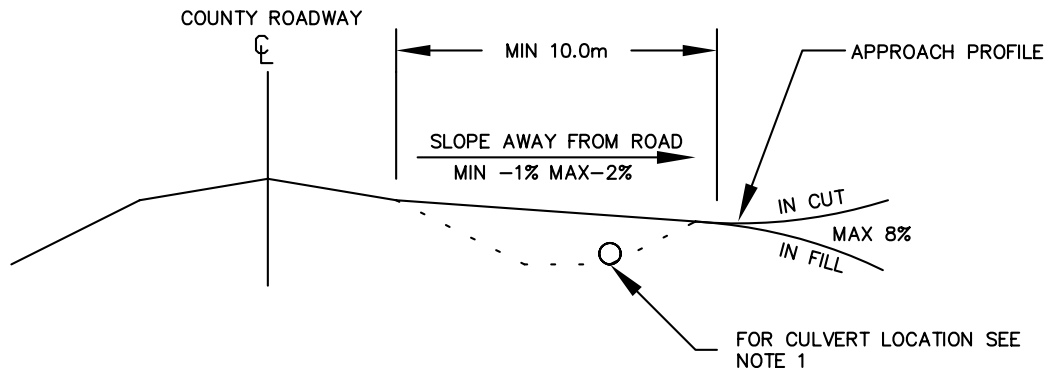
	TITLE:	STANDARD DETAILS	
	TYPICAL RIP-RAP FOR CULVERT SIZE 400 - 1200 DIA		SCALE: N.T.S.
			DATE: JAN 2007
	STD. DWG NO.	R-11	

NOTES

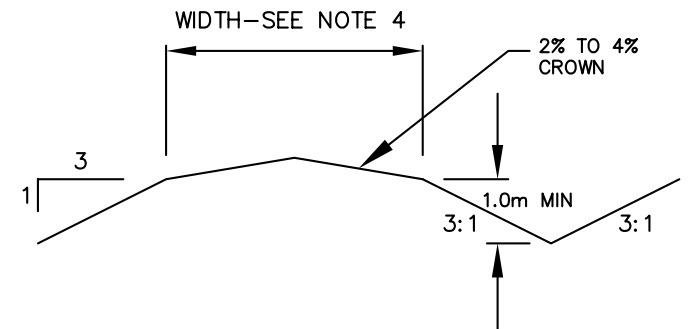
- 1) WHEN CULVERTS ARE REQUIRED THEY MUST BE C.S.P. CULVERTS AND BE THE FOLLOWING MIN. DIAMETERS
RESIDENTIAL - 0.500m
INDUSTRIAL - 0.600m
- 2) ALL DIMENSIONS SHOWN ARE IN METERS
- 3) MINIMUM APPROACH LENGTH - FROM EDGE OF ROAD SHOULDER TO R/W BOUNDARY
- 4) WIDTH - 8.0 MIN & 15.0 MAX
- 5) REFER TO DWG R-11 FOR THE RIP-RAP CULVERT END TREATMENT DETAILS.



APPROACH PLAN

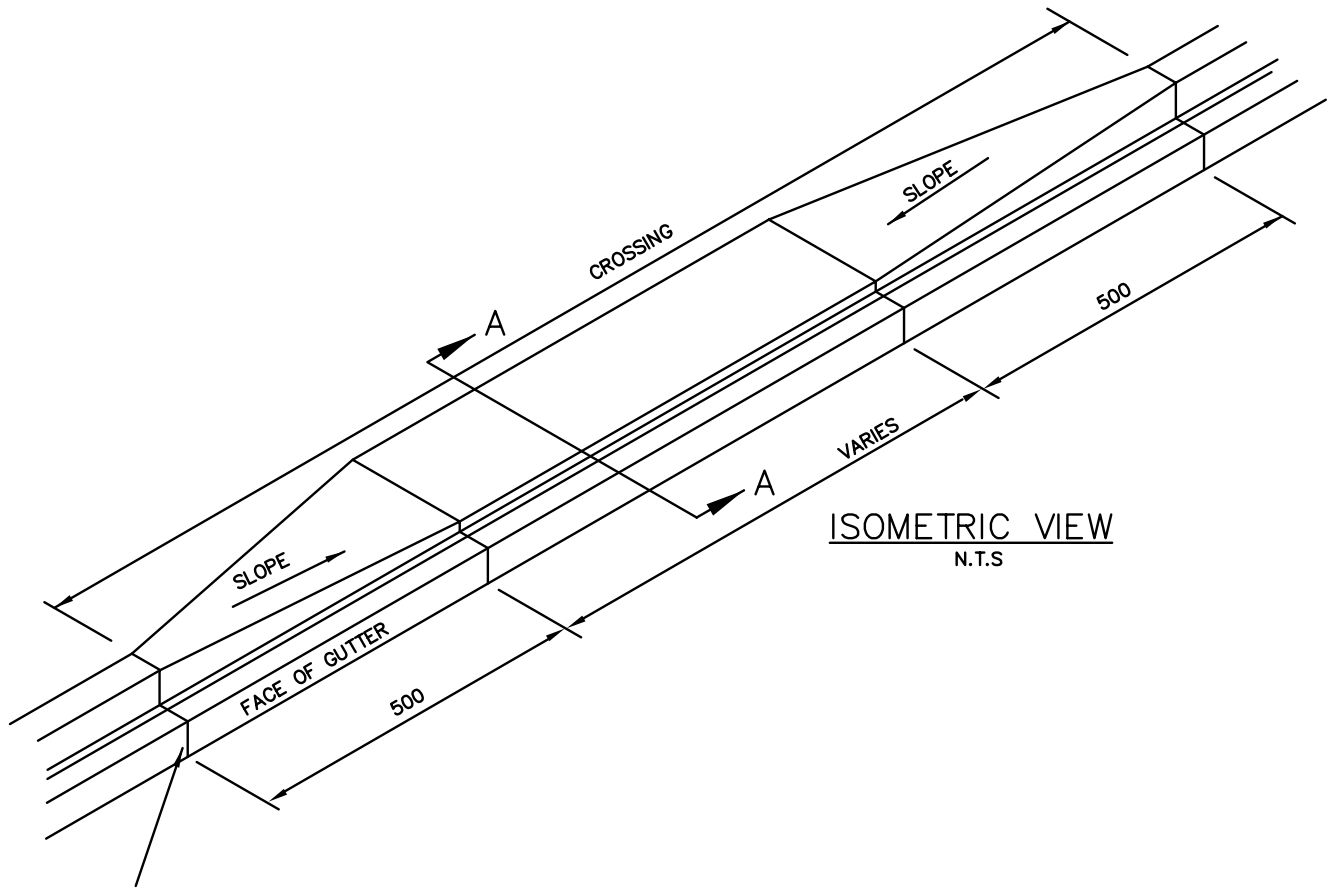


DITCH AND CULVERT LOCATION



APPROACH CROSS SECTION

	TITLE:	TYPICAL RESIDENTIAL & INDUSTRIAL APPROACHES	
	STANDARD DETAILS		
	SCALE: N.T.S.		
	DATE: JAN 2007		
STD. DWG NO.		R-12	

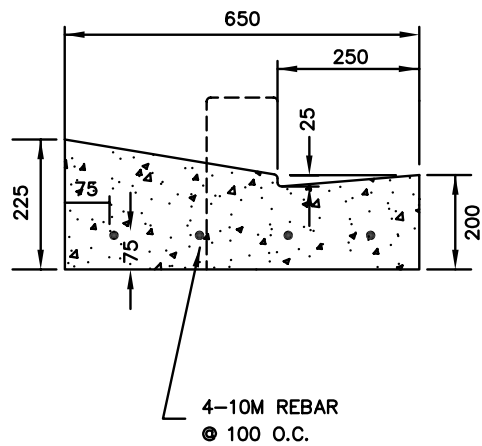


ISOMETRIC VIEW
N.T.S.

CONTRACTION
JOINT

NOTES:

1. MAINTAIN THICKENED DEPTH THROUGHOUT.
2. ALL DIMENSIONS ARE IN MILLIMETRES



SECTION A - A



TITLE:

INDUSTRIAL / COMMERCIAL
CURB & GUTTER CROSSING

STANDARD DETAILS

SCALE: N.T.S.

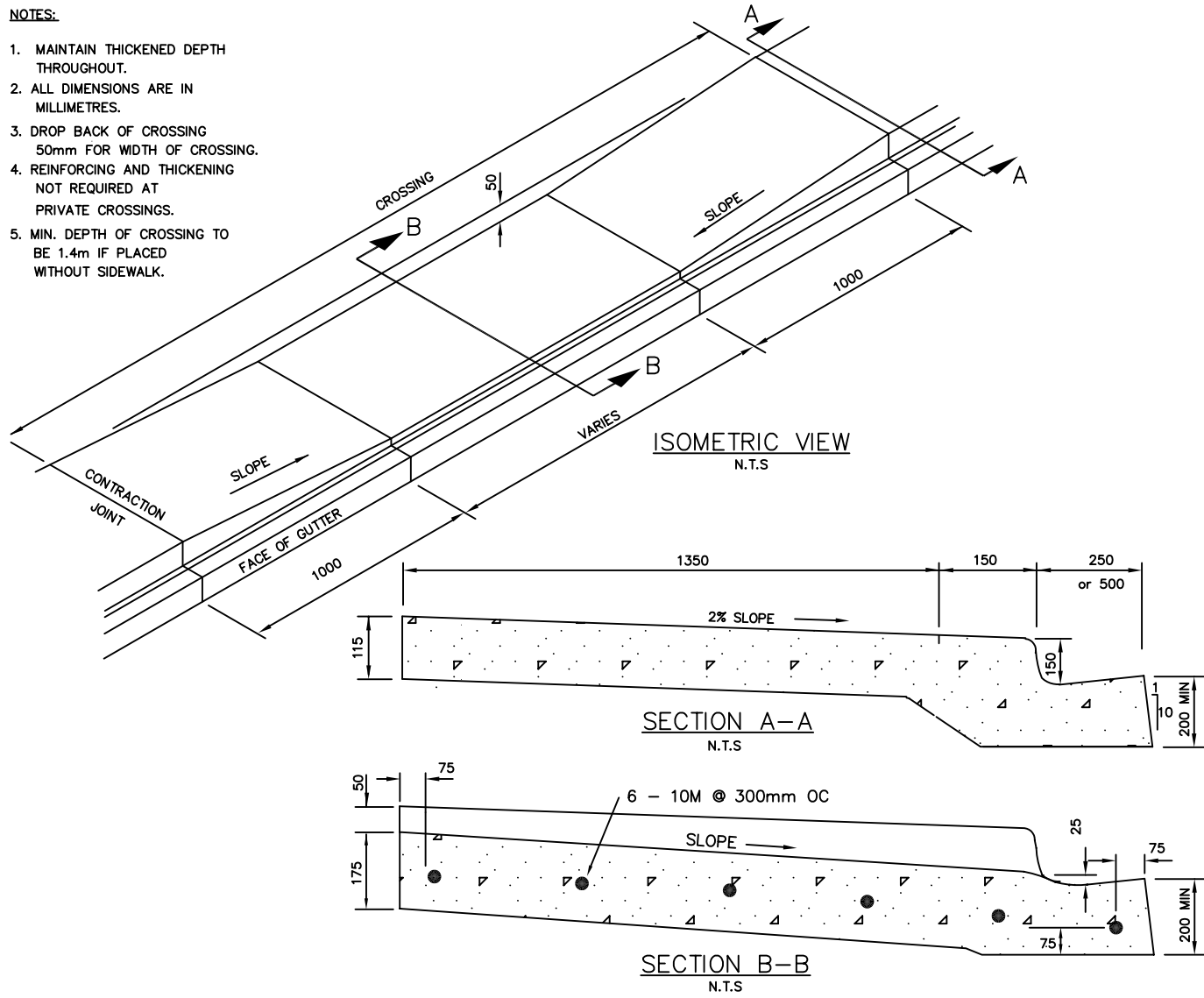
DATE: JAN 2007

STD. DWG NO.

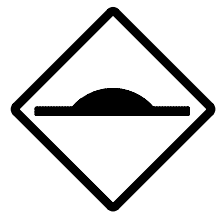
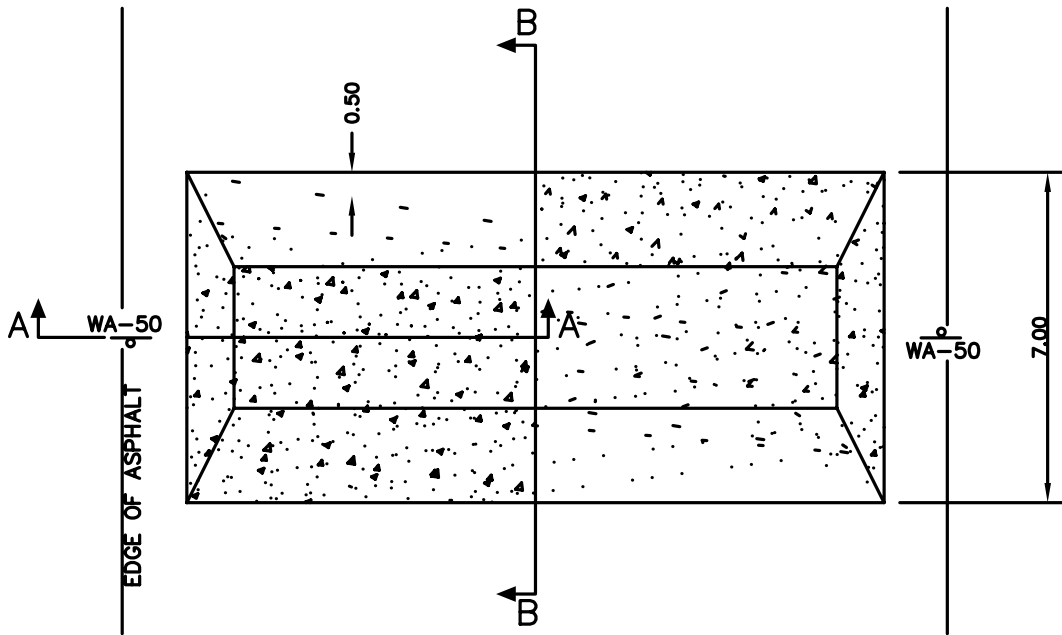
R-13

NOTES:

1. MAINTAIN THICKENED DEPTH THROUGHOUT.
2. ALL DIMENSIONS ARE IN MILLIMETRES.
3. DROP BACK OF CROSSING 50mm FOR WIDTH OF CROSSING.
4. REINFORCING AND THICKENING NOT REQUIRED AT PRIVATE CROSSINGS.
5. MIN. DEPTH OF CROSSING TO BE 1.4m IF PLACED WITHOUT SIDEWALK.



	TITLE:	TYPICAL MONOLITHIC LANE AND DRIVEWAY CROSSING	
	STANDARD DETAILS		
	SCALE: N.T.S.		
	DATE: JAN 2007		
	STD. DWG NO.	R-14	

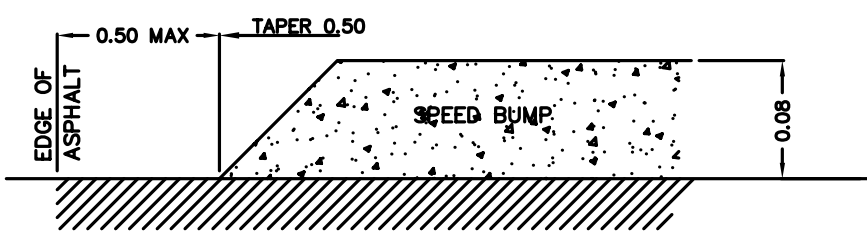


WA-50
450mm X 450mm
SPEED BUMP

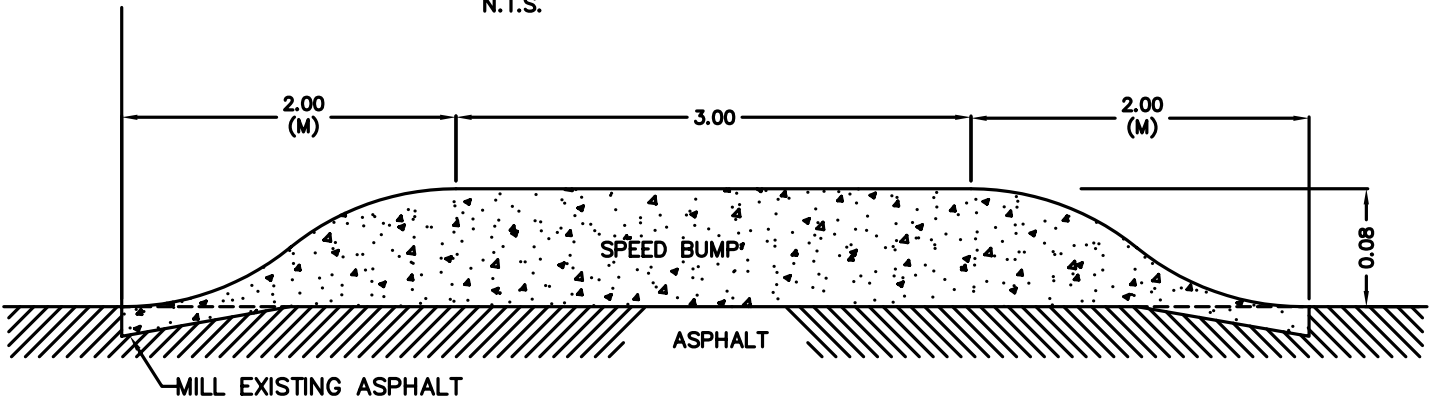
TWO WAY STREET/LANE
N.T.S.

NOTES:

1. PAINT 1.0 m WIDE YELLOW LINE ACROSS BOTH FACES OF BUMP.
2. PAINT 0.6 m WIDE CHEVRON PATTERN ON ENTIRE SURFACE.



SECTION A - A
N.T.S.



SECTION B - B
N.T.S.

