

DISTRICT OF MACKENZIE

Bylaw No. 780

A bylaw of the District of Mackenzie  
to regulate the subdivision of land

The Municipal Council of the District of Mackenzie in open meeting assembled, ENACTS AS FOLLOWS:

1. INTERPRETATION

In this bylaw, unless the context otherwise requires:

"APPLICANT" means a person applying for the approval of a subdivision whether as the owner or his duly authorized agent, or as a purchaser under an Agreement for sale, or such purchaser's duly authorized agent of the property proposed.

"APPROVAL FINAL" means the Approving Officer affixing his signature to the subdivision plan.

"APPROVING OFFICER" means any person duly authorized by the Municipal Council to act as Approving Officer pursuant to the provisions of the Land Title Act.

"BOULEVARD" means that portion of a highway between the curb lines or the lateral boundary lines of a roadway and the adjoining property or between curbs on median strips or islands, but does not include curbs, sidewalks, ditches, or driveways.

"BUILDING REGULATIONS" means regulations regarding the construction of buildings by the current building bylaw of the Municipality and the BC Building Code.

"DEVELOPER" means the subdivider or his contractor or his agent appointed in writing.

"DISTRICT OR MUNICIPALITY" means the District of Mackenzie.

"FRONTAGE" means that length of a parcel boundary which immediately adjoins a highway other than a lane or a walkway or a waterbody where access is via water. In the case of a parcel fronting on more than one highway, the narrower side of the parcel abutting a highway shall be its frontage.

"HIGHWAY" includes a public street, road, path, walkway, trail, lane, bridge, road, thoroughfare, and any other way, open to the use of the public and is measured from lot line to lot line but does not include a statutory right-of-way on private property.

"HIGHWAY, ARTERIAL" means a major highway serving as a major traffic route between areas of the Municipality.

"HIGHWAY, COLLECTOR" means a highway serving several local highways and may serve as a connector between neighbourhoods.

"HIGHWAY, CUL DE SAC" means a highway with only one point of intersection with another highway and which terminates in a vehicle turning area.

"HIGHWAY, LOCAL" means a highway serving a residential neighbourhood not intended to carry traffic from one neighbourhood to another.

"HIGHWAY, RURAL" means a highway serving rural parcels of land not being an arterial highway.

"LANE" means a highway more than 3 metres but not greater than 8 metres in width, intended to provide "secondary" access to parcels of land, but a lane is not a half road.

"LOT" means a parcel, block or other area of land that has been registered as such in the Land Title Office or developed pursuant to the Condominium Act.

"LOT DEPTH" means the horizontal distance between the front and rear lot lines. For non-rectangular lots it shall be the average distance between the front lot line and the rear lot lines.

"LOT LINE, FRONT" means the lot line common to the lot and an abutting highway, where there is more than one lot line abutting a highway the front lot line shall be determined as the shorter of the lines common to the lot and a highway.

"LOT LINE, REAR" means the lot line opposite to and most distant from the front lot line or, where the rear portion of the lot is bounded by intersecting side lot lines, shall be deemed to be the point of such intersection.

"LOT, THROUGH" means a lot abutting two parallel or approximately parallel streets.

"LOT WIDTH" means the shortest distance between side lot lines of a lot measured perpendicular to the side lot lines if the side lot lines are parallel, and measured along the front setback if the side lot lines are not parallel.

"MEDICAL HEALTH OFFICER" means the Medical Health Officer or his authorized delegate appointed under the Health Act for the territorial jurisdiction of the area in which a subdivision is located.

"MUNICIPAL ENGINEER" means a professional engineer engaged by the District to provide engineering services.

"OWNER" means the registered owner of an estate in fee simple or the registered holder of the last registered agreement for sale.

"PANHANDLE LOT" means any lot which is serviced and gains highway frontage through the use of a narrow strip of land which is an integral part of the lot (hereinafter called the "access strip").

"PARCEL" means a lot, block, or other area in which land is held or into which land is subdivided, including strata lots created by strata plan but does not mean a highway or portion thereof.

"POTABLE WATER" means water which is approved for drinking purposes by the Medical Health Officer.

"PROFESSIONAL ENGINEER" means a person who is registered or duly licenced as such under the provisions of the Engineering Profession Act.

"PROVEN SUPPLY" means that a minimum of 2000 litres per day of potable water must be proven to be available to the satisfaction of the Public Works Superintendent.

"RIGHT-OF-WAY" includes land or an interest in land acquired for the purpose of:

- (a) public rights of passage with or without vehicles; or
- (b) constructing, maintaining, or operating any railway, tramway, or aerial tramway; or
- (c) erecting and maintaining any pole-line, wood or timber chute; or
- (d) laying, placing and maintaining drains, ditches, water courses, pipes, transmission lines, or wires for the conveyance, transmission or transportation of water, gas, oil, electric power, communication, or for the disposal of sewage;
- (e) operation and maintenance of the undertaking for which the Statutory Right-of-Way is required.

"ROADWAY" means the portion of the highway that is improved, designed or ordinarily used for vehicular traffic.

"STREETS" includes all roads, squares, thoroughfares and other public ways, but does not include lanes or trails.

"SUBDIVISION" means any change in the existing size, shape, number or arrangement of a lot or lots, whether by plan or metes and bounds description.

"TRUNK SEWER" means any sanitary sewer of a 300 mm diameter or greater.

"TRUNK STORM SEWER" means any sanitary sewer main of a 600 mm diameter or greater.

"TRUNK WATER MAIN" means any water supply main of a 300 mm diameter or greater.

"WALKWAY" means a highway intended to carry pedestrian and non-motorized traffic.

"WATER COURSE" means any natural drainage course or source of water, whether usually containing water or not, and includes any lake, river, creek, spring, ravine, swamp, gulch, or source of ground water whether enclosed or in a conduit.

"WORKS" means the highways, drainage, water and sewer systems, the sidewalks, boulevards, street lighting and underground wiring or any other works to be provided for in a subdivision of land under this bylaw.

"ZONE" means a zone created by the District of Mackenzie Zoning bylaw as amended or as replaced.

2. **PRELIMINARY LAYOUT CONSIDERATION**

- (a) An applicant for subdivision approval may, before preparing a plan of subdivision to be submitted for approval pursuant to the provisions of the Land Title Act, request preliminary layout consideration.
- (b) This request shall be accompanied by sketch plans of the proposal and include information that the Approving Officer may require to determine whether or not the proposed subdivision will meet the requirements of this bylaw.
- (c) The request for preliminary layout consideration is preliminary to and shall not be considered to be an application for subdivision in a form satisfactory to the Approving Officer under the Municipal Act.
- (d) Preliminary layout considerations of any subdivision shall not be construed as approval of the proposed subdivision for land registration or any other purpose.
- (e) Preliminary layout consideration shall not be considered as acceptance by the Municipality or its approving officer of anything except the general layout of the proposed subdivision, and a list of minimum conditions which would be taken into consideration on an application for approval.
- (f) Preliminary layout consideration is valid for a period of 90 days.
- (g) Preliminary layout consideration is revocable by the Approving Officer at any time before approval is granted.

3. **APPLICATION FOR SUBDIVISION APPROVAL AND FEE**

- (a) An applicant for subdivision approval or on a request for preliminary layout consideration shall, on his application, state the use to which he intends to put the land following its subdivision.
- (b) An applicant for subdivision approval shall submit with his application for approval a fee in the amount of \$25.00 for the first parcel to be created by the subdivision and \$10.00 for each additional parcel.

4. **CONFORMITY WITH THIS BYLAW**

- (a) No person shall subdivide land in the Municipality contrary to the provisions of this bylaw.
- (b) The Approving Officer may exempt a person proposing to subdivide land from any prescribed minimum frontage from the limitation provided under the Municipal Act.

5. **SEVERABILITY**

If any section, subsection, sentence, clause, or phrase of this bylaw is for any reason held to be invalid by the decision of any court, such decision shall not affect the validity of the remaining portions of this bylaw.

6. AREA, SHAPE AND DIMENSIONS OF LOTS

- (a) No subdivision shall be created in any zone so that any lot created by the subdivision has an area in square metres or hectares or a width or a depth in metres less than those set out for the zone in which it is located in Schedule "A" to this bylaw.
- (b) Notwithstanding the requirements of Subsection (a) minimum frontage and lot sizes do not apply:
  - 1. Where the lot being created is to be used solely for the unattended equipment necessary for the operation of:
    - (a) a community water system;
    - (b) a community sewer system;
    - (c) a community gas distribution system
    - (d) a community radio or television receiving antenna;
    - (e) a radio or television receiving antenna;
    - (f) a telecommunication relay station;
    - (g) an automatic telephone exchange;
    - (h) an air or marine navigational aid;
    - (i) electrical substations or generation stations;
    - (j) any other similar facility or utility governed by Provincial or Federal legislation.
  - 2. Where dedication or acquisition of land for highway, school or park reduces a parcel to an area or frontage less than set down in Schedule "A".
- (c) subject to Section 994 of the Municipal Act the access strip or panhandle portion of panhandle lots must be as follows:
  - 1. for industrial zoned lots a minimum width of 10 metres;
  - 2. for residential zoned lots a minimum width of 4.5 metres;
  - 3. for commercial zoned lots a minimum width of 8 metres.

The access strip or panhandle portion of the lot shall not be calculated as part of the minimum lot area or for determining lot depth.
- (d) Notwithstanding the preceding regulations, the minimum area of lots shall be increased:
  - 1. as necessary to suit the topography and to ensure that the gradient on access driveways to service the proposed lots shall not exceed fifteen percent (15%);
  - 2. so that lots traversed by a natural water course are increased by an amount equal to the area of the water course plus the area of a right-of-way for maintenance purposes of the water course of at least 7 metres on each bank of the water course;
  - 3. so that lots traversed by a right-of-way for any public utility purposes are increased by an amount equal to the area of the right-of-way.

7. HIGHWAY ALIGNMENT, GRADE AND SIZE

No highway proposed to be dedicated by subdivision plan shall be shown on a plan, dedicated, laid out or constructed unless the dimensions, locations, alignment and gradient meet the requirements for highways as set out in Schedule "C" hereto.

8. HIGHWAY DEDICATION, SERVICING AND CONSTRUCTION STANDARDS

- (a) The subdivider shall provide, without compensation:
1. for the purpose of a highway within the subdivision, land not exceeding 20 metres in width;
  2. for the purpose of widening a highway that borders or is within the subdivision, land not exceeding 10 metres in width;
  3. lanes where the Approving Officer deems it necessary to provide secondary access in order that reasonable traffic flow can be assured on the main highway. A lane shall have a minimum width of seven (7) metres.
- (b) Where, in the opinion of the Approving Officer, terrain and soil conditions are such that a roadway having a width of 8.0 metres can not be adequately supported, protected, and drained within the widths specified in subsection (a)1., land sufficient to support, protect, and drain such a roadway may be required without compensation.

9. USE AND FUTURE SUBDIVISION

- (a) Notwithstanding any other provision of this bylaw, no lot shall be subdivided unless the lots created by the subdivision are suited to the use to which they are intended and the owner of the land being subdivided shall state in writing such intended use when application is made for approval of the proposed subdivision.
- (b) No lot shall be subdivided unless the proposed subdivision is suited to the configuration of the land being subdivided.
- (c) No lot shall be subdivided in such a manner as to make impracticable the future subdivision of the lots being created by the subdivision or of any adjacent land.