SINUSOIDAL SPEED BUMP DEVELOPMENT:

DISTANCE (M)	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875	1.000	1.125	1.250	1.375	1.500	1.625	1.750	1.875	2.000
FINISHED HEIGHT(mm)	0	1	3	7	12	18	26	32	40	48	55	62	68	73	77	79	80

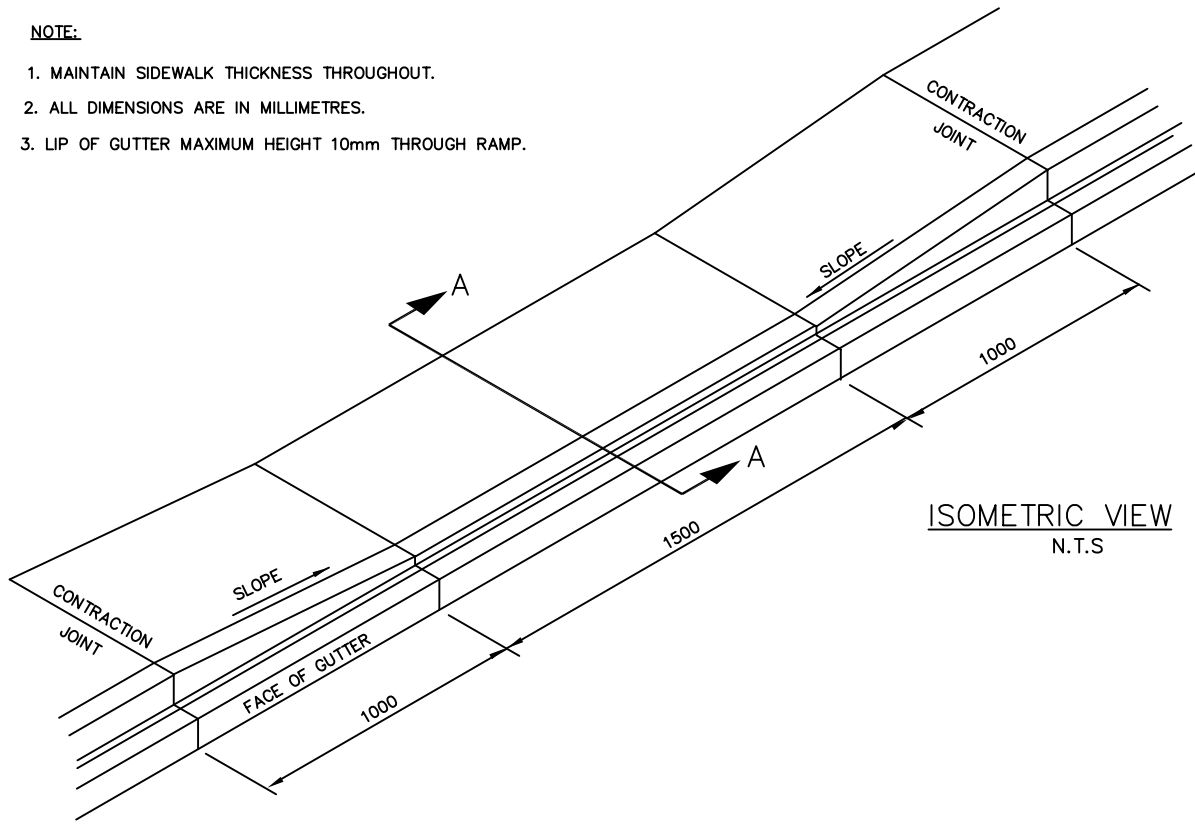


TITLE:
**ASPHALT
SPEED BUMP**

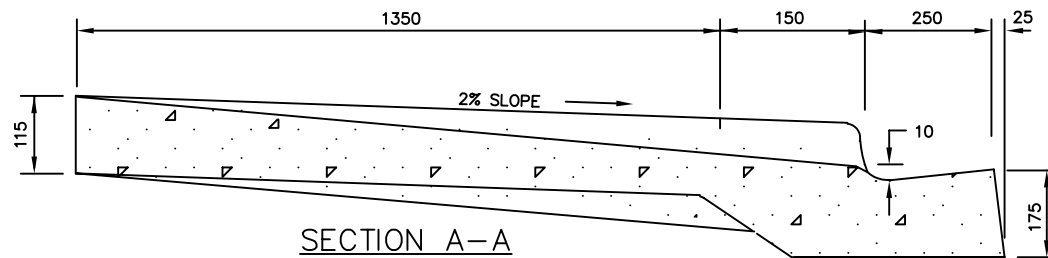
STANDARD DETAILS	
SCALE: N.T.S.	
DATE: JAN 2007	
STD. DWG NO.	R-15

NOTE:

- 1. MAINTAIN SIDEWALK THICKNESS THROUGHOUT.
- 2. ALL DIMENSIONS ARE IN MILLIMETRES.
- 3. LIP OF GUTTER MAXIMUM HEIGHT 10mm THROUGH RAMP.



ISOMETRIC VIEW
N.T.S



SECTION A-A
N.T.S



TITLE:

PARAPLEGIC RAMP
DETAILS ON TANGENT

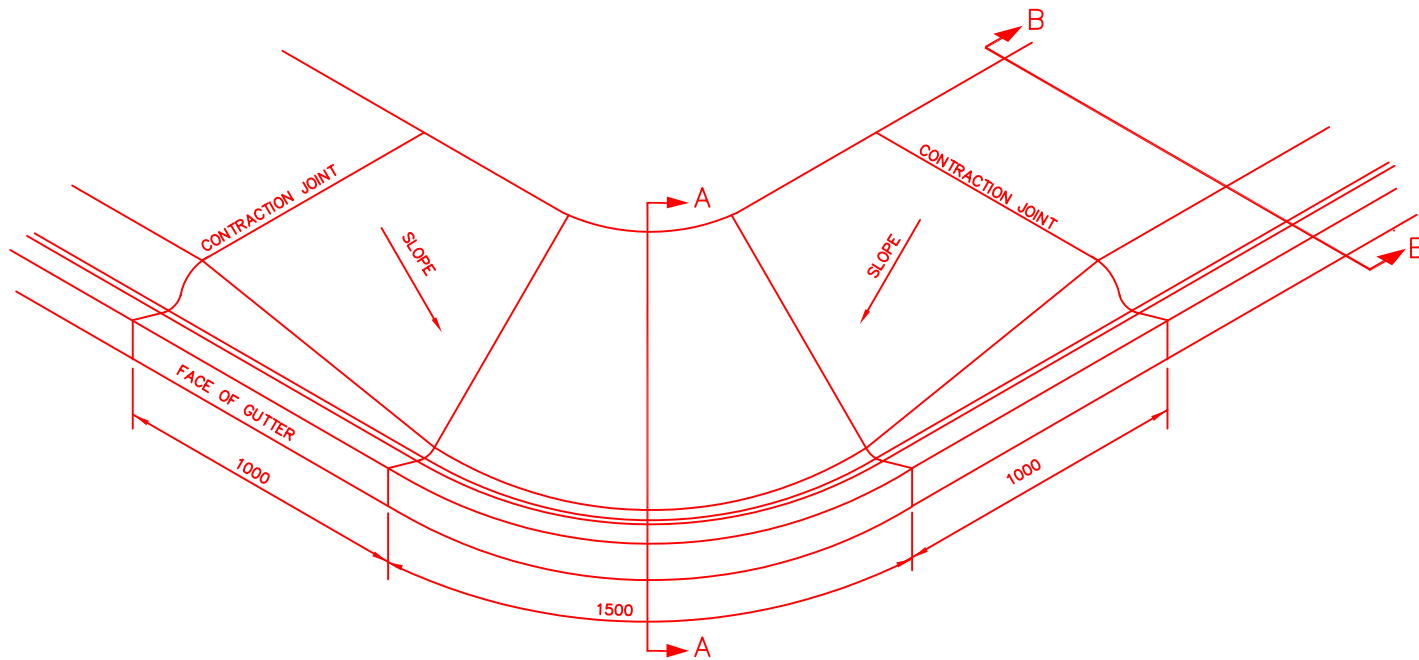
STANDARD DETAILS

SCALE: N.T.S.

DATE: JAN 2007

STD. DWG NO.

R-16



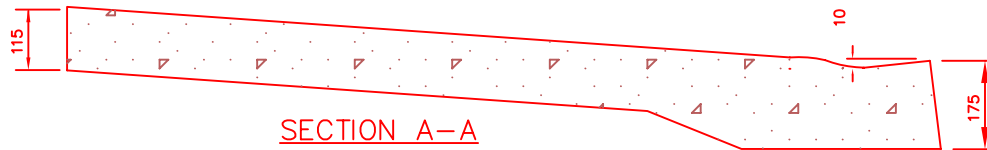
ISOMETRIC VIEW

N.T.S



SECTION B-B

N.T.S



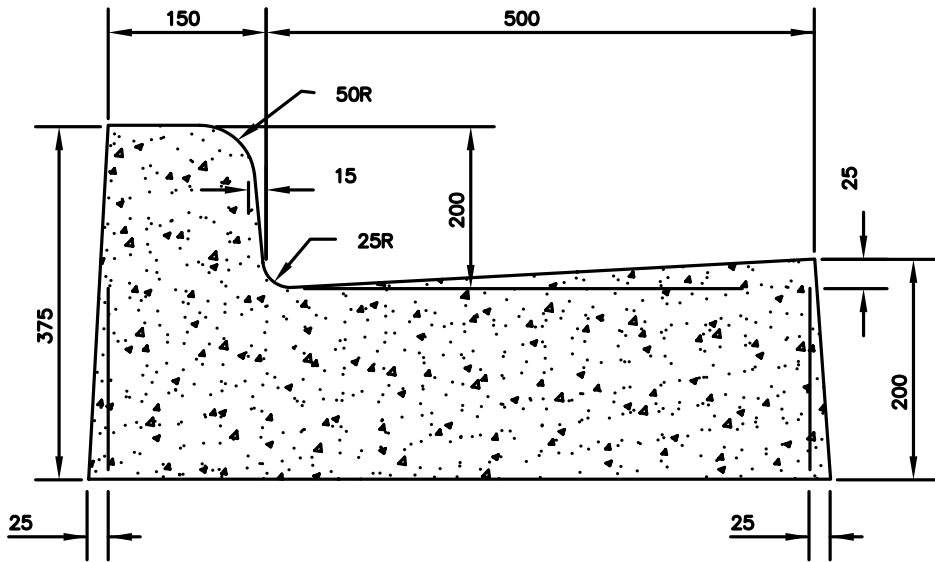
SECTION A-A

N.T.S

NOTES:

1. MAINTAIN SIDEWALK DEPTH THROUGHOUT.
2. ALL DIMENSIONS ARE IN MILLIMETRES.
3. LIP OF GUTTER MAXIMUM HEIGHT 10mm THROUGH LIP.

	TITLE:	PARAPLEGIC RAMP DETAILS AT CENTER OF CURB RETURN FOR ROLLED CURB		STANDARD DETAILS	
				SCALE: N.T.S.	
				DATE: JAN 2007	
			STD. DWG NO.	R-17	



NOTES:

1. 25 mm BATTER NOT REQUIRED FOR HANDFORMED.
2. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED.



TITLE:

500mm CURB & GUTTER
FOR ARTERIAL ROADWAYS

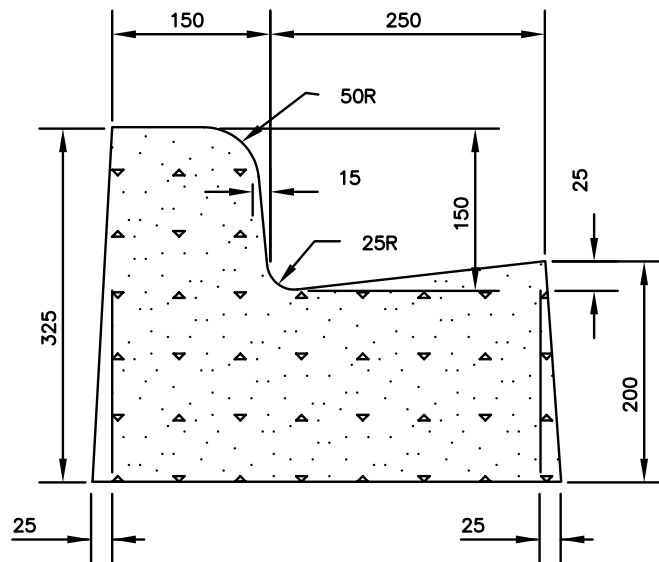
STANDARD DETAILS

SCALE: N.T.S.

DATE: JAN 2007

STD. DWG NO.

R-18



NOTES:

1. 25 mm BATTER NOT REQUIRED FOR HANDFORMED.
2. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED.



TITLE:

250mm STANDARD
CURB & GUTTER

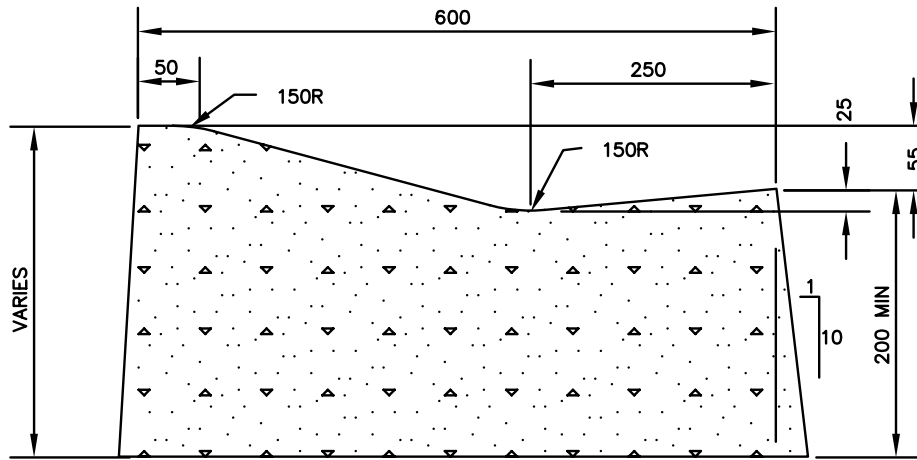
STANDARD DETAILS

SCALE: N.T.S.

DATE: JAN 2007

STD. DWG NO.

R-19



NOTES:

1. 25 mm BATTER NOT REQUIRED FOR HANDFORMED.
2. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED.



TITLE:

250mm ROLLED
CURB AND GUTTER

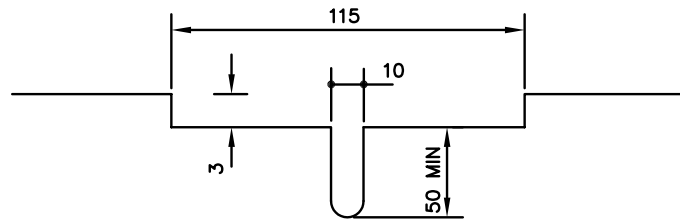
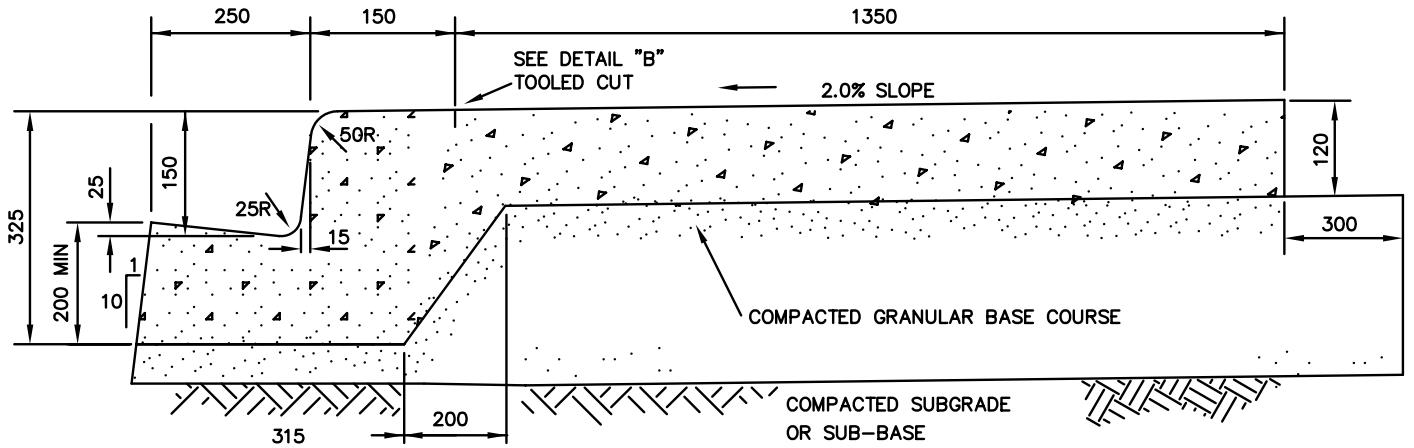
STANDARD DETAILS

SCALE: N.T.S.

DATE: JAN 2007

STD. DWG NO.

R-20



DETAIL "B"

NOTE:

1. ALL DIMENSIONS ARE IN MILLIMETRES.



TITLE:

1.50m STANDARD
MONOLITHIC SIDEWALK

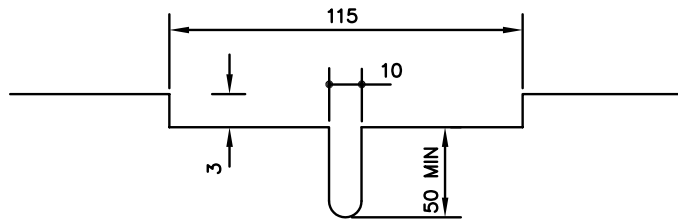
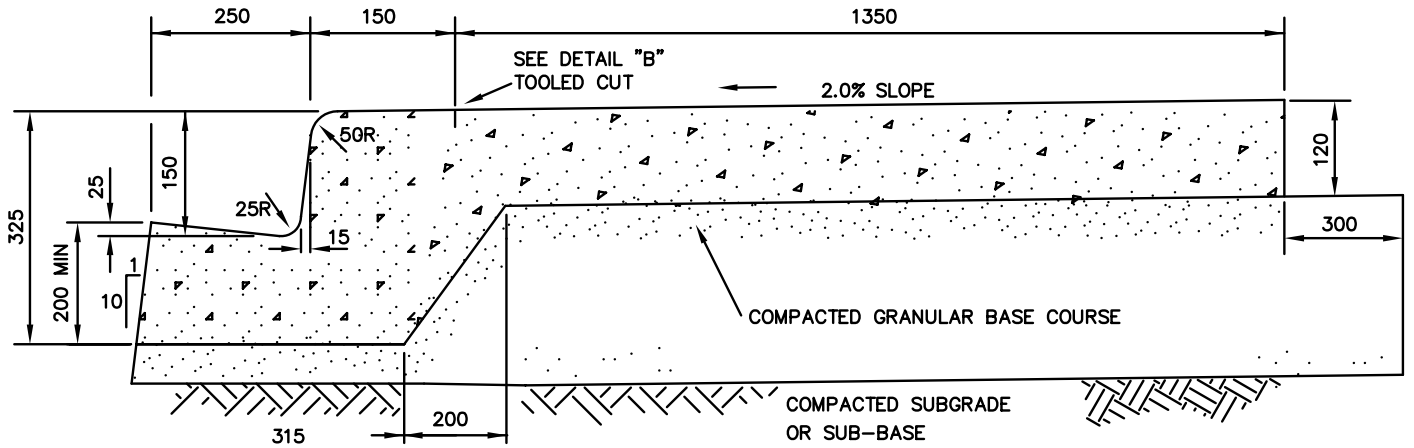
STANDARD DETAILS

SCALE: N.T.S.