10. WORKS REQUIRED AND CONSTRUCTION STANDARDS

No person shall subdivide land except in conformity to the relevant requirements set out below and unless specifically provided otherwise all works and services required to be constructed and installed shall be constructed and installed at the expense of the owner of land proposed to be subdivided. All construction and installation shall be carried out in conformity with Schedule "B", "C", "D", "E", and "F" hereto. All services provided shall be constructed to allow for connection to lands and systems beyond the proposed subdivision where applicable.

(a) Highways

All new highways within the subdivision, including widening strips of existing highways, cul de sacs, lanes and walkways shall be cleared, graded, drained, surfaced and constructed in accordance with Schedule "C" hereto.

(b) Sidewalks

1. The subdivider shall provide sidewalks on highways within the lands being subdivided in accordance with the standards as set out in Schedule "C" hereto.
2. Without limiting the generality of subsection (b)1. the approving officer may require:
  - (a) Sidewalks along a highway within the subdivision on which substantial pedestrian traffic is expected to be generated; and
  - (b) Sidewalks along the side of a highway within the subdivision which fronts on or abuts a school, park, recreation facility, public building, shopping and commercial development; and
  - (c) Sidewalks on one side of an arterial or collector highway within the subdivision; and
  - (d) Walkways within the subdivision to facilitate pedestrian movement.
3. Walkways leading to a public open space or a linear pedestrian movement system shall be constructed in accordance with the standards set out in Schedule "C" hereto.

(c) Boulevards

Where any lot in a R1, R2, R3, RM1, RM2, C1, C2, C3, or P1 is to be subdivided, and new highways are created, boulevards shall be located and constructed in accordance with Schedule "C" hereto.

(d) Street Lighting

Where any lot in a R1, R2, R3, RM1, RM2, RM3, C1, C2, C3, RC1 or P1 zone is to be subdivided, and new highways are created, streetlighting will be located and constructed in accordance with Schedule "C" hereto.

(e) Underground Wiring

Where any lot in a R1, R2, R3, RM1, RM2, RM3, C1, C2, C3, RC1 or P1 zone is to be subdivided, and new highways are created, all wiring will be underground and shall be located and constructed in accordance with Schedule "C" hereto.

(f) Water Distribution

Where any lot in a R1, R2, R3, RR1, RM1, RM2, RM3, C1, C2, C3, RRC1, RC1, M1, M2 or P1 zone is proposed to be subdivided a water distribution system shall be provided in accordance with the standards set out in Schedule "D" hereto; and

1. If the lands intended to be subdivided are located within a specified area of the Municipality that provides water for the benefit of the specified area or is within an area of the Municipality that can be serviced by the water supply system of the Municipality, a water distribution system shall be provided in accordance with the standards set out in Schedule "D" hereto and the water distribution system shall be connected to the existing water supply system of the Municipality in accordance with the standards set out in Schedule "D" hereto and the bylaws of the Municipality.
2. Where the proposed subdivision is located in an area of the Municipality that is not within an area in which the Municipality can supply water, before the Approving Officer grants final subdivision approval the application must provide evidence that each lot in the subdivision has its own proven supply of potable ground water as specified by the Public Health Engineer and in accordance with the requirements of Provincial Regulations and the standards set out in Schedule "D" hereto.

(g) Sewage Collection and Disposal

1. Where any lot in a R1, R2, R3, RM1, RM2, RM3, C1, C2, C3, RC1, M1, or P1 zone is proposed to be subdivided such lot shall not be subdivided unless the subdivision is provided with a sewage collection and disposal system in accordance with the standards set out in Schedule "E" hereto and the collection system is connected by trunk sewer mains to the municipal trunk sewer mains in accordance with the standards set out in Schedule "E".
2. Where it is proposed to create unsewered lots by subdivision, the applicant shall cause percolation and ground water depth tests to the satisfaction of the Medical Health Officer in accordance with the requirements of the Provincial Regulations. The results of such tests shall be submitted with the application to subdivide together with evidence that sewage effluent may be disposed of in accordance with the Provincial Regulations and the provisions of Schedule "E".

(h) Drainage

Where any lot in a zone other than A is proposed to be subdivided, and requires provision of a drainage system, the subdivision shall be provided with a drainage collection system in accordance with the standards set out in Schedule "F" hereto and the drainage collection system shall be connected by trunk drainage mains to the municipal trunk drainage system in accordance with the standards set out in Schedule "F" hereto.

(i) Bonding and Servicing Agreement

All works and services required to be constructed and installed at the expense of the owner of the land proposed to be subdivided pursuant to this bylaw shall be constructed and installed to the standards prescribed in this bylaw prior to the approval of the subdivision by the Approving Officer, unless:



1. the owner of the land deposits with the Municipality cash or a Letter of Credit in the form provided for in the 991 Servicing Agreement. The deposit shall be in the amount of one hundred and ten percent (110%) of the cost of designing, construction and installation of the works and services as estimated by the District and the owner of the land enters into an Agreement with the Municipality in the form provided for in the 991 Servicing Agreement to construct and install the prescribed work and services by a specified date or forfeit the amount deposited with the Municipality;
2. the owner of the land deposits with the Municipality for the maintenance period, on or before the date of issuance of the Certificate of Completion of said works and services, security in the form of a bond in an amount equal to at least five (5) percent of the estimated construction cost of the said works and services, as calculated by the District, from which the Municipality may deduct the cost of maintaining the works, remedying any defects or damages should the owner fail to do so.

(j) Connections

Where an owner of land proposed to be subdivided constructs and installs the works necessary to serve the proposed subdivision without entering into a 991 Servicing Agreement with the municipality as referred to in the immediately preceding section hereof, the owner shall not connect such works at any of the sewer, drainage, electrical or water works of the Municipality and the Municipality shall not accept the works constructed and installed by the owner or any part thereof, until:

1. the District has recommended acceptance of the works;
2. the proposed subdivision has received Final Approval by the Approving Officer;
3. the owner has deposited with the District "as-built" drawings of such works prepared by a Professional Engineer;
4. the owner has caused the approved subdivision plans to be registered in the Land Title Office and has deposited with the Municipality a copy of all rights-of-way required where such works cross private property, such rights-of-way to be in the form provided for in the 991 Servicing Agreement.