DATE: JAN 2007

STD. DWG NO.

R-21



DETAIL "B"

NOTE:

1. ALL DIMENSIONS ARE IN MILLIMETRES.



TITLE:

1.50m STANDARD
MONOLITHIC SIDEWALK

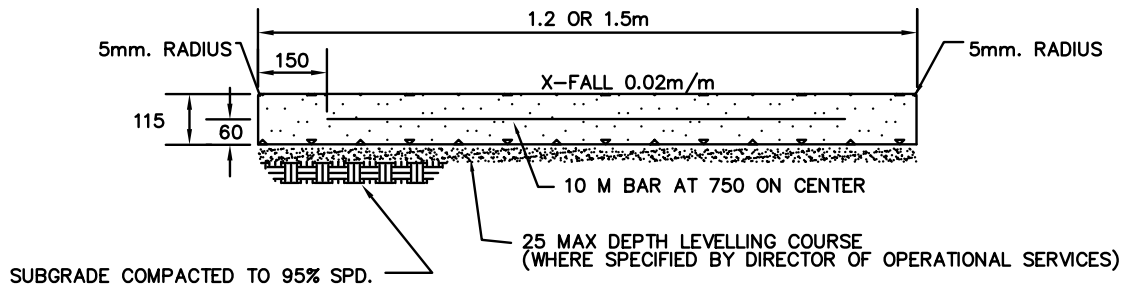
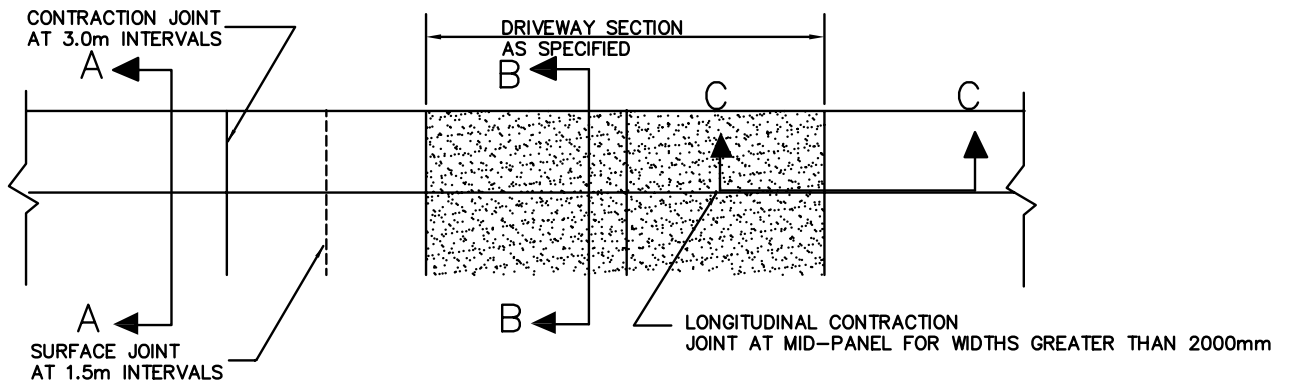
STANDARD DETAILS

SCALE: N.T.S.

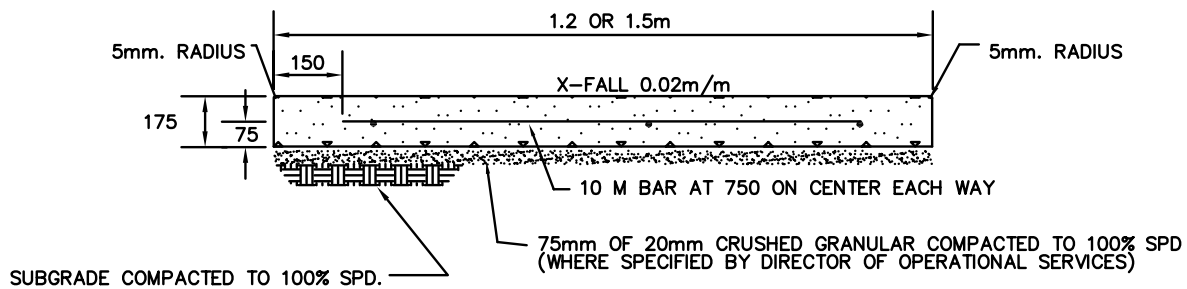
DATE: JUNE 2005

STD. DWG NO.

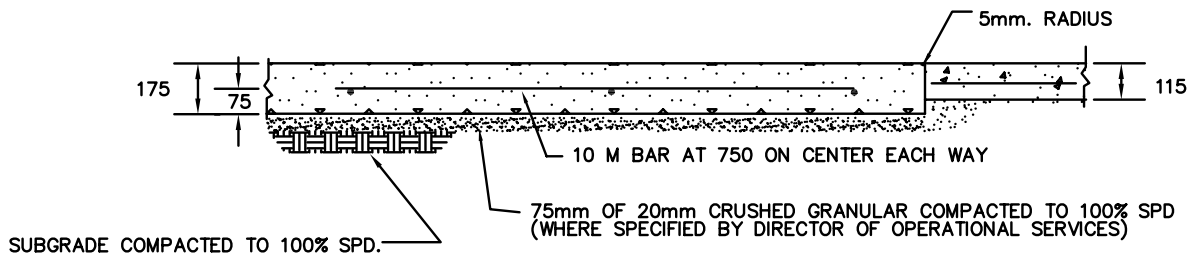
R-22



SECTION A-A...STANDARD SIDEWALK



SECTION B-B...DRIVEWAY SECTION



SECTION C-C...TRANSITION

NOTE:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED.



TITLE:

1.20m OR 1.50m
SEPARATE SIDEWALK

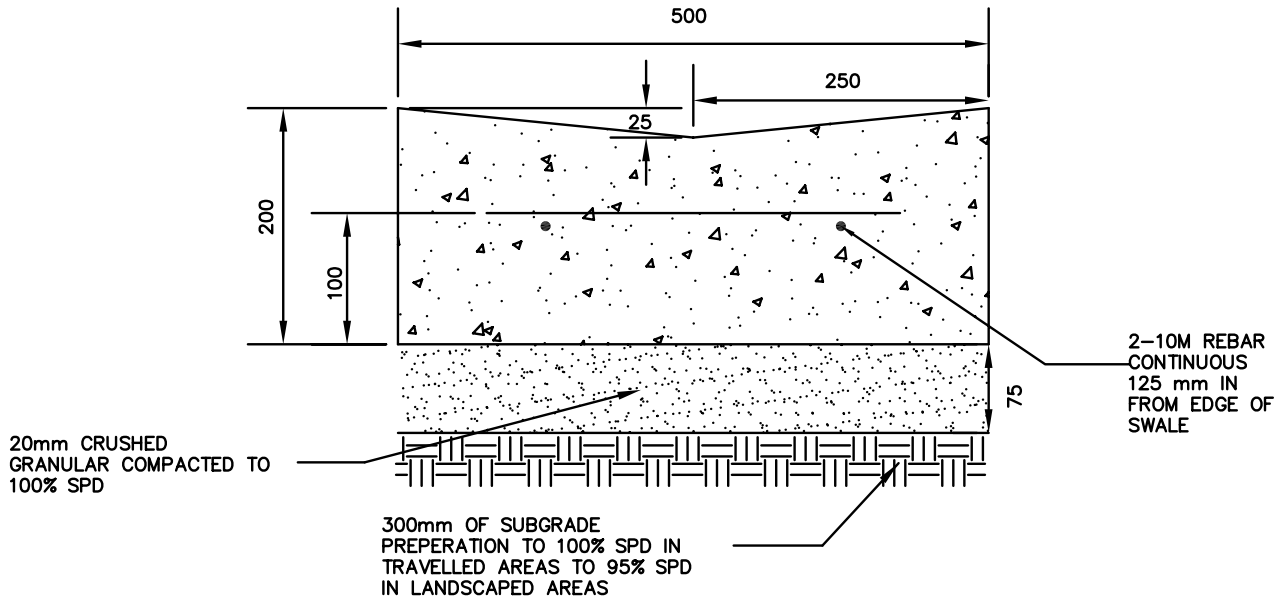
STANDARD DETAILS

SCALE: N.T.S.

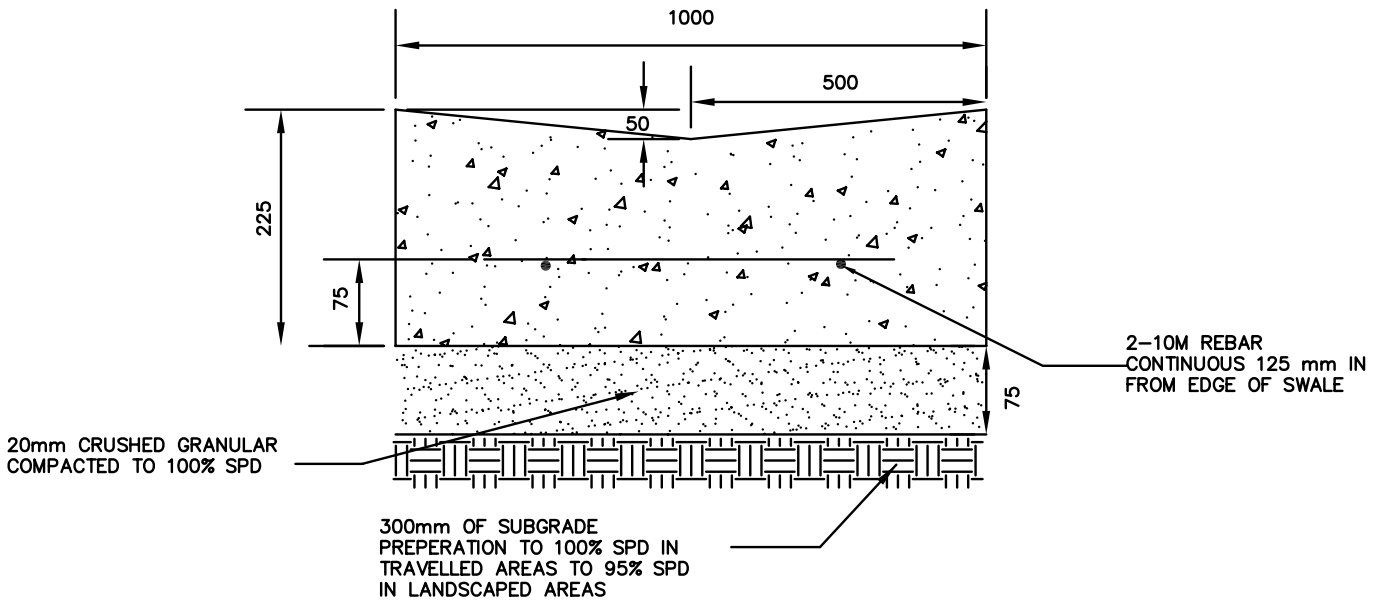
DATE: JAN 2007

STD. DWG NO.

R-23



500mm CONCRETE SWALE



1000mm CONCRETE SWALE

NOTE:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED.



TITLE:

CONCRETE DRAINAGE SWALES

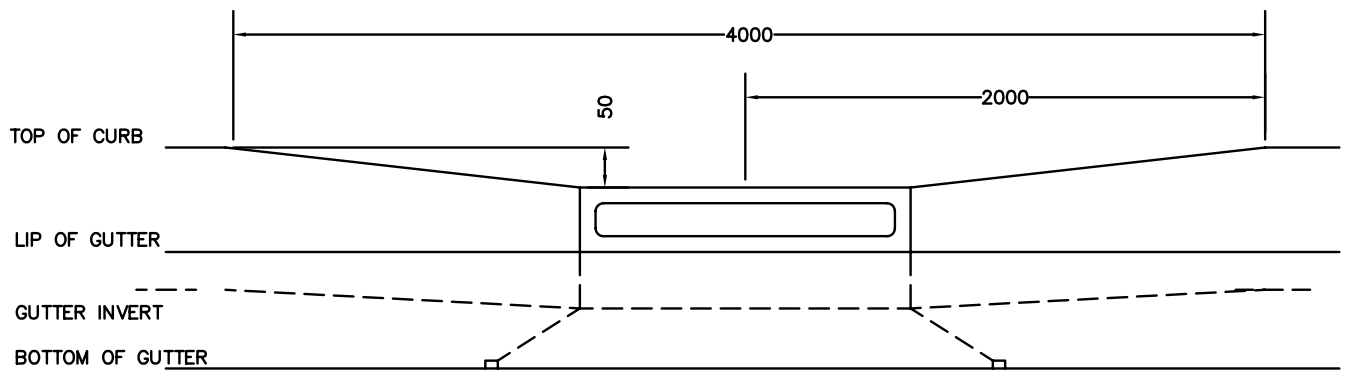
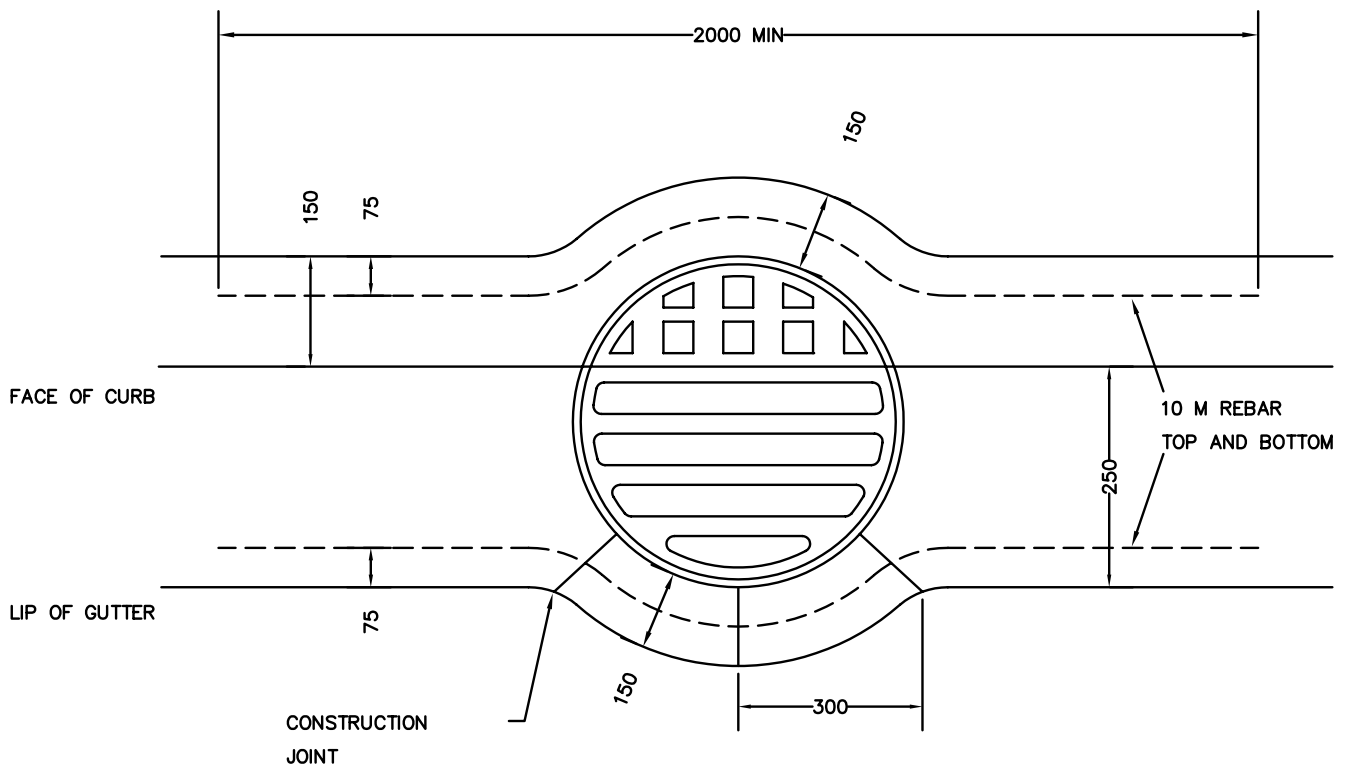
STANDARD DETAILS

SCALE: N.T.S.

DATE: JAN 2007

STD. DWG NO.

R-24



NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED.



TITLE:

TYPICAL CATCH BASIN
INSTALLATION
150 CURB & 250 GUTTER

STANDARD DETAILS

SCALE: N.T.S.

DATE: JAN 2007

STD. DWG NO.

R-25

Building Grade Certificate

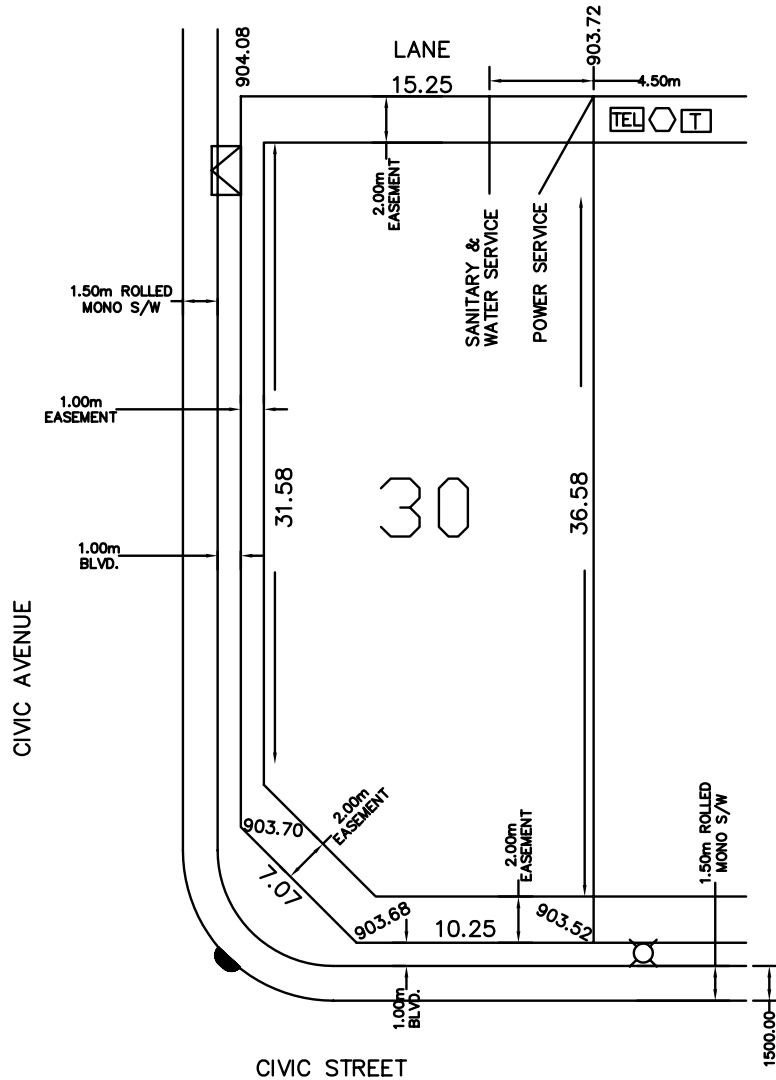
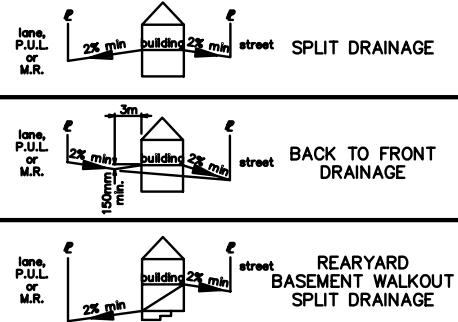
Issued by:

YHC

No.

R-26

1. When excavating in a right-of-way (easement), check for utilities.
2. Standing at the water shut-off and facing the building, the sanitary service is on the left side of the water service.
3. All dimensions are in metres and decimals thereof. The elevations are in metres above geodetic mean sea level.
4. Elevations noted on the Certificate are within 100mm of actual.
5. The builder must construct to within 100mm of the design landscape elevation and illustrated drainage patterns unless otherwise approved by the Development Officer.
6. If the information on this Certificate has been prepared by a private developer or their agent, the County accepts no responsibility for its accuracy.



- ☐ TRANSFORMER
- ELECTRICAL BOX
- ▣ TELUS PEDESTAL
- △ CA.T.V. PEDESTAL
- ⊠ MAIL BOX
- ⊗ LIGHT STANDARD
- HYDRANT
- ▬ CATCH BASINS
- DRAINAGE PATTERN

TOP OF FOOTING ELEVATIONS:

Max. depth below average sidewalk= DEPTH
 Lowest elevation= LTF

AS-BUILT SEWER INVERT ELEVATIONS:

Sanitary at right-of-way line= SANI
 Storm at right-of-way line= STM

DESIGN LANDSCAPE ELEVATIONS:

Elevation at the front of house= GRADE
 Elevation at the rear of house= GRADE

Civic Address: CIVIC

Lot: LOT Block: BLOCK Plan No.: PLAN

Developer: DEV Scale: SCALE

Drawn By: XYZ ENGINEERING SERVICES LTD. Date: DATE

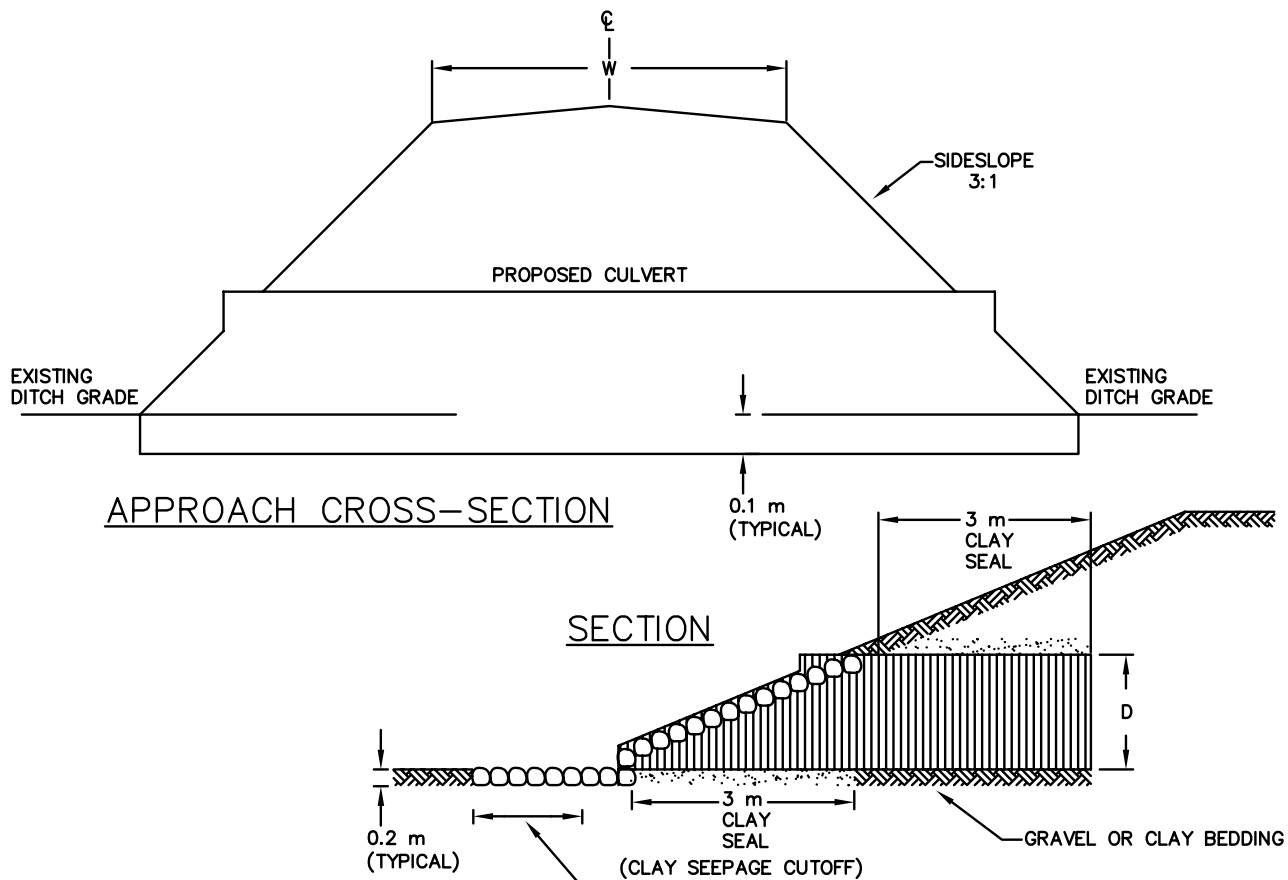
Approved By: _____ Date: _____

Received By: _____ Date: _____

I certify that the final landscape grade will be (front) _____ (rear) _____

Signature of owner or representative _____

Print full name _____



NOTES:

1. THE SIDE SLOPES OF THE APPROACH SHALL BE A MINIMUM OF 3:1 ON APPROACHES TO ALL COUNTY ROADS.

2. THE MINIMUM ALLOWABLE CULVERT DIAMETER IS 500 mm, UNLESS SPECIFIC WRITTEN APPROVAL FROM THE DIRECTOR OF PUBLIC WORKS, OR DESIGNATE.

3. THE CULVERT SHALL BE ALIGNED WITH THE BACK OF THE DITCH BOTTOM. THE CULVERT IS TO BE COUNTERSUNK 100mm BELOW THE DITCH BOTTOM

4. THE CULVERT SHALL BE OF SUCH LENGTH AS TO PROVIDE A NEAT, FINISHED APPEARANCE, WITHOUT EXCESS EXPOSED PIPE.

5. ROCK RIP-RAP SHALL BE HAND LAID AT BOTH ENDS OF THE CULVERT IN ACCORDANCE WITH THE ACCOMPANYING DRAWING.

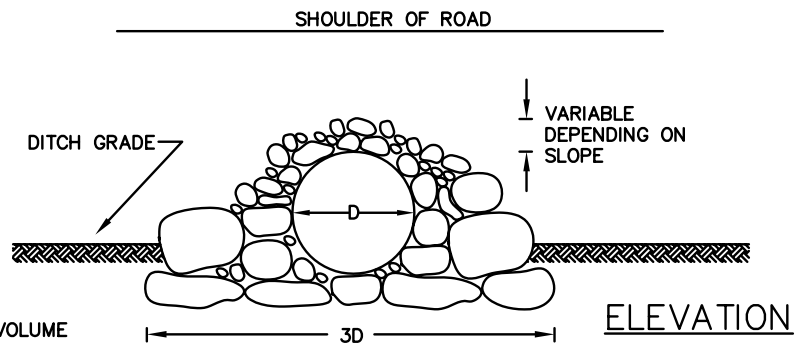
6. THE COUNTY USES THE EXPECTED TRAFFIC TYPE AND VOLUME TO DETERMINE THE MINIMUM WIDTH OF THE DRIVING SURFACE OF THE APPROACH.

7. 300 mm DEPTH OF COVER OVER C.S.P. IS REQUIRED.

8. APPROACH SURFACE TO BE AS DESIGNATED BY THE COUNTY.

9. RIP-RAP SHALL BE PLACED WITH THEIR BEDS AT RIGHT ANGLES TO THE SLOPE, THE LARGER STONES BEING USED IN THE BOTTOM COURSES AND THE SMALLER STONES AT TOP.

10. RIP-RAP SHALL BE LAID IN CLOSE CONTACT SO AS TO BREAK JOINTS AND IN SUCH A MANNER THAT THE WEIGHT OF THE STONE IS CARRIED BY THE EARTH AND NOT BY THE ADJACENT STONES.



ACCESS INSTALLATION

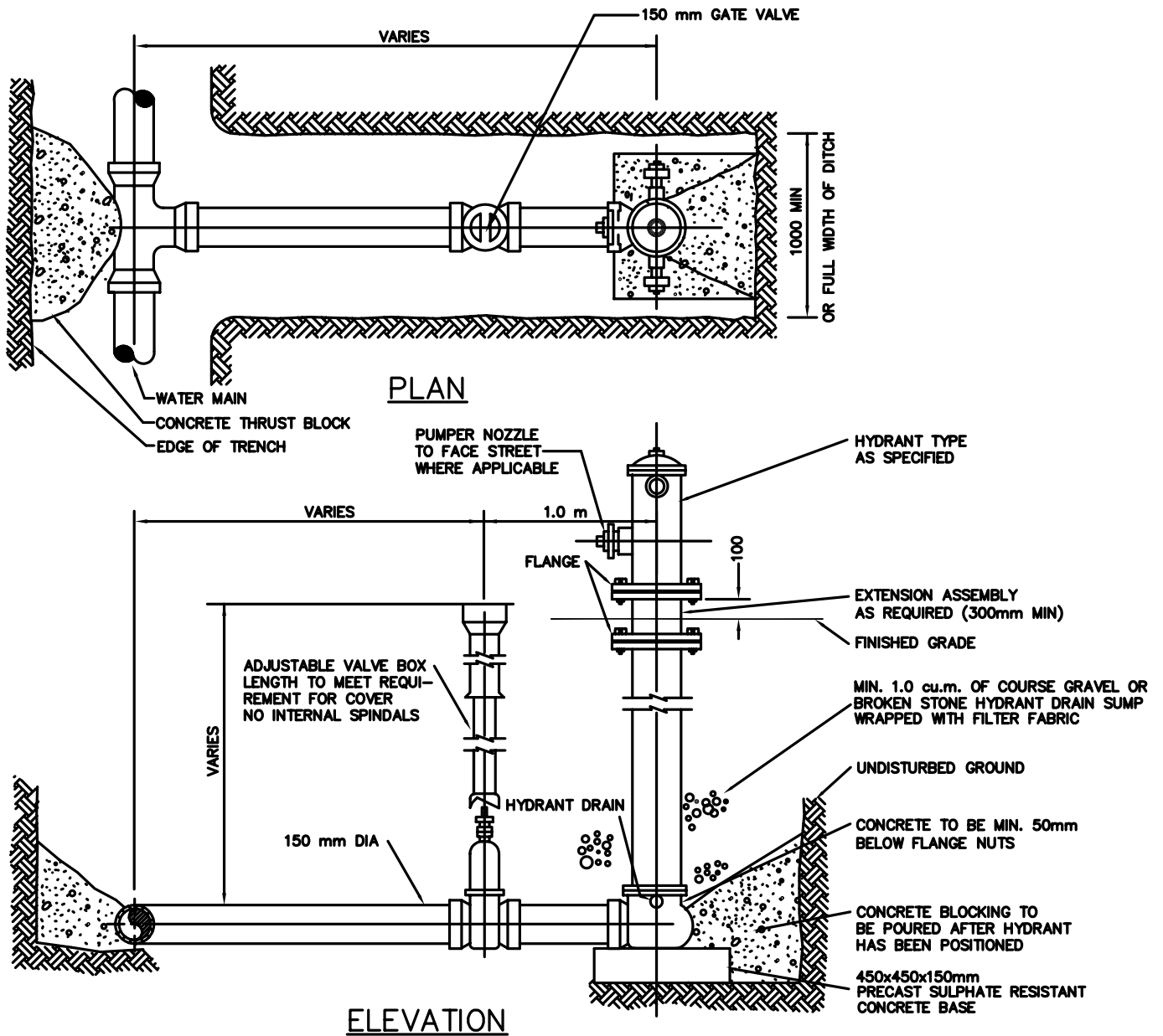
STANDARD DETAILS

SCALE: N.T.S.

DATE: JAN 2007

STD. DWG NO.

R-27



NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.
2. CONCRETE TO BE 25 MPa @ 28 DAYS.
3. HYDRANTS SHALL BE COMPRESSION TYPE CONFORMING TO AWWA C502 COMPLETE WITH PLUGGED DRAINS, STAINLESS STEEL BOLTS AND ASPHALTIC COATED HYDRANT COMPONENTS.
4. PROVIDE CATHODIC PROTECTION AS SHOWN ON STD. DWG. NO. W-06
5. THRUST BLOCKS TO BE PLACED AGAINST UNDISTURBED GROUND HAVING A MINIMUM BEARING OF 7300 kg/m²
6. CONCRETE TO BE POURED CLEAR OF ALL FLANGES, JOINTS, AND HYDRANT DRAIN.
7. APPROVED BACKFILL TO BE COMPACTED TO A MINIMUM OF 98% SPD.
8. DO NOT ALLOW PONDING OR STANDING WATER AROUND HYDRANT
9. PLACEMENT OF HYDRANT AND ORIENTATION OF PUMPER NOZZLE TO BE APPROVED.
10. HYDRANT TO BE PLUGGED OR DRAINING AS DICTATED BY SITE CONDITIONS.



TITLE:

TYPICAL VALVE & HYDRANT DETAIL

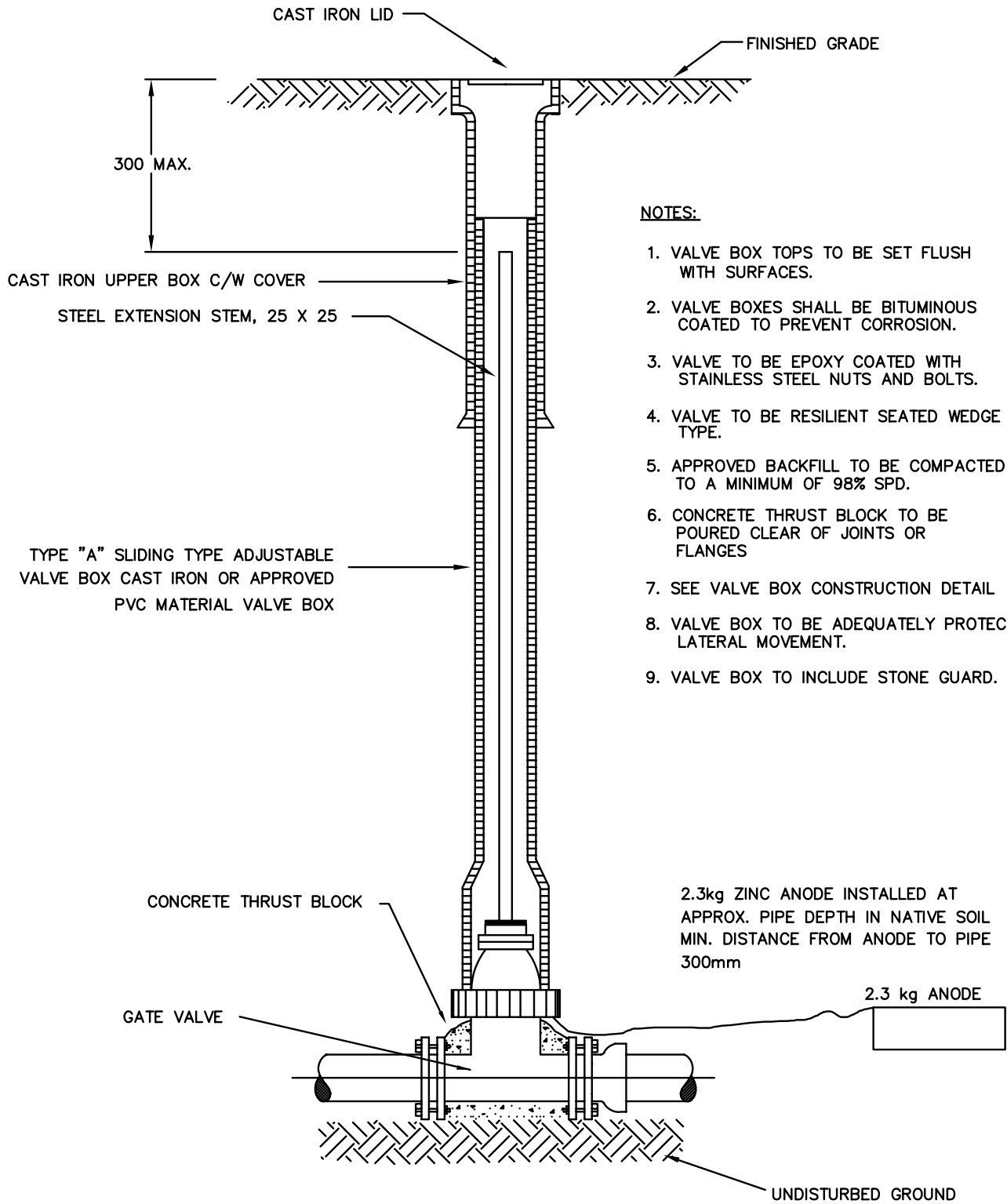
STANDARD DETAILS

SCALE: N.T.S.