11. SCHEDULES

Schedules "A" through "F", of this bylaw form part of this bylaw.

12. ENTRY

The Approving Officer, Public Works Superintendent and their delegates may enter at all reasonable times upon the lands for which application to subdivide has been made in order to ascertain whether the provisions of this bylaw are being obeyed.

13. CONTRAVENTION AND OTHER REGULATIONS

Except where a setback in respect of a highway, or where the dedication of roads, lanes, walkways, or public use lands is concerned, no subdivision shall be approved which would cause any existing building or structure or sewage disposal installation or used source of potable water to contravene any building, zoning or other regulation in force on the parcel under consideration.

14. PENALTY

A person who contravenes this bylaw by doing an act that it forbids, or omitting to do an act that requires to be done, commits an offence and is liable upon summary conviction to a fine of not more that \$2,000.00 plus the cost of prosecution.

15. CITATION

This bylaw may be cited for all purposes as "Subdivision Bylaw No. 780, 1993".

16. REPEAL

Bylaw No. 685 cited as "District of Mackenzie Subdivision Bylaw No. 685, 1989" and Bylaw No. 720 cited as "District of Mackenzie Subdivision Amendment Bylaw No. 720, 1990" are hereby repealed.

READ a first time this 22nd day of February, 1993.

READ a second time this 22nd day of February, 1993.

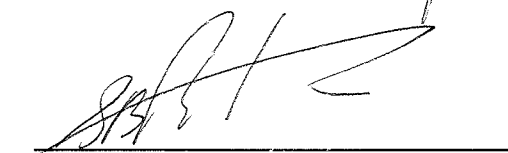
READ a third time this 22nd day of February, 1993.

RECONSIDERED AND ADOPTED this 8th day of March, 1993.

I hereby certify the foregoing to be a true and correct copy of District of Mackenzie Bylaw No. 780 cited as "Subdivision Bylaw No. 780, 1993"

  
\_\_\_\_\_  
Mayor

\_\_\_\_\_  
Clerk

  
\_\_\_\_\_  
Clerk

SCHEDULE ALOT AREA, WIDTH AND DEPTH

	Zone	Minimum Lot Area	Minimum Lot Width	Minimum Lot Depth
R-1	Residential Single Family	557 sq m	17 m	30 m
R-2	Residential Two Family	557 sq m	18 m	30 m
R-3	Residential Compact Home	525 sq m	15 m	35 m
RR-1	Rural Residential Single Family	8,100 sq m	45 m	100 m
RM-1	Residential Multi-Family - Low Density	836 sq m	24 m	34 m
RM-2	Residential Multi-Family - Medium Density	836 sq m	24 m	34 m
RM-3	Residential Mobile Home Park	20,200 sq m	-	-
C-1	General Commercial	139.4 sq m	6 m	23 m
C-2	Service Commercial	139.4 sq m	6 m	23 m
C-3	General Special Commercial	139.4 sq m	6 m	23 m
RRC-1	Rural Commercial	10,000 sq m	45 m	100 m
RC-1	Recreation Commercial	139.4 sq m	-	-
M-1	Light Industrial	557 sq m	-	-
M-2	General Industrial	1,858 sq m	-	-
M-3	Heavy Industrial	10,000 sq m	-	-
M-4	Airport Industrial	139 sq m	-	-
P-1	Institutional and Public Use	929 sq m	-	-
A	Agriculture	20,000 sq m	-	-

SCHEDULE B  
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DRAWINGS

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## SCHEDULE B

### GENERAL PROVISIONS

#### 1. DEFINITIONS

In these Schedules unless the context otherwise requires:

"Approving Officer" means a person appointed as an Approving Officer for the District of Mackenzie under the "Land Title Act".

"District" means District of Mackenzie.

"Engineer" means a qualified engineering firm or professional engineer acceptable to the District, engaged by the Developer to provide complete engineering services in respect of the development.

#### 2. CONSTRUCTION OF HIGHWAYS

The District shall permit the Developer to layout, construct and erect works and coordinate the installation of the private utility works in the highways to be dedicated by the subdivision plan, but subject to the terms and conditions hereinafter provided in General Provisions and subject to the Bylaws of the District governing the use of highways and subject to all Provincial and Federal statutes and regulations governing construction and the use of highways.

#### 3. SUBDIVISION PLAN

The Developer shall be solely responsible for the preparation of subdivision plans and for the registration of the approved subdivision plans in the Land Title Office at Prince George. In no case shall a single phase of development be approved unless the tentative subdivision plan for the entire development has been submitted to the Approving Officer and approved by him.

The Developer shall forward to the District of Mackenzie a copy of the approved and registered subdivision plan once it has been registered at the Land Title Office in Prince George.

The Developer shall forward to the District of Mackenzie a copy of the approved prospectus where applicable once it has been registered with the Superintendent of Brokers, Insurance and Real Estate.

#### 4. ENGINEERING DRAWINGS

Prior to commencing any works the Developer shall produce engineering drawings satisfactory to the District for the installation of the underground, surface and overhead works connected with the servicing of the subdivision including the works to be supplied and installed by the private utility companies. The District of Mackenzie may require the Developer to engage the services of a qualified

consulting engineering firm or qualified engineer acceptable to the District to prepare the engineering drawings, contract documents, reports, studies and any other engineering information which may be required by the District relevant to the development of the subdivision. Engineering drawings prepared and signed by private utility companies in support of their works will be acceptable.

The engineering drawings shall be submitted to and shall receive the approval of the District prior to commencement of construction. Such approval shall be construed only to mean that the drawings meet the general intent of the Bylaw and the Schedules attached hereto and shall not derogate from the right of the District to require such changes, the necessity for which becomes apparent from time to time, in order that the requirements of the Bylaw shall be met.