DATE: JAN 2007

STD. DWG NO.

W-01



NOTES:

1. VALVE BOX TOPS TO BE SET FLUSH WITH SURFACES.
2. VALVE BOXES SHALL BE BITUMINOUS COATED TO PREVENT CORROSION.
3. VALVE TO BE EPOXY COATED WITH STAINLESS STEEL NUTS AND BOLTS.
4. VALVE TO BE RESILIENT SEATED WEDGE TYPE.
5. APPROVED BACKFILL TO BE COMPACTED TO A MINIMUM OF 98% SPD.
6. CONCRETE THRUST BLOCK TO BE POURED CLEAR OF JOINTS OR FLANGES
7. SEE VALVE BOX CONSTRUCTION DETAIL
8. VALVE BOX TO BE ADEQUATELY PROTECTED AGAINST LATERAL MOVEMENT.
9. VALVE BOX TO INCLUDE STONE GUARD.

2.3kg ZINC ANODE INSTALLED AT APPROX. PIPE DEPTH IN NATIVE SOIL
MIN. DISTANCE FROM ANODE TO PIPE 300mm

2.3 kg ANODE



TITLE:

MAIN VALVE CASING DETAIL

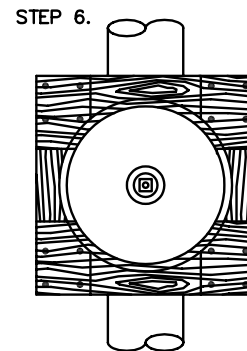
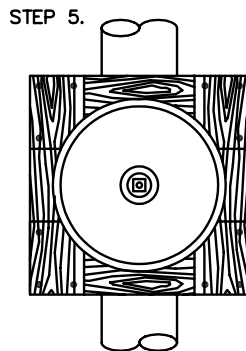
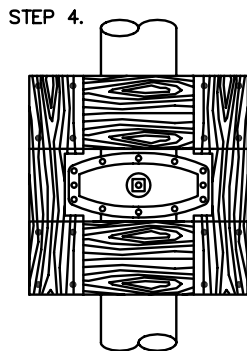
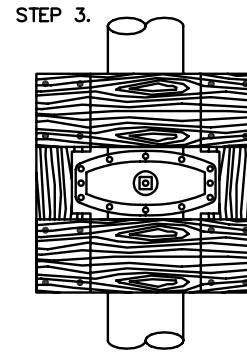
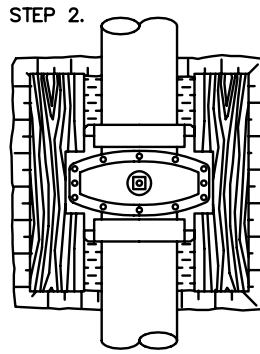
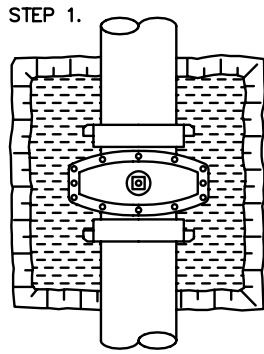
STANDARD DETAILS

SCALE: N.T.S.

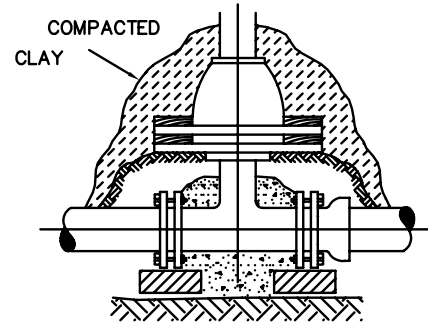
DATE: JAN 2007

STD. DWG NO.

W-02



STEP 7.



PROCEDURE:

- STEP 1. BUILD A 609 mm X 609 mm LEVEL FLAT BASE OF COMPACTED CLAY USING A FLAT TAMPER UP TO WITHIN 12 mm OF THE TOP OF THE TOP FLANGE.
- STEP 2. CUT OR NOTCH OUT TWO OF THE 50X200X600 TREATED BOARDS THE WIDTH OF VALVE FLANGE AND LAY ON BASE PARALLEL TO PIPE.
- STEP 3. INSTALL TWO 50x200x600 TREATED BOARDS TRANSVERSELY OR AT RIGHT ANGLES TO THE FIRST SET AND NO CLOSER TO THE FLANGE THAN THE CUTOUT SO THAT THEY DO NOT PROTRUDE OVER THE FLANGE. NAIL WITH GALVANIZED COATED NAILS AS ILLUSTRATED. APPROX. 6mm CLEARANCE TO FLANGE.
- STEP 4. ADD AND NAIL ALTERNATE LAYERS OF BOARDS MAKING SURE EDGES ARE NO CLOSER TO VALVE THAN CUTOUT, CONTINUE UNTIL MINIMUM REQUIRED CLEARANCE (100 mm) FROM TOP OF VALVE BONNET TO VALVE NUT IS OBTAINED.
- STEP 5. CENTER VALVE BONNET SECTION OVER OPERATING NUT AND FASTEN WITH FOUR NAILS WITH THE TOP 19 mm BENT OVER TO SECURE IN PLACE.

- STEP 6. TWO PIECES OF BOARD ARE NOW CUT OUT TO OUTSIDE CIRCUMFERENCE OF BONNET AND UNDERCUT TO ACCOMODATE BONNET THICKNESS. THESE ARE NOW NAILED TRANSVERSELY TO LAST LAYER OF BOARDS.



CUT TO CIRCUMFERENCE OF VALVE BONNET AND BEVEL

- STEP 7. APPROPRIATE LENGTHS OF BOTTOM AND TOP SECTION OF CASING ARE NOW INSTALLED AND BACKFILLED WITH COMPACTED CLAY TO ABOVE JOINT.



TITLE:

VALVE BOX CONSTRUCTION DETAIL

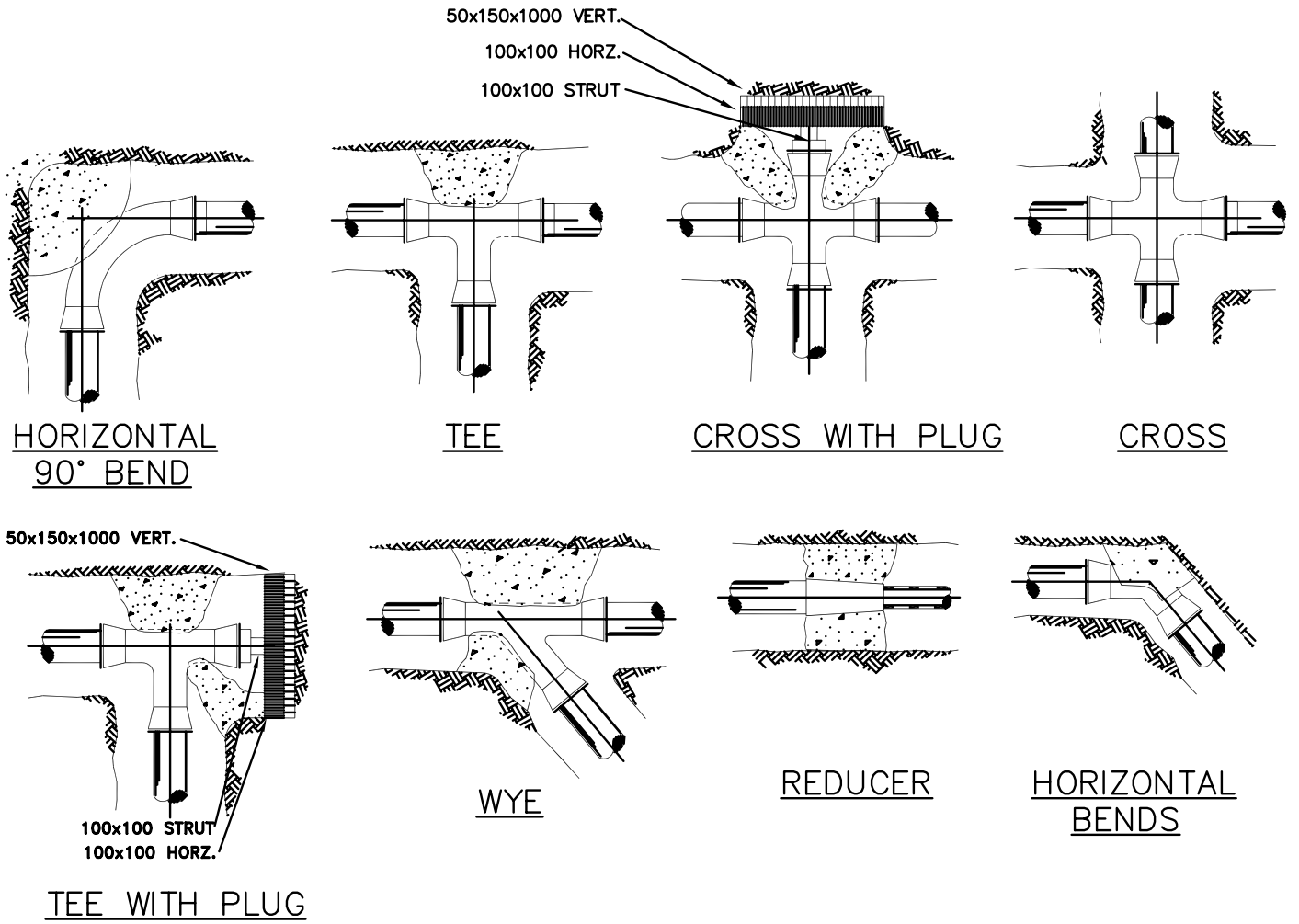
STANDARD DETAILS

SCALE: N.T.S.

DATE: JUNE 2005

STD. DWG NO.

W-03



NOTE:

1. ALL DIMENSIONS IN MILLIMETRES.
2. ALL FITTINGS TO BE WRAPPED IN 6 ML POLYETHYLENE PRIOR TO POURING CONCRETE.
3. ALL CONCRETE TO BE MIN. 25 MPa @ 28 DAYS.
4. THE REQUIRED BEARING AREA SHALL BE DETERMINED BY THE CONTRACTOR TO SUIT SOIL CONDITIONS.

HORIZONTAL THRUST BLOCK BEARING AREA						
MINIMUM CONCRETE AREA IN CONTACT WITH UNDISTURBED SOIL (sq. m)						
FITTING	SIZE OF MAIN (mm)					
	150	200	250	300	400	500
Dead End Main & Tee	0.35	0.62	0.97	1.40	2.49	3.90
11 1/4 Degree Bend	0.07	0.12	0.20	0.28	0.50	0.78
22 1/2 Degree Bend	0.14	0.24	0.38	0.55	0.97	1.52
45 Degree Bend	0.27	0.48	0.75	1.07	1.91	2.98
90 Degree Bend	0.50	0.88	1.38	1.98	3.53	5.51
Valve & Reducer	0.35	0.62	0.97	1.40	2.49	3.90

NOTE:

- BEARING AREA CALCULATED USING THE FOLLOWING:
 - (a) HYDRAULIC PRESSURE 1380 kPa.
 - (b) SOIL BEARING CAPACITY 72 Kpa.
- CONCRETE STRENGTH TO BE 25MPa.
- CONCRETE TO BE CLEAR OF BELLS & PIPE.
- PLACE 6ml POLYETHYLENE BETWEEN CONCRETE AND PIPE.
- SEE DWG. DET-03 FOR "CLASS B BEDDING DETAILS" FOR "d" DEPTH.
- BOLD LINE REPRESENTS THE BEARING SURFACE.



TITLE:

THRUST BLOCK DETAILS

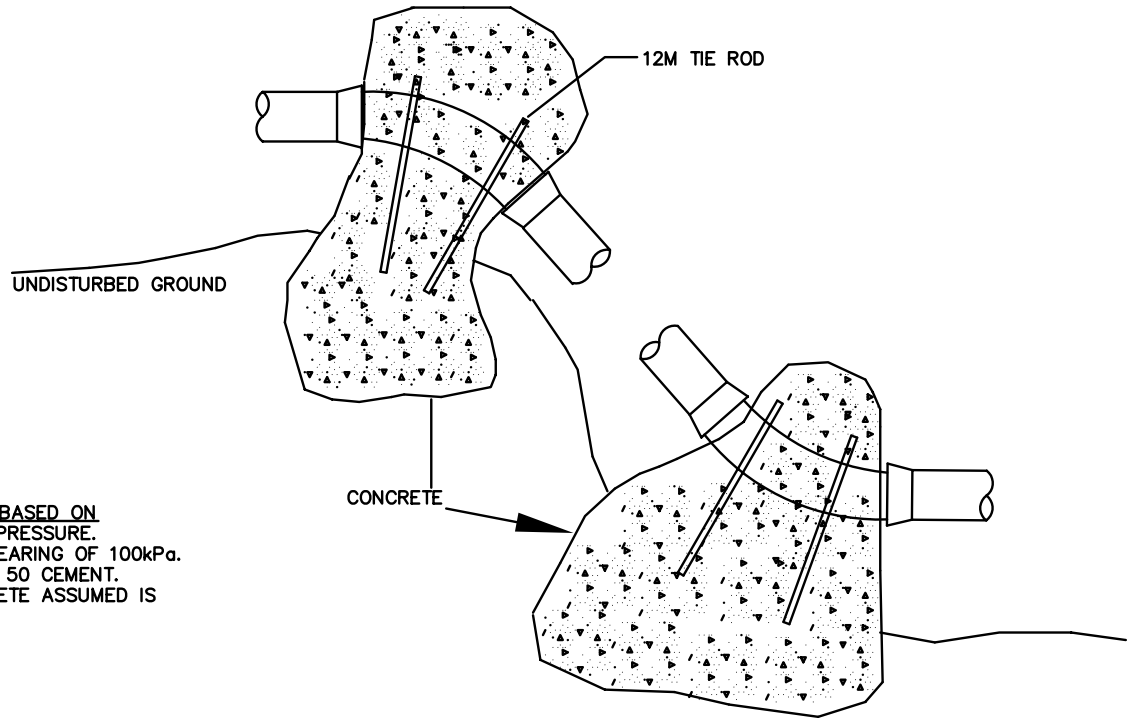
STANDARD DETAILS

SCALE: N.T.S.

DATE: JAN 2007

STD. DWG NO.

W-04



THRUST BLOCK DESIGN IS BASED ON
 1. 1035kPa MAX. SYSTEM PRESSURE.
 2. A MIN VERTICAL SOIL BEARING OF 100kPa.
 3. CONCRETE 25MPa TYPE 50 CEMENT.
 4. UNIT WEIGHT OF CONCRETE ASSUMED IS 2400kb/m³

UPWARD THRUST (GRAVITY) TABLE

FOR CALCULATION OF BASIC THRUST
 BLOCK BEARING AREA (IN SQUARE METERS)

BEND \ PIPE SIZE	PIPE SIZE						
	150	200	250	300	350	400	450
11.25°	0.16	0.28	0.45	0.64	0.87	1.14	1.44
22.50°	0.32	0.57	0.88	1.27	1.73	2.26	2.82
30°	0.42	0.75	1.17	1.69	2.3	3.00	3.80
45°	0.62	1.11	1.73	2.50	3.40	4.44	5.62

DOWNWARD THRUST TABLE

FOR CALCULATION OF BASIC THRUST
 BEARING AREA (IN SQUARE METERS)

BEND \ PIPE SIZE	PIPE SIZE						
	150	200	250	300	350	400	450
11.25°	0.04	0.07	0.11	0.15	0.21	0.27	0.34
22.50°	0.08	0.13	0.21	0.30	0.41	0.53	0.67
30°	0.10	0.18	0.28	0.40	0.54	0.71	0.89
45°	0.15	0.26	0.41	0.59	0.80	1.05	1.32



TITLE:

VERTICAL BEND
 THRUST BLOCK DETAIL

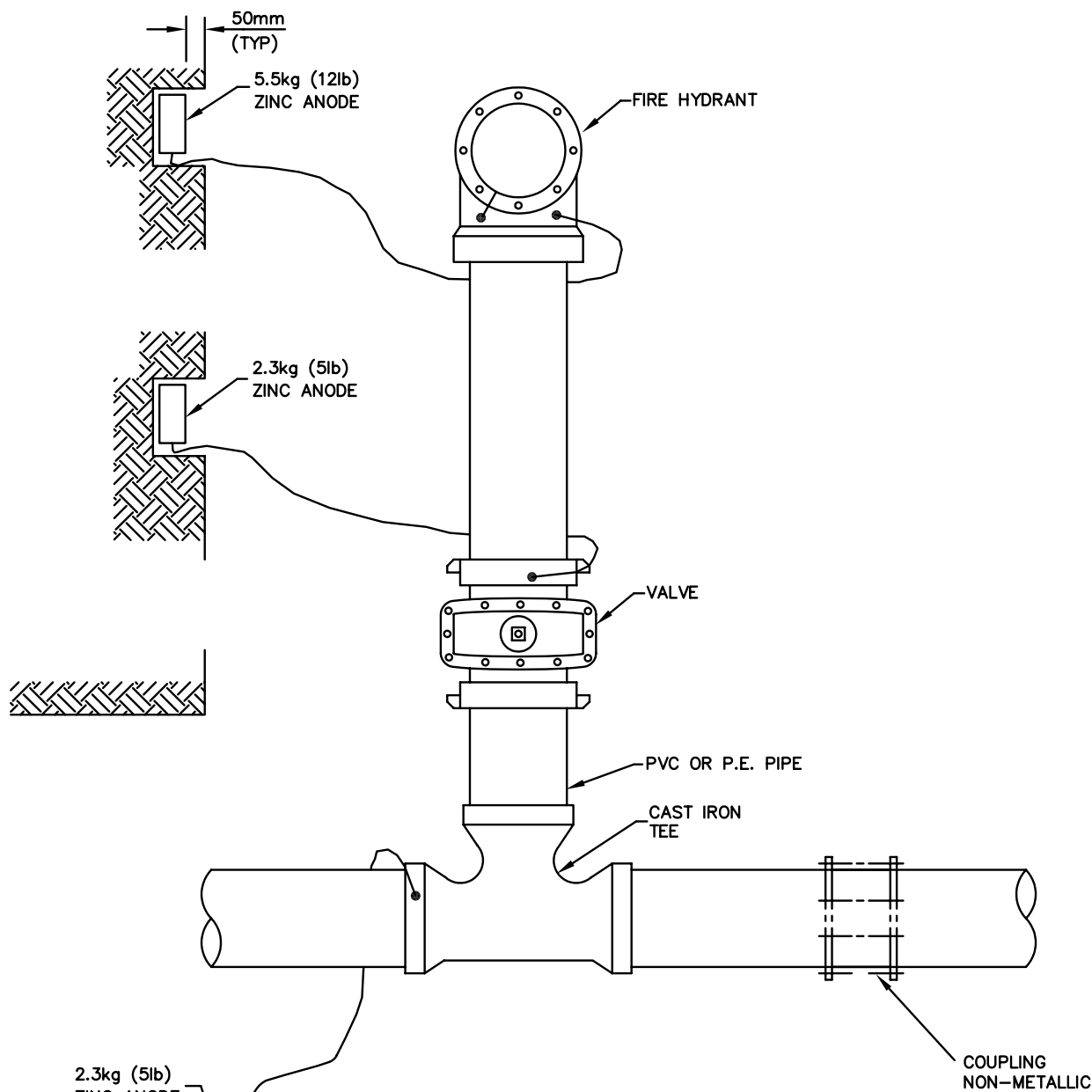
STANDARD DETAILS

SCALE: N.T.S.