The Developer shall submit to the Provincial Ministry of Environment detailed engineering drawings showing plans and profiles of sanitary sewer and water main installations and appurtenant structures to these systems and shall obtain all necessary Provincial Agency approvals prior to commencement of construction of any works. A copy of the Provincial Agency permits and a print of each approved drawing shall be filed with the District.

Following approval of the detailed engineering drawings, three prints of the approved drawings and contract drawings shall be deposited with the District. Any additions or revisions shall receive the District's approval prior to construction of the subject matter of the addition or revision.

## 5. SCHEDULE

If applicable, following the submission and approval of the subdivision plan, the Developer shall submit in writing a tentative time schedule for the development of the complete subdivision showing the approximate commencement of each phase of the subdivision. Prior to commencing any work on a phase of subdivision development, the Developer shall submit a more detailed time schedule of the works to be constructed from land clearing to completion of street surface improvements.

## 6. INSPECTION

The Developer's consulting engineer, at the Developer's expense, shall provide full layout and inspection services for all works installed by the Developer or his contractors and shall ensure that all works are constructed and installed in accordance with the standards and specifications contained in this Bylaw. The consulting engineer shall file all his inspection reports with the District, who may refuse to accept such report if there is reason to doubt the adequacy of such inspection. Should such report in the opinion of the District be unsatisfactory, the District may carry out the inspections at the cost of the Developer.

The District shall have the right to appoint its own inspectors to inspect the Developer's works from time to time and this inspection shall be at the District's cost. Any inspection carried out by the District shall in no way relieve the Developer of any obligations or responsibility whatsoever in connection with the

installation of the works of the subdivision. If the District discovers any defect or requires any correction, the matter shall be reported to the Developer's inspector for appropriate action. The District shall not issue any direct order to the Developer's contractor except in the case of emergency. Requests from the District to the Developer's inspector shall be acted on immediately.

## 7. MATERIALS

The Developer shall submit to the District prior to commencing construction on any phase of the subdivision, a complete list of the type of materials to be incorporated in the subdivision works along with the time schedule of construction. The materials list shall set out the type of materials to be incorporated in the works, the name of the manufacturer, a description of the material, its composition, the class or grade, the ASTM or AWWA specification number and trade name of the materials. All materials used in the works must conform to the District's standards as set out in this Bylaw. Any materials not meeting the District's standards or the approval of the District shall not be incorporated in the works.

## 8. CERTIFICATE OF ACCEPTANCE

- a) Upon completion of any phase of subdivision, the Developer shall supply to the District a notification of completion of the works under the hand and seal of the consulting engineer of the Developer as well as "as-constructed" drawings of the works and completed Municipal Service Record Cards as shown on Standard Drawing No. B-100. If the work is acceptable to the District, a Certificate of Completion shall be issued. Such Certificate may be issued separately for that portion of the works being the water distribution system, sanitary sewer, collection system and appurtenant structures, service connections, storm drains, street lights and controls and all private utility facilities necessary to service a phase of the subdivision for use. Subject to the guarantee, as hereinafter provided, the District shall, on issuance of the Certificate of Acceptance, be responsible for the maintenance and operation of the works covered thereby.
- b) A second Certificate of Completion may be issued for any phase of subdivision at the completion of the surface works including the installation of street paving, final boulevard grading and clean-up.
- c) On receipt of the Developer's notification of completion, the "as-constructed" drawings and the Municipal Service Record Cards, the District shall inspect the works and upon being satisfied that the works are completed according to the approved plans and specifications he may issue his Certificate of Acceptance to the Developer. This Certificate may be in two parts for any phase of subdivision as described above. No phase of subdivision works shall be accepted until they are ready to operate and this shall include connection to District services or appropriate outfalls or other services provided by the District.

- d) If upon application for Certificate of Acceptance, the District refused to accept the works the Developer shall repair the works installed and correct deficiencies in the works not resulting from normal wear and tear and acts of God and not resulting from the action of the District.

**9. FINAL INSPECTION**

Within 12 months of the issuance of the Certificate of Acceptance, the District will reinspect the works accepted and shall give notice to the Developer of any deficiencies and damage, not resulting from normal wear and tear of operation and acts of God and not resulting from the actions of a third party and the Developer shall forthwith correct the deficiencies and repair the damage. If the damage or deficiencies are not repaired or corrected forthwith upon written notice of the same, then the necessary repair and corrections may be done by the District at the expense of the Developer.

**10. ONE YEAR GUARANTEE**

As provided above, the Developer shall repair the works installed and correct deficiencies in the works not resulting from normal wear and tear and acts of God and not resulting from the action of a third party for a period of one year from the date of the Certificate of Acceptance. The District may, at their option, carry out the repair and correct deficiencies without notice to the Developer if, in the opinion of the District, the work must be done immediately because of a hazard of any kind to the public or to ensure the proper operation of the works considered defective or damaged. The District shall bill the Developer for such emergency works undertaken and the Developer shall pay the cost thereof to the District.

**11. CONVEYANCE OF RIGHTS-OF-WAY AND EASEMENTS**

- a) Upon acceptance of the work by the District, the Developer shall execute such documents as shall be produced by the District conveying to the District all right, title and interest of the Developer in the works.
- b) The Developer shall grant to the District all rights-of-way as shall be required by the District for purpose of servicing the works installed where the works are installed on property other than highways. The Developer shall execute such right-of-way agreements as the District may produce to the Developer for this purpose prior to the Certificate of Acceptance being issued by the District.

**12. LEGAL SURVEYS**

The Developer shall be responsible for all the legal surveys in connection with the subdivision and shall prepare all the documents necessary for registration of the subdivision. The Developer shall at his sole expense, maintain sufficient legal survey control to the satisfaction of the District throughout the construction



program and shall, upon completion of the construction of highways and boulevards, cause each legal lot corner to be posted by a qualified land surveyor at the Developer's sole cost.

### **13. BARRICADES AND DETOURS**

- a) The Developer shall provide all such barricades, lighting and signs as shall be required to protect the public while the works are being installed. In order to maintain traffic movement with the least possible inconvenience, the Developer shall construct, where necessary in the opinion of the District, such detours, temporary bridges and barriers as may be required to allow the public to drive safely around the works being installed.
- b) Prior to commencing excavation on or in the vicinity of highways, the Developer shall contact the owners of all the utilities that may be affected by this work and request from them instructions for the emergency action to be taken in the event of damage to a utility of service connection.

### **14. WAIVER**

Where because of the size, location or service requirements of any subdivision the services of a professional engineer is not required in the opinion of the District the provision set out above dealing with the engineering drawings, construction and inspection of works not applicable may be waived by the District.

### **15. INDEMNITY AND INSURANCE**

The Developer shall save harmless and effectually indemnify the District against:

- a) All actions and proceedings, costs, damages, expenses, claims, and demands whatsoever and whomsoever brought by reason of the execution of the said works and all such claims recoverable from the District of the property of the District, or any property which the District by duty or custom is obliged, directly or indirectly, in any degrees, to construct, repair or maintain, during the term of this Agreement, shall be paid by the Developer, and if recoverable from the District shall, together with any costs and expenses incurred in connection therewith, be charged to the Developer.
- b) All expenses and costs which may be incurred by reason of the execution of the said works resulting in damage to any property owned in whole or in part by the District for which the District by custom or duty is obliged, directly or indirectly, in any way or to any degree, to construct, repair or maintain, shall be paid by the Developer, and if paid by the District shall, together with any costs and expenses incurred in connection therewith, be charged to the subdivision.
- c) All expenses and costs which may be incurred by reason of liens for non-payment of labour or materials, Workers' Compensation assessments, unemployment insurance, federal or provincial tax, check-off and for encroach-

ments owing to mistakes in survey, and all such claims recoverable from the District, or the property of the District, or any property which the District by duty or custom is obliged, directly or indirectly, in any way or to any degree, to construct, repair or maintain, shall be paid by the Developer, and if recovered from the District shall, together with any costs and expenses incurred in connection therewith, be charged to the Developer. Provided this paragraph shall not be construed as to extinguish any rights which the District would have were it not for the inclusion of this paragraph.

- d) The Developer shall at his sole expense throughout the currency of the work carry comprehensive liability insurance in the amount of at least one million dollars (\$1,000,000) with insurance companies licenced to carry on business in the Province of British Columbia in partial discharge of its obligation under Clauses 15.a), 15.b) and 15.c) of this Section and in every such policy of insurance the District shall be named as an additional insured with proceeds payable as the interest of the District and Developer may appear. The Developer shall forthwith, and prior to commencement of the work, furnish the District with a certified copy of every policy of insurance herein required.

#### **16. FAULTY MATERIAL OR WORKMANSHIP GUARANTEE**

The Developer shall indemnify and save harmless the District against all expenses and costs which may be incurred by the District as a result of faulty workmanship and defective material in any of the works installed by the Developer, provided that such fault or defect is called to the attention of the Developer in writing prior to one year from the date of the District's Certificate of Acceptance.

As provided in Clause 7, "Materials", the District shall approve all materials going into the works prior to their installation but such approval shall in no way relieve the Developer of liability for replacing or repairing the material if it proves to be defective or is damaged in installation.

#### **17. REBATE OF FEDERAL SALES TAX**

The District will cooperate with the Developer by signing and certifying such correct documents as presented to it to assist the Developer in obtaining the rebate of Provincial Sales Tax on all materials used in the installation of water distribution, sewerage or drainage systems. The Developer shall be responsible for determining from the Federal Tax Department which materials are exempt from Federal Tax and how the rebate is to be claimed. No claim for payment by the District may be made by the Developer for loss resulting from failure on the part of the Developer to obtain a tax rebate on materials.

#### **18. OVERSIZE WORKS**

It is recognized that large diameter trunk service mains may be required to pass through a subdivision in order to service properties beyond the subdivision boundaries. In addition, extra street widths may be required to accommodate

future anticipated traffic flow through the subdivision or around the perimeter roads. The following are therefore set as standard sizes and depths for service mains and road widths, the cost of which are to be the responsibility of the Developer and the difference in cost between actual sizes, depths or widths required may be paid by the District in compliance with the Municipal Act to the Developer or by the Developer to the District depending upon the installing agency at the current rates determined on the basis of such costs to the District in the year of installation.

**a) Sanitary Sewer**

The standard size shall be up to and including 250 mm diameter. Standard depth shall be up to and including 4.5 metres from centreline of the finished road surface. No compensation shall be paid to the Developer if the depth of a sanitary sewer required to service his own subdivision exceeds 4.5 metres or exceeds 250 mm diameter.

**b) Water Mains**

The standard size shall be up to and including 250 mm diameter, standard depth shall be up to 3.0 metres of cover. Waterworks fittings and valves shall be standard up to and including 250 mm diameter. All fire hydrants, valves and leads are to be supplied at the sole cost of the Developer. No compensation shall be paid to the Developer if the size of water main required to service his own subdivision exceeds 250 mm diameter.

**c) Storm Sewers**

The standard main size shall be up to and including 600 mm diameter. Standard depth shall be up to and including 4.5 metres from centreline of the finished road to pipe invert. No compensation shall be paid to the Developer if the storm sewer depth exceeds 4.5 metres or 600 mm in diameter in order to service his own subdivision.

**d) Road Allowance**

The standard width shall be up to and including 24.40 metre. Additional right-of-way required over and above the 24.40 metre width to accommodate the arterial streets within the subdivision shall be paid by the District at the unit price per hectare as agreed upon or upon failure to agree as set by arbitration pursuant to the Arbitration Act.