DATE: JAN 2007

STD. DWG NO.

W-05



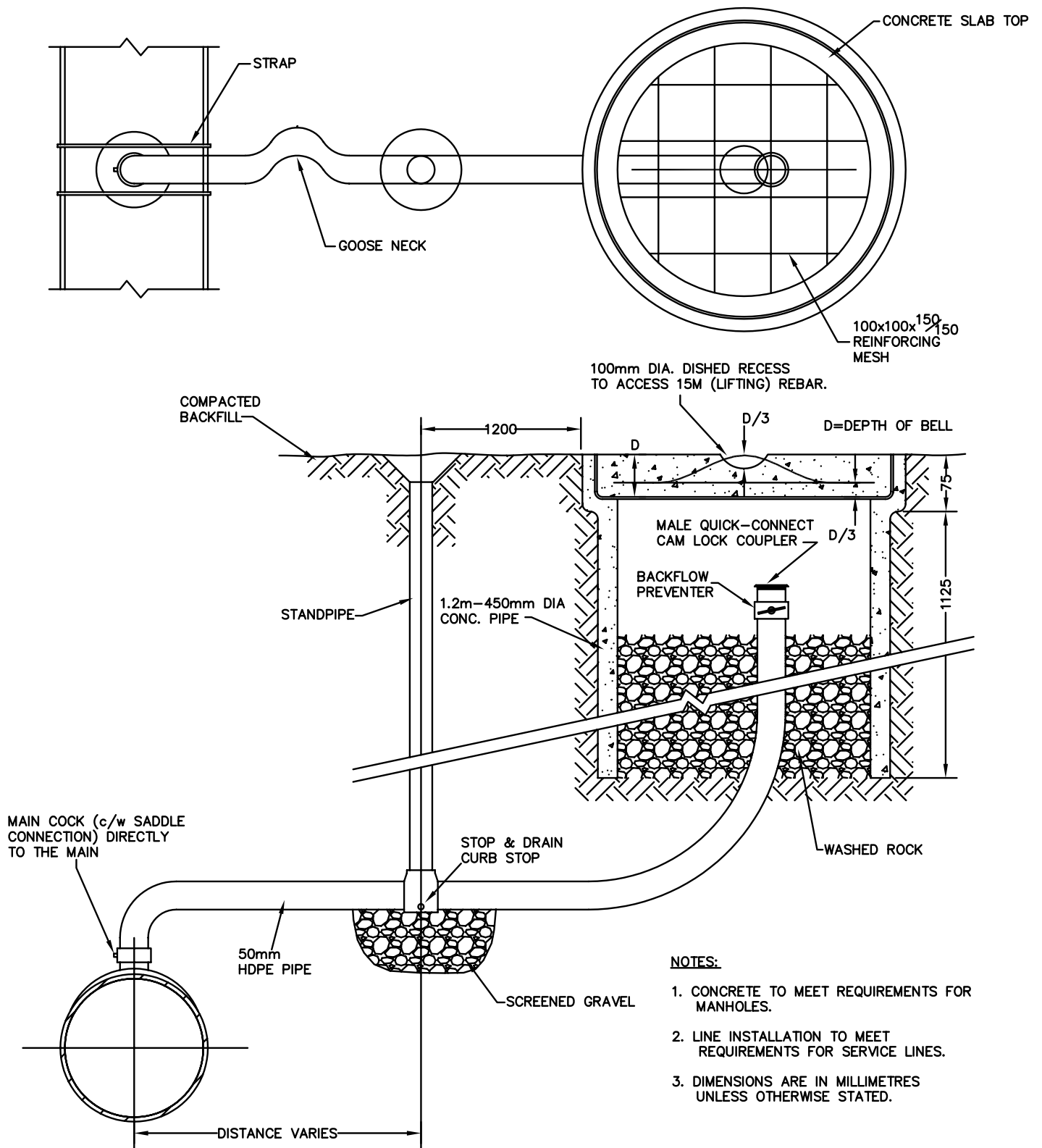
NOTES:

1. MIN DISTANCE FROM ANODE TO PIPE IS 300mm.
2. INSTALL ANODE AT APPROX. PIPE DEPTH IN NATIVE SOIL.
3. ALL ZINC ANODES ON FITTINGS AND VALVES ARE 2.3 kg (5lb).
4. ALL ZINC ANODES ON HYDRANTS ARE 5.5 kg (12lb).
5. ZINC ANODES TO BE EMBEDDED INTO TRENCH WALL TO PROVIDE FOR A MINIMUM OF 50mm OF NATIVE CLAY COMPLETELY SURROUNDING THE ANODE.
6. ANODES TO BE AT LEAST 300mm CLEAR OF THRUST BLOCK.
7. REPLACE CLAY OVER ANODES AND COMPACT.



TITLE:
 TYPICAL ANODE
 INSTALLATION OF VALVES
 IRON FITTINGS & HYDRANTS

STANDARD DETAILS	
SCALE: N.T.S.	
DATE: JAN 2007	
STD. DWG NO.	W-06



TITLE:

AIR RELIEF VALVE AND
FLUSHING CHAMBER

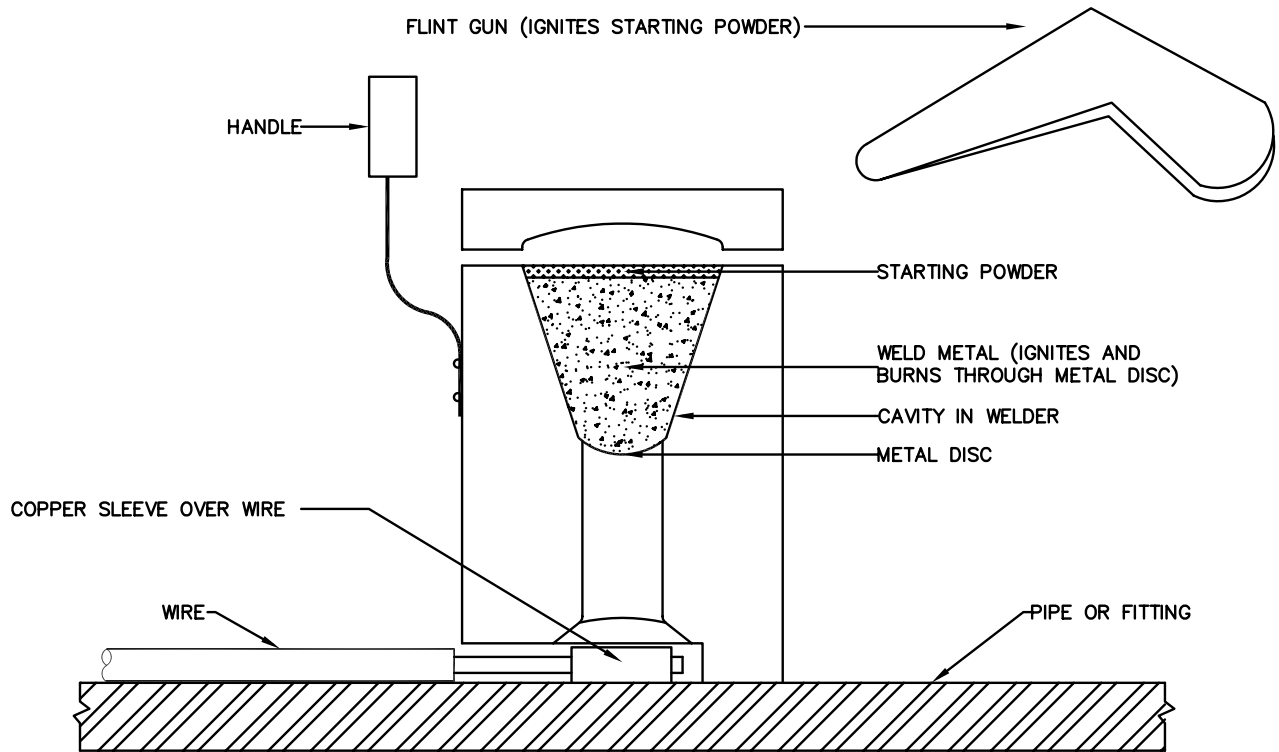
STANDARD DETAILS

SCALE: N.T.S.

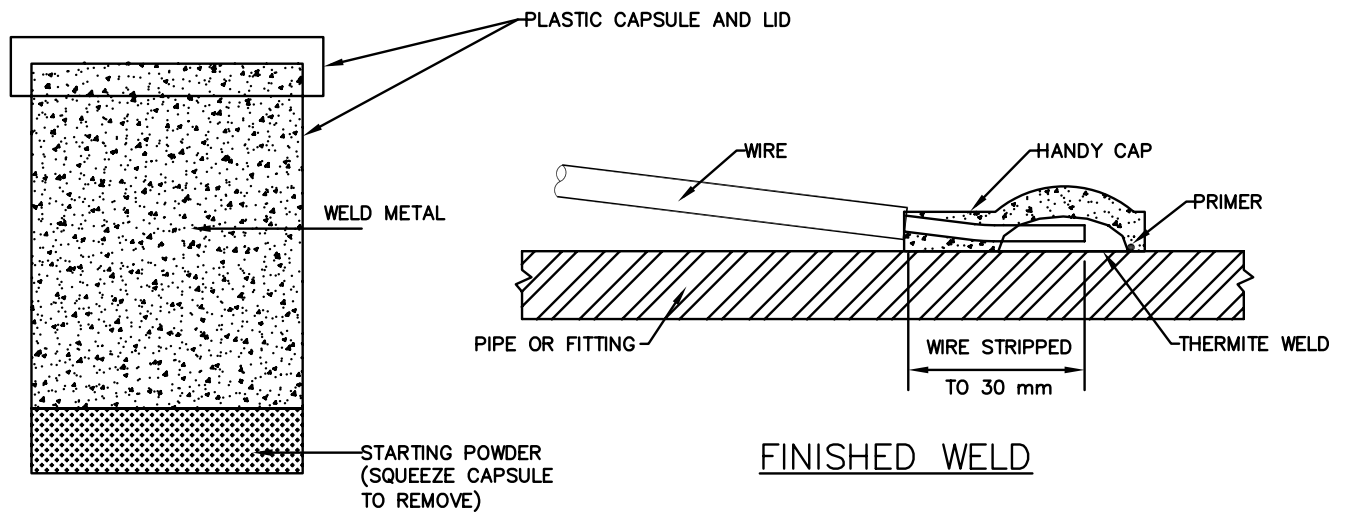
DATE: JAN 2007

STD. DWG NO.

W-07



CADWELD



FINISHED WELD

WELD METAL CAPSULE

NOTES:

1. CADWELD TO BE PERFORMED AS PER MANUFACTURERS SPECIFICATIONS



TITLE:

ANODE INSTALLATION CADWELD

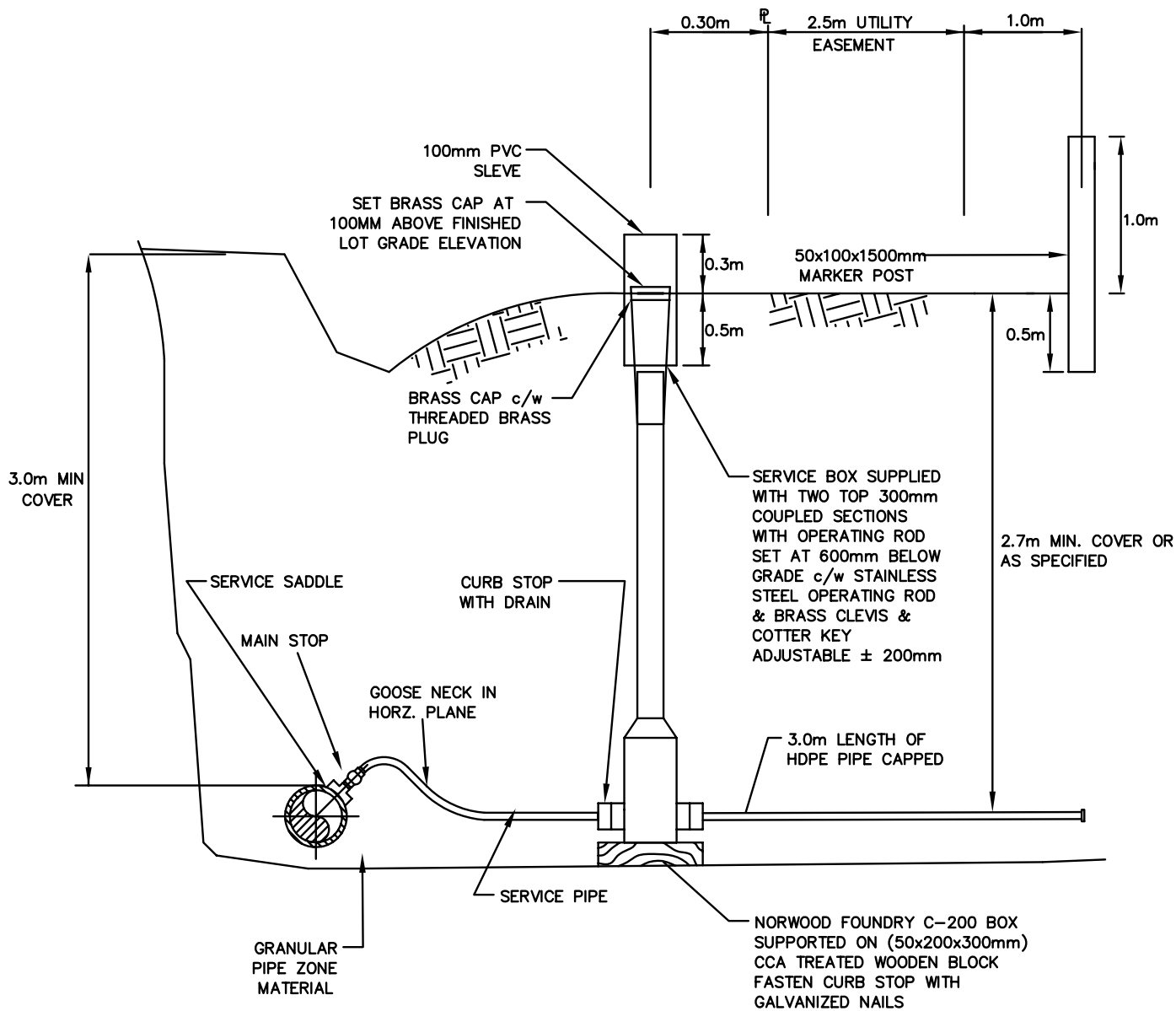
STANDARD DETAILS

SCALE: N.T.S.

DATE: JAN 2007

STD. DWG NO.

W-08



TITLE:

TYPICAL WATER SERVICE CONNECTION

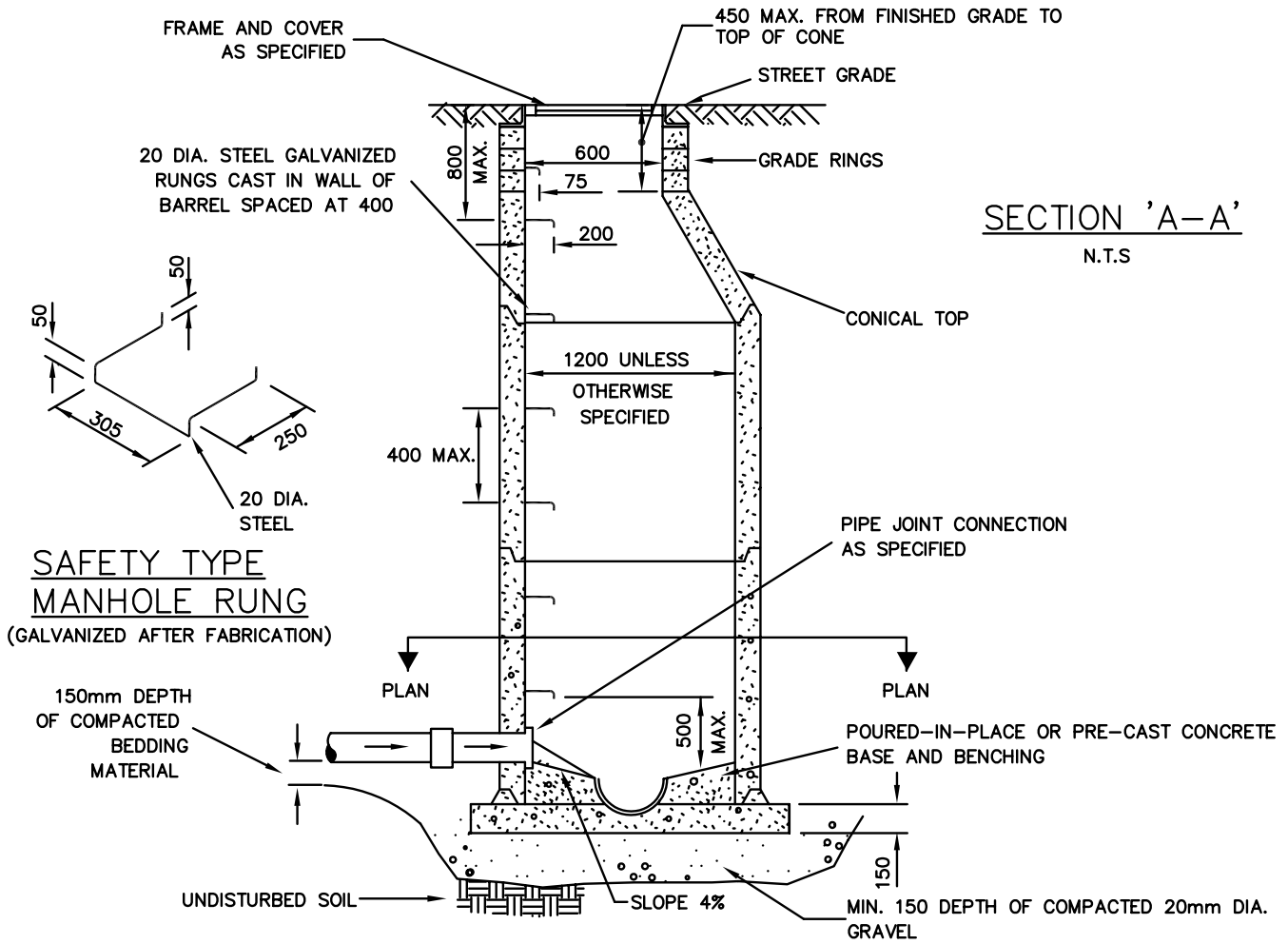
STANDARD DETAILS

SCALE: N.T.S.

DATE: JAN 2007

STD. DWG NO.

W-09

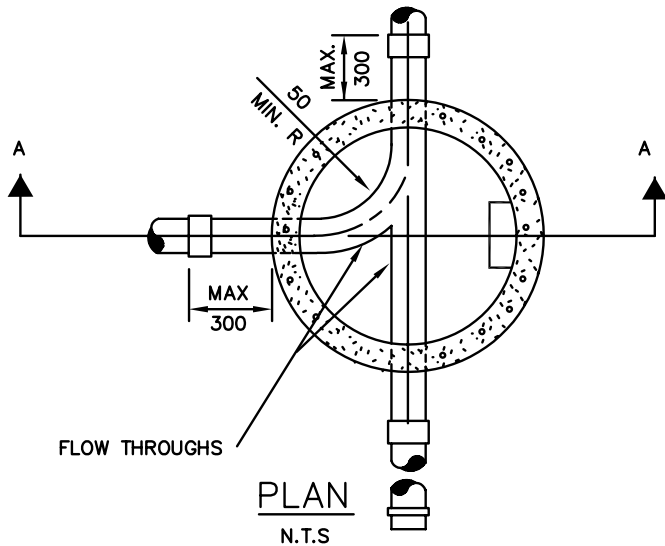


**SAFETY TYPE
MANHOLE RUNG**
(GALVANIZED AFTER FABRICATION)

SECTION 'A-A'
N.T.S.

NOTES:

1. ALL PRE-CAST MANHOLES MUST CONFORM TO A.S.T.M. SPECIFICATIONS C478.
2. POURED-IN-PLACE CONCRETE SHALL HAVE 28 DAYS COMPRESSIVE STRENGTH OF AT LEAST 25 MPa.
3. ALL JOINTS TO BE SET WITH RUBBER GASKET AND SET WITH NON-SHRINK GROUT, INSIDE AND OUT, FOR THE FULL CIRCUMFERENCE.
4. FORM FLOW TROUGH IN PARTIALLY SET CONCRETE AND TROWEL SMOOTH.
5. ALL DIMENSIONS GIVEN IN MILLIMETRES UNLESS OTHERWISE STATED.
6. MAX. DIST. FROM RIM TO TOP RUNG IS 800 mm.
7. BACKFILL AROUND MH. WITH SELECT NATIVE MATERIAL. COMPACT TO 98% S.P.D.
8. FLAT TOP SECTION TO BE USED FOR MANHOLES UP TO 1.8 m BURY.
9. ALL JOINTS TO BE WATERTIGHT. METHODS TO BE CONSISTENT WITH SITE CONDITIONS.
10. FOR MANHOLES 5.0 m IN DEPTH OR GREATER, A SAFETY PLATFORM SHALL BE INSTALLED.
11. MANHOLES TO MEET REQUIREMENTS OF MANHOLE DETAILS AND SPECIFICATIONS.
12. SAFETY STEPS TO BE PROVIDED, SPACED AT 400 MAX. FIRST STEP 150 MAX. BELOW FRAME, LAST STEP 500 MAX. ABOVE BASE.



TITLE:

MANHOLE DETAIL
TYPE 5A PRECAST

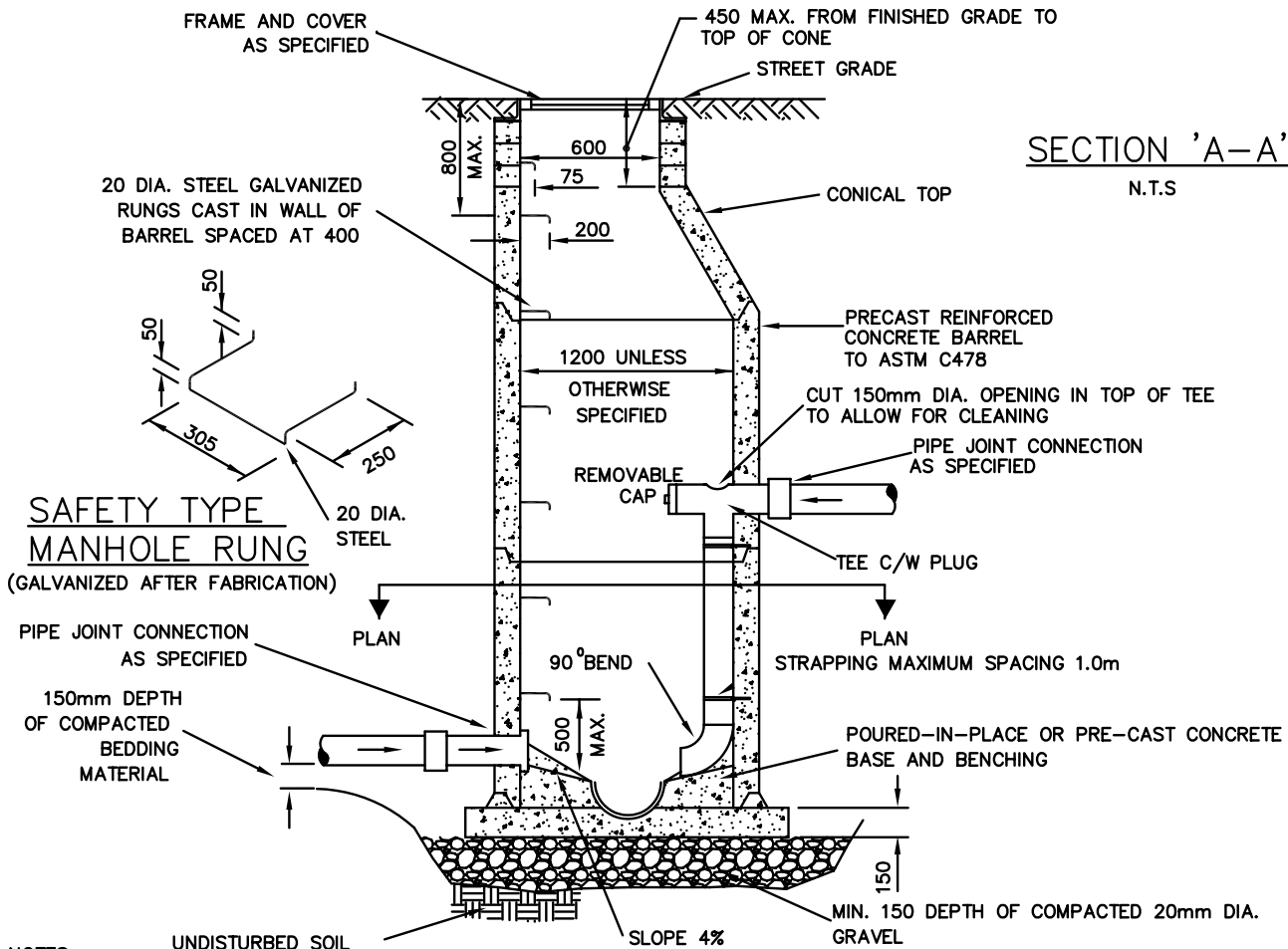
STANDARD DETAILS

SCALE: N.T.S.

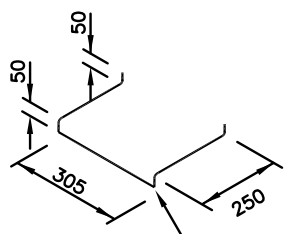
DATE: JAN 2007

STD. DWG NO.

S-01

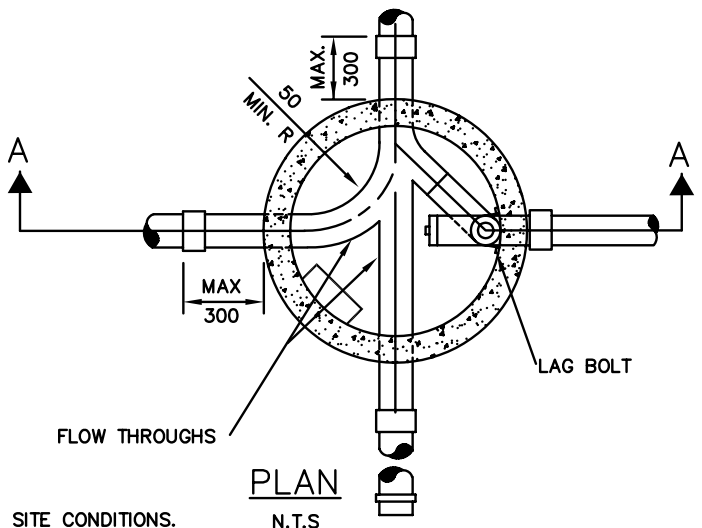


**SAFETY TYPE
MANHOLE RUNG**
(GALVANIZED AFTER FABRICATION)



NOTES:

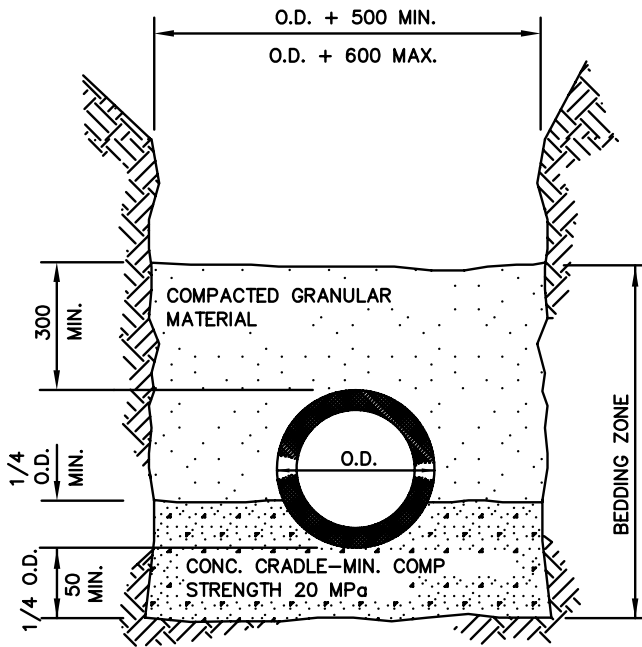
1. ALL PRE-CAST MANHOLES MUST CONFORM TO A.S.T.M. SPECIFICATIONS C478.
2. POURED-IN-PLACE CONCRETE SHALL HAVE 28 DAYS COMPRESSIVE STRENGTH OF AT LEAST 25 MP_a.
3. ALL JOINTS TO BE SET WITH RUBBER GASKET AND SET WITH NON-SHRINK GROUT, INSIDE AND OUT, FOR THE FULL CIRCUMFERENCE.
4. FORM FLOW THROUGH IN PARTIALLY SET CONCRETE AND TROWEL SMOOTH.
5. ALL DIMENSIONS ARE GIVEN IN MILLIMETRES UNLESS OTHERWISE STATED.
6. MAX. DIST. FROM RIM TO TOP RUNG IS 800 mm.
7. BACKFILL AROUND MH. WITH SELECT NATIVE MATERIAL AND COMPACT TO 98 % S.P.D.
8. FLAT TOP SECTION TO BE USED FOR MANHOLES UP TO 1.8 m BURY.
9. ALL JOINTS TO BE WATERTIGHT. METHODS TO BE CONSISTENT WITH SITE CONDITIONS.
10. FOR MANHOLES 5.0 m IN DEPTH AND GREATER, A SAFETY PLATFORM SHALL BE INSTALLED.
11. MANHOLES TO MEET REQUIREMENTS OF MANHOLE DETAILS AND SPECIFICATIONS.
12. LAG BOLTS AND STRAPPING ARE TO BE INSTALLED IMMEDIATELY BELOW THE TEE AND A CONTINUAL 1.0 m VERTICAL SPACING TO THE BASE.
13. DIAMETER, SIZE, AND TYPE OF VERTICAL PIPE TO MATCH INLET PIPE.
14. SAFETY STEPS TO BE PROVIDED, SPACED AT 400 MAX. FIRST STEP 800 MAX. BELOW FRAME, LAST STEP 500 MAX. ABOVE BASE.



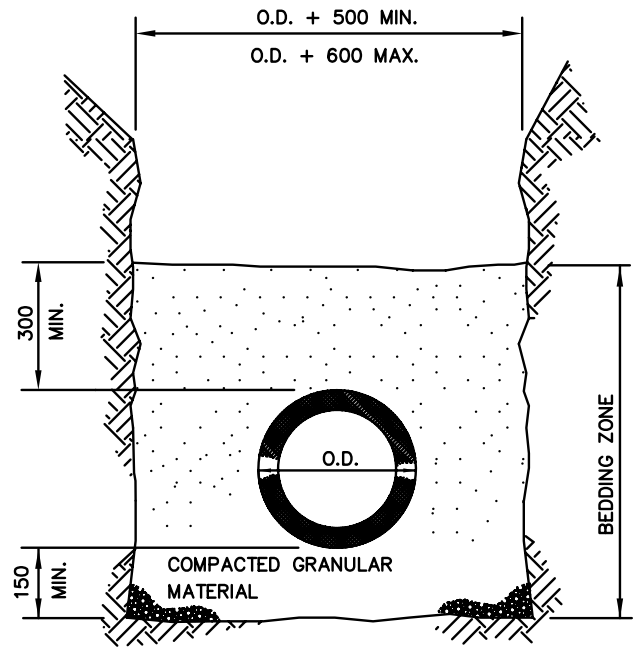
TITLE:
INTERIOR DROP MANHOLE DETAIL

STANDARD DETAILS	
SCALE: N.T.S.	
DATE: JAN 2007	
STD. DWG NO.	S-02

CLASS 'A' BEDDING



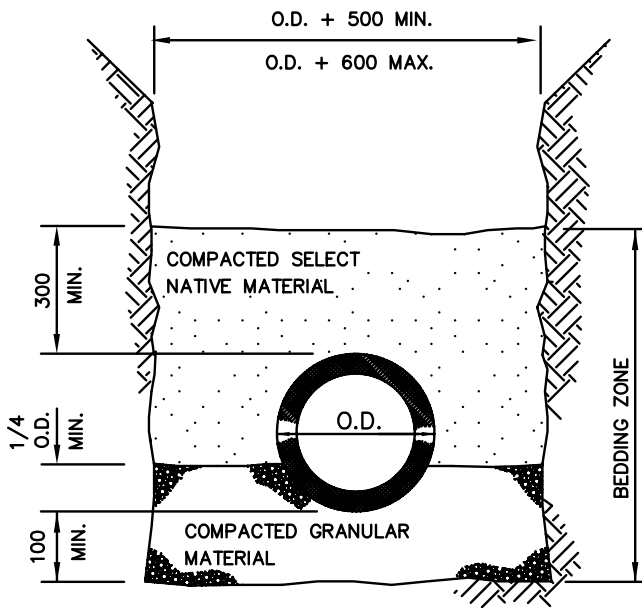
CLASS 'B' BEDDING



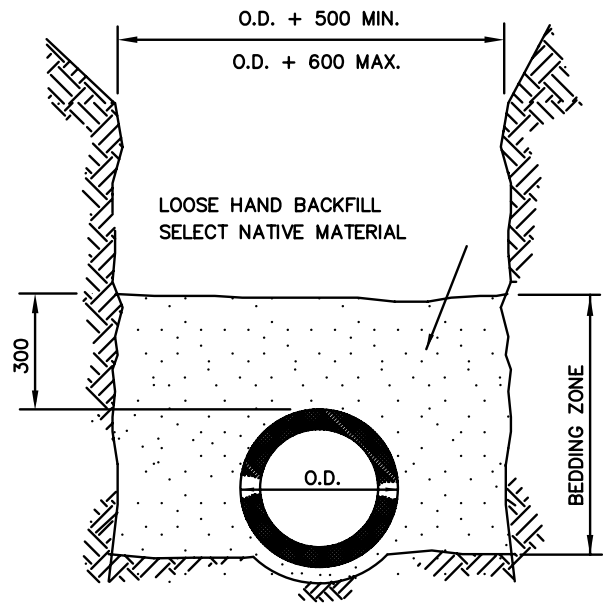
NOTE:

1. COMPACTION OF BEDDING ZONE SHALL BE AS PER SPECIFICATIONS. (MIN. 95% S.P.D.)
2. ALL DIMENSIONS ARE GIVEN IN MILLIMETRES UNLESS OTHERWISE STATED.
3. BACKFILL COMPACTION REQUIREMENTS WILL VARY. BACKFILL ABOVE PIPE ZONE TO BE APPROVED MATERIAL.
4. TRENCH SIDE SLOPES TO BE CONSISTENT WITH OCCUPATIONAL HEALTH AND SAFETY REQUIREMENTS

CLASS 'C' BEDDING



CLASS 'D' BEDDING



TITLE:

PIPE BEDDING DETAILS

STANDARD DETAILS

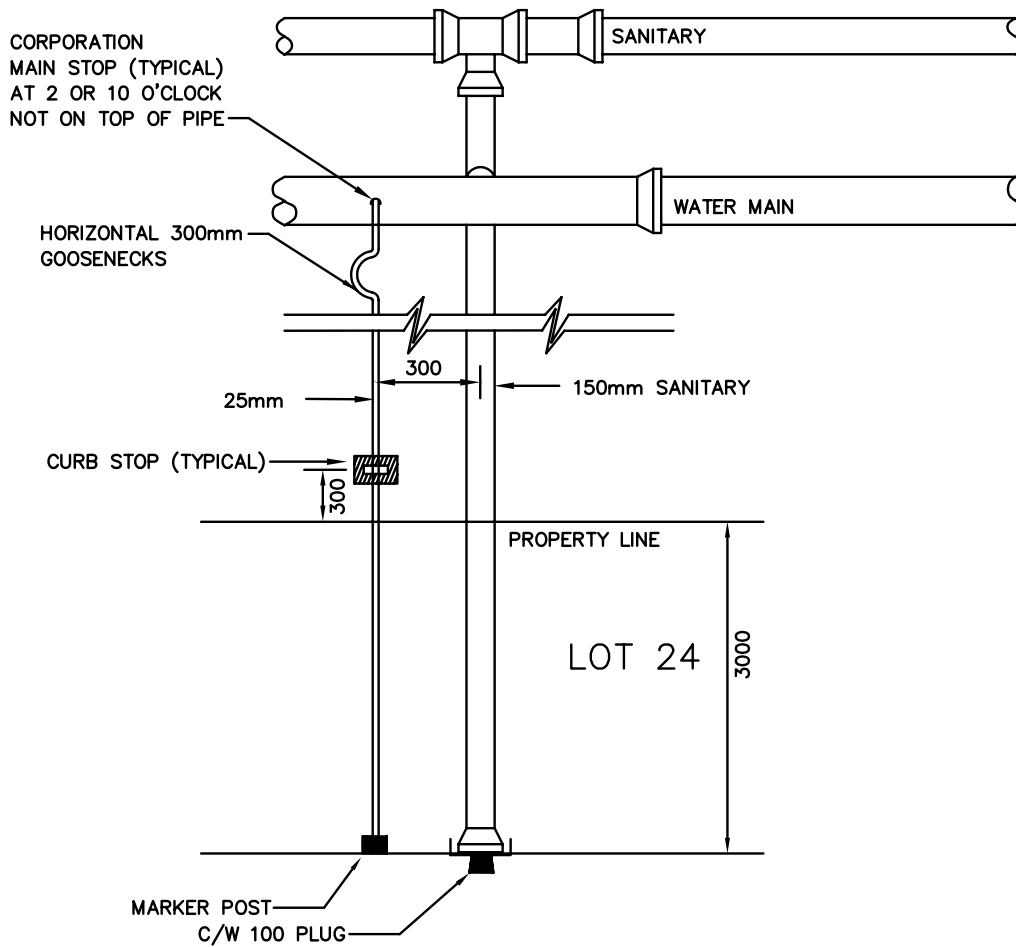
SCALE: N.T.S.