**e) Street Width**

The standard width from curb face to curb face shall be up to and including 13 metres. Additional road widths required by the District for additional traffic lanes shall be paid by the District at the unit prices paid by the District for such work in that construction season.

**f) Special Structures**

Special structures or works such as pumping stations or outfalls may be submitted for consideration for cost sharing if the said structures or works are to be used to service lands outside the subdivision. The cost sharing formula shall be negotiated and agreed between the Developer and the District prior to any works in the subdivision being commenced.

**19. DRAWING STANDARDS**

**a) General Requirements**

1. A complete set of construction drawings shall consist of:

- a) General Plan
- b) Key Plan
- c) Plan and Profile for Streets, Lanes, Drainage
- d) Plan and Profile for Storm Sewers                      may be combined
- e) Plan and Profile for Sanitary Sewers                    on one drawing
- f) Plan and Profile for Water Main                         sheet
- g) Plan for Underground Power, communication wiring (telephone and cablevision) and roadway lighting
- h) Additional Plans Showing any Special Details

In addition, if deemed necessary by the District a lot grading plan shall be provided.

- 2. Drawing scales and dimensions shall be in metric units. The metric symbols and abbreviations used are according to the international system of units (SI).
- 3. All drawings shall be sized 594 mm x 841 mm.
- 4. The drawings shall be neat and legible and they shall clearly describe the work in sufficient detail.
- 5. Lettering on drawings must conform to American Standards Association (ASA 214-1-1946) with dimensions, etc., to minimum size equivalent of 80 CLeroy and streets to minimum size equivalent of 200 CL Leroy.
- 6. Standard drafting procedures are to be used for line density, arrowhead, radii, dimensions, etc.
- 7. All elevations shown on drawing shall be based on geodetic datum.
- 8. Plan and profile drawings shall be to the scale:

Horizontal	1:500
Vertical	1:50

with the profile below and plan above the drawing.

9. Drawings of details of manholes, catchbasins, hydrants, etc., compatible with Municipality's Standard Drawings shall be included in the specifications or with the construction drawings. Standard symbols for the various facilities as attached to these Standards shall be used on all drawings.

**b) Key Plan**

1. The key plan of the whole subdivision shall be to a scale of 1:500.
2. The following shall be shown on the key plan:
  - all known existing underground services including power, telephone, and natural gas
  - water courses on the site
  - pavement
  - ditches, culverts, storm sewers, manholes and catchbasins
  - sanitary sewers, manholes, cleanouts and service connections
  - water mains, valves, hydrants, blowoffs, and service connections
  - all property, right-of-way and easement lines
  - lot, road allowance and easement dimensions
  - lot numbers
  - 1 metre contour lines of the existing ground for slopes up to 10 percent and 2 metre contour lines for slopes greater than 10 percent
  - underground power communication wiring, gas and roadway lighting
  - plan and profile drawing reference numbers
  - north arrow

**c) Location Plan**

A location plan to a small scale 1:10,000 showing the location of the subdivision in relation to major streets shall be provided. The location plan may be drawn on one corner of the key plan drawing.

**d) Streets**

1. Streets and Lanes
  - a) The following information shall be shown on the plan:
    - street and lane allowance, property and lot lines
    - edges of pavement
    - stations of the BC and EC of horizontal curves together with the delta angle, centreline radius, tangent length and centreline arc length
    - details of intersections with spot elevation and at all critical points
    - details of curb and gutter
    - details of sidewalks and walkways
    - lot number
    - north arrow.

2. The following shall be shown on the profile:

- existing ground profile and finished pavement profile along the centreline at maximum 20 metre intervals
- percent grade to two decimal places
- station and elevations of BVC, EVC and VPI
- length of vertical curve
- elevations along the vertical curve at 10 metre intervals
- elevation and station of low or high spots of vertical curves
- where the levels of existing ground vary considerably across the right-of-way, the existing ground profile on both property lines shall also be shown.

**e) Water**

1. The following information shall be shown on the plan:

- locations of the pipe centreline, pipe size and type, hydrants, valves, fittings and all related appurtenances in relation to road, easement and adjacent property and lot lines
- location of service connections; connections not conforming to the standard offset require a distance from lot line
- lot numbers
- north arrow.

2. The following information shall be shown on the profile:

- the profile line of the existing and finished ground on centreline, and the invert of the pipe
- where the pipe is not to be laid at a constant depth below the finished grade, the invert elevation shall be shown at 20 metre intervals
- sanitary and storm sewers crossing the water main
- extent of work required in making the connection to existing water main.

**f) Sewage Collection**

1. The following information shall be shown on the plan:

- locations of the pipe centreline, manholes, cleanouts, and other appurtenances in relation to road, easement and adjacent property and lot lines
- location of service connections; connections not conforming to the standard offset require a distance from lot line
- dimensions of easements
- lot numbers
- elevations of the existing ground 20 metres back from the road property line inside the adjacent lots, at 20 metre intervals.
- minimum basement elevations
- north arrow.

2. The following information shall be shown on profile:
  - the profile line of existing and finished ground on centreline, and the invert of the proposed sewer size, type and class of pipe
  - distance between manholes
  - percent grades to two decimal places
  - invert elevations of inlet, outlet and branch lines at manholes
  - water mains and storm sewers crossing the sanitary sewer.

**g) Drainage and Storm Sewers**

1. The following information shall be shown on the plan:
  - locations of ditch lines, culverts, storm sewer pipe centrelines, manholes, ditch inlets and catchbasins
  - pipe offsets from property line
  - culvert diameter and invert elevations. For culverts larger than 600 mm in diameter, details of intake and outlet structures
  - number and diameter of driveway culverts to be supplied
  - lot numbers
  - north arrow.
2. The following information shall be shown on the profile:
  - the profile line of existing and finished ground on centreline, and the invert of the proposed storm sewer
  - size, type and class of pipe
  - distance between manholes
  - percent grades to two decimal places
  - invert elevations of inlet, outlet and branch lines at manholes.