DATE: JAN 2007

STD. DWG NO.

S-03

TYPICAL SINGLE SERVICE



NOTES:

1. YELLOWHEAD COUNTY IS NOT RESPONSIBLE FOR OWNERSHIP OR MAINTENANCE OF SERVICES ON PRIVATE PROPERTY.
2. ENDS OF SERVICES TO BE MARKED WITH A 50mm x 100mm STAKE PROTRUDING 700mm ABOVE GROUND PAINTED AS FOLLOWS:
 - A. CURBSTOP - BLUE
 - B. END OF SERVICE IN SEPERATE TRENCH - GREEN
 - C. END OF WATER SERVICE INSIDE PRIVATE PROPERTY - BLUE
3. WHERE STORM SEWER SERVICE IS TO BE INSTALLED, PLACE 0.3m FROM SANITARY ON FAR SIDE FROM WATER.
4. SEWER SERVICES MUST BE PROPERLY CAPPED.
5. ALL DIMENSIONS GIVEN IN MILLIMETRES UNLESS OTHERWISE STATED.
6. YELLOWHEAD COUNTY MAY REQUIRE ALTERNATE PLACEMENT OF CURB STOP.



TITLE:

SINGLE SERVICE LAYOUT

STANDARD DETAILS

SCALE: N.T.S.

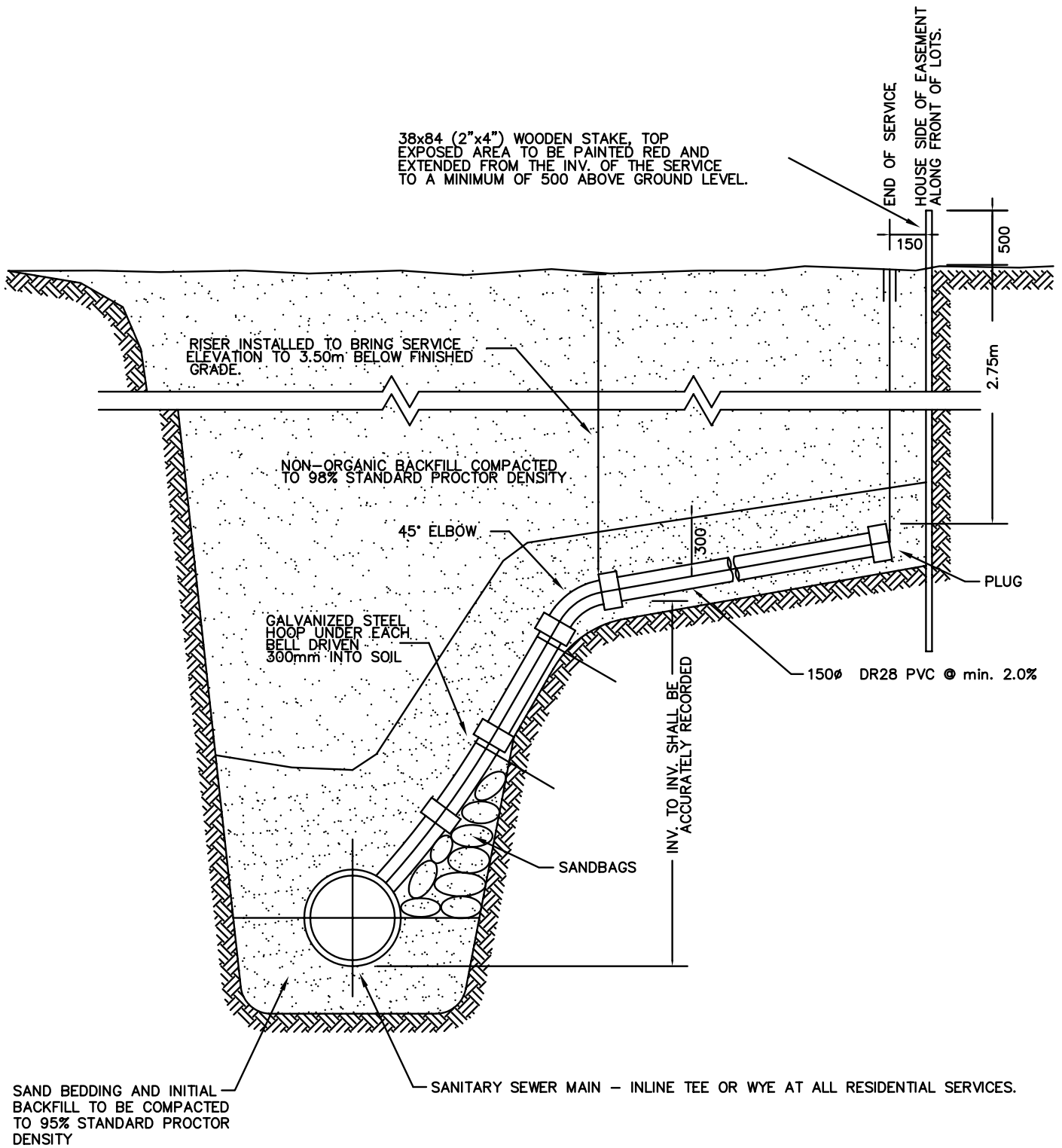
DATE: JAN 2007

STD. DWG NO.

S-04

NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED.



TITLE:

RESIDENTIAL SANITARY SEWER
SERVICE RISER CONNECTION

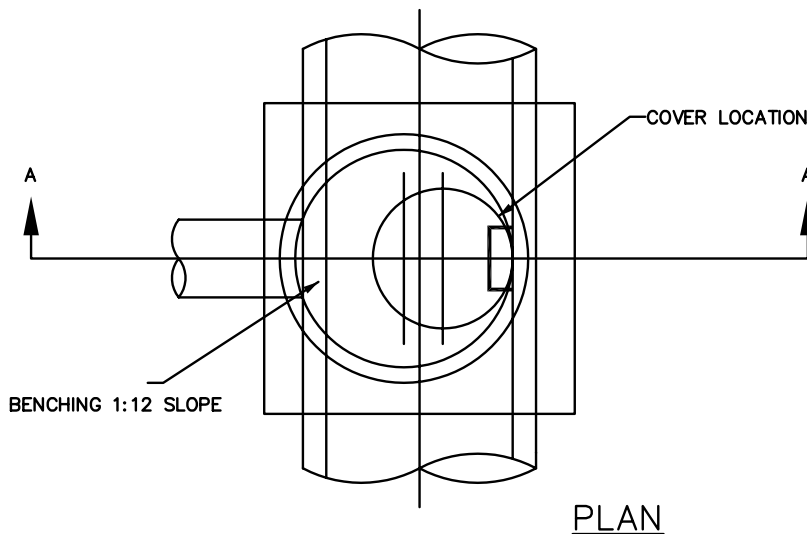
STANDARD DETAILS

SCALE: N.T.S.

DATE: JAN 2007

STD. DWG NO.

S-05



PLAN

MANHOLE FRAME & COVER
AS SPECIFIED - TOP ELEVATION
AS SPECIFIED IN STREET SPECIFICATIONS

GRADE RINGS AS REQUIRED.
WITH WATERTIGHT JOINTS.

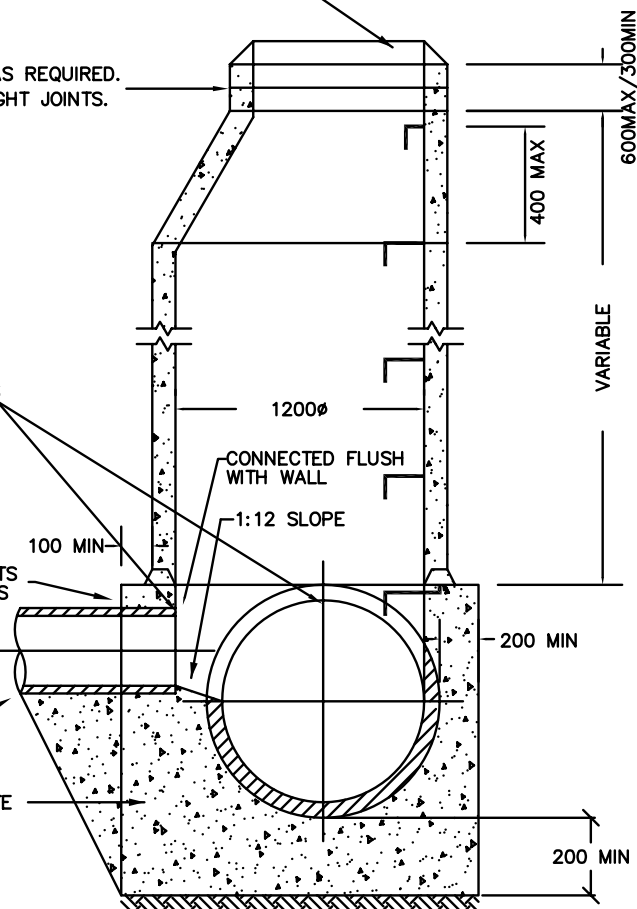
NOTE
MATCH OBVERTS

WATERTIGHT JOINTS
AND CONNECTIONS

CLASS A
CONCRETE
BEDDING TO
FIRST JOINT

25 MPa CONCRETE

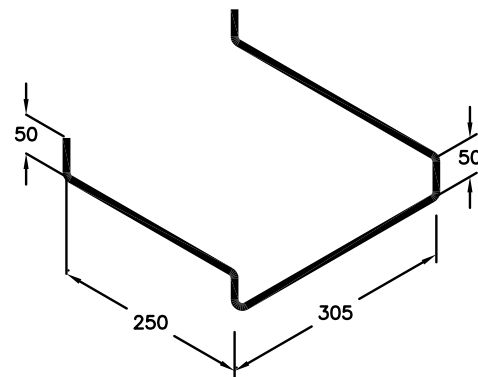
UNDISTURBED SUITABLE SOLID SOIL
OR MECHANICALLY COMPACTED TO
98% STANDARD PROCTOR DENSITY



SECTION A-A

NOTES:

1. PRE-CAST CONCRETE COMPONENTS MUST CONFORM TO A.S.T.M. SPECIFICATIONS C478.
2. POURED-IN-PLACE CONCRETE TO HAVE 28 DAYS COMPRESSIVE STRENGTH OF AT LEAST 25 MPa.
3. ALL JOINTS TO BE SET WITH RUBBER GASKET AND FINISHED WITH NON-SHRINK GROUT, INSIDE AND OUTSIDE, FOR THE FULL CIRCUMFERENCE.
4. FORM FLOW TROUGH IN PARTIALLY SET CONCRETE AND TROWEL SMOOTH.
5. ALL DIMENSIONS GIVEN IN MILLIMETRES UNLESS OTHERWISE STATED.
6. MAX. DIST. FROM RIM TO TOP RUNG IS 800 mm.
7. BACKFILL AROUND MH. WITH SELECT NATIVE MATERIAL COMPACT TO 98 % S.P.D.
8. FLAT TOP SECTION TO BE USED FOR MANHOLES UP TO 1.8 m BURY.
9. ALL JOINTS TO BE WATERTIGHT. METHODS TO BE CONSISTENT WITH SITE CONDITIONS.
10. FOR MANHOLES 5.0 m IN DEPTH OR GREATER, A SAFETY PLATFORM SHALL BE INSTALLED.
11. MANHOLES TO MEET REQUIREMENTS OF MANHOLE DETAILS AND SPECIFICATIONS.
12. SAFETY STEPS TO BE SPACED AT 400 MAX. DISTANCE. FIRST STEP TO BE 800 MAX. BELOW FRAME, LAST STEP TO BE 300 MAX. ABOVE BENCHING.
13. CHANNELLING AND BENCHING TO BE FINISHED TO TROWEL SMOOTHNESS.



20Ø GALVANIZED IRON MANHOLE
SAFETY STEPS



TITLE:

TYPICAL PERCHED MANHOLE
FOR 600 TO 1050 mm DIAMETER PIPES

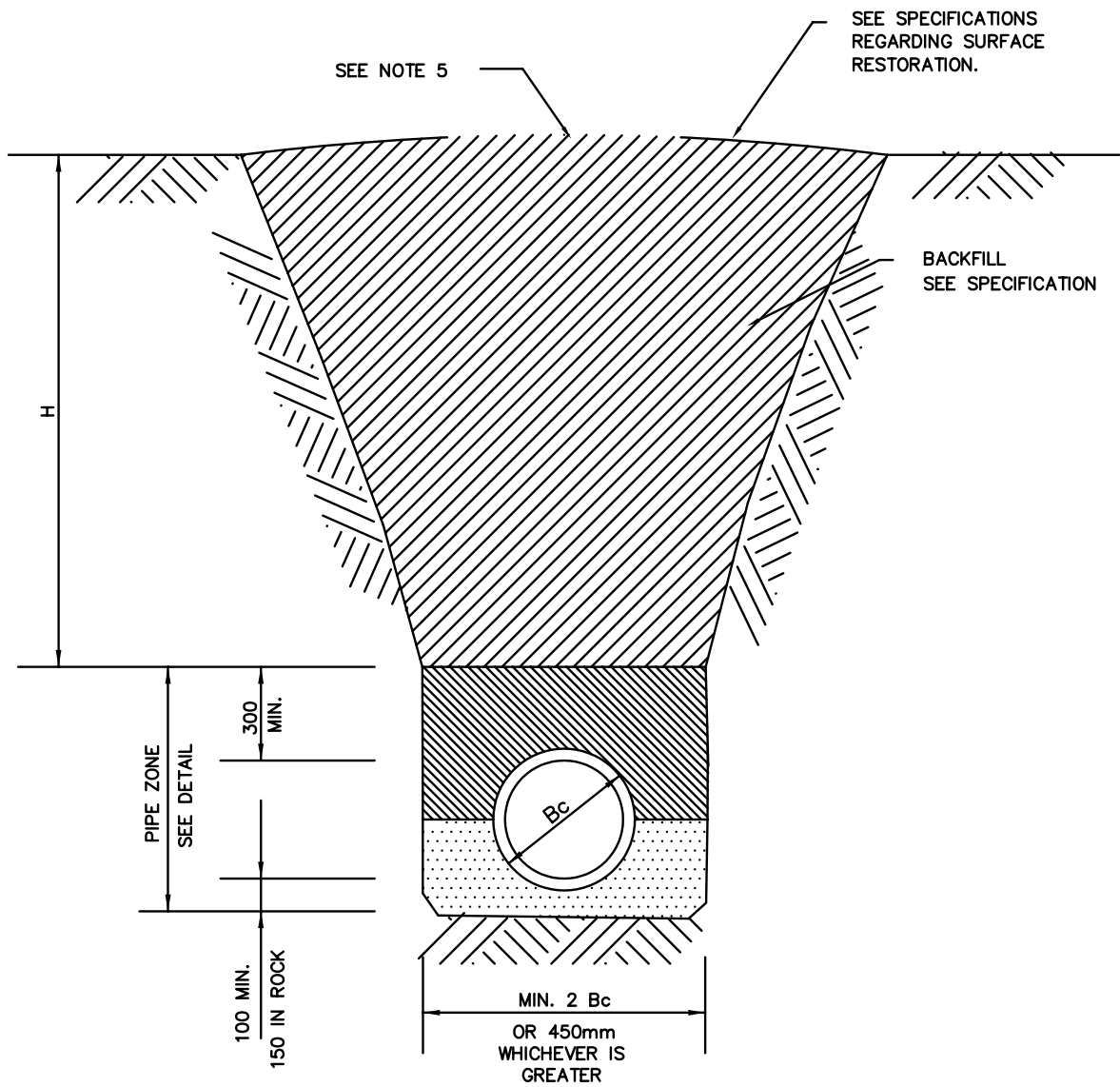
STANDARD DETAILS

SCALE: N.T.S.

DATE: JAN 2007

STD. DWG NO.

S-06



NOTES:

1. WHEN CUT BACK SLOPES ARE TO BE USED IN LIEU OF CAGES AND SHORING, THESE SLOPES ARE TO MEET REQUIREMENTS OF LOCAL CODES.
2. SEE SPECIFICATIONS FOR MINIMUM COVER ABOVE PIPE.
3. MIN. PIPE ZONE WIDTH IS SPECIFIED TO ALLOW PROPER PIPE ZONE COMPACTION.
4. B_c = OUTSIDE PIPE DIAMETER.
5. FOR UNCOMPACTED BACKFILL, CROWN TRENCH BY $0.1 \times H$.



TITLE:

TYPICAL TRENCH DETAIL

STANDARD DETAILS	
SCALE: N.T.S.	
DATE: JAN 2007	
STD. DWG NO.	S-07