**h) Lot Grading Plans**

The following information shall be shown on the plan:

- property lines, lot numbers, easements and road allowances
- existing topography and contours at 1 metre intervals
- minimum basement elevations
- proposed elevations after lot grading
- north arrow.

**20. STANDARD DRAWINGS**

The following standard drawing shall form part of Schedule "B":

B-100 Service Connection Record Card

SERVICE CONNECTION RECORD CARD

SUBDIVISION STANDARDS

DISTRICT OF MACKENZIE

NOTE: THIS IS A REDUCTION OF A RECORD CARD. FOR AS BUILT RECORD PURPOSES FULL SIZED CARDS CAN BE OBTAINED FROM THE APPROVING OFFICER.

ROLL NUMBER		LEGAL DESCRIPTION					
LOT	BLK.	D.L.	1/4	SEC.	T.P.	PLAN	

THE DISTRICT OF MACKENZIE

ADDRESS OF PROPERTY
---------------------

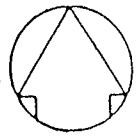
Municipal Services Record

MASTER LEGAL MAP

	WATER	SANITARY SEWER	STORM SEWER
DATE OF APPLICATION			
PERMIT NUMBER			
INSTALLATION DATE			
SIZE OF SERVICE			
LOCATION AT P.L.			
INVERT AT P.L.			
LENGTH OF CONNECTION			
METER SIZE & TYPE			
DEPTH OF MAIN			
DIST FROM WYE TO M.H.			
MEASURED FROM M.H. No.			
RISER			
TYPE OF PIPE			

CONNECTION LOCATIONS SKETCH

WATER \_\_\_\_\_ SANITARY \_\_\_\_\_ STORM .....



CULVERT INSTALLATIONS

DATE	PERMIT No.	SIZE/TYPE	FOOTAGE

ISSUED SEPT., 1980

REVISION

REVISION

SCALE N.T.S.

STD. DWG. No.

B-100



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## SCHEDULE C

### HIGHWAYS

#### GENERAL

This Schedule refers to streets, curb and gutter, boulevards, sidewalks, roadway lighting, underground wiring and natural gas.

#### 1. SPECIFICATIONS OR STANDARDS

When references to the following abbreviations are made, they refer to Specifications, Standards or methods of the respective Association. Abbreviations listed herein but not mentioned in the specifications shall be disregarded.

The number and letter following the abbreviations denote the Association's serial designation for the Specification of Standard to which reference is made. All references to these Specifications, Standards or Methods shall, in each instance, be understood to refer to the latest adopted revision, including all amendments.

ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
CAN	National Standards of Canada
CSA	Canadian Standards Association
RTAC	Roads and Transportation Association of Canada
USBS	US Bureau of Standards

#### DESIGN CRITERIA

#### 1. GENERAL

Roads shall be designed to minimize traffic hazards, to provide adequate access to all parcels within the subdivision and to adjacent land or as are necessary to implement any applicable municipal traffic plans and due regard shall be given to provide efficient gravity drainage.

Cul-de-sacs in areas with single family dwellings shall conform to the standard drawing in this Schedule. The dimensions shall be increased to meet traffic and vehicular requirements in areas with other zoning, or where the turnaround is skewed. Cul-de-sacs shall conform to the specifications stated in Section 4 Standard Widths. If necessary to ensure through pedestrian traffic to schools, parks and other facilities, a walkway shall be provided from the turnaround to an adjacent street.

The Developer shall conform to the specifications of all relevant utility companies.

The provisions set out for Rural Local and Rural Collector streets shall only apply to the following zones, which are identified on the Zoning Map, Schedule "A".

- RR-1 Rural Residential Single Family
- M-2 General Industrial
- M-3 Heavy Industrial
- M-4 Airport Industrial

**2. HORIZONTAL ALIGNMENT**

- a) Roads shall as far as possible be arranged without jogs or sharp changes in alignment and centrelines of intersecting streets shall meet at a single point. Whenever possible, roads shall intersect at right angles, but in no case at any angle less than 70 degrees, which angle shall be maintained for a distance of at least 38 metres measured from the centre point of the intersection.
- b) The horizontal alignment of the road shall be on the centreline of the road allowance, taking into consideration the location of all present and foreseeable future services to be installed within the road allowance.
- c) Centreline chainage stations shall be referenced and dimensioned from legal survey markers. The degree of curvature shall be relative to the classification of the road and its design speed. The minimum radius of curve and maximum superelevations shall conform to Table A-1 below.

**TABLE A-1  
HORIZONTAL ALIGNMENT**

	Design Speed	Minimum Centreline Radius	Maximum Superelevation
Urban Local Undivided (ULU)	50 km/hr	50 m	0.02 m/m
Rural Local Undivided (RLU)	50 km/hr	50 m	0.02 m/m
Urban Collector Undivided (UCU)	60 km/h	130 m	0.06 m/m
Rural Collector Undivided (RCU)	60 km/h	130 m	0.06 m/m

Horizontal curves shall be fully described showing their internal angle, radius, tangent length and arc.

The minimum radius of edge of pavement or surfacing aggregate shall be 9 metres.

3. VERTICAL ALIGNMENT

a) Superelevation

Horizontal curves on local roads shall not be superelevated without the consent in writing of the District. Collector roads shall be superelevated if required by the criteria for centreline radius and speed.

The length of a transition from a normal cross sectioned road to a section of road where there is superelevation shall in no case be less than 30 metres for a 50 km/h designed road or 40 metres for a 60 km/h designed road. In selecting the length of the transition, care and consideration shall be given to drain all of the travelled surface.

b) Intersections

Breaks in grade may be required on all roads at an intersection. Within 30 metre radius of the centre point of an intersection the maximum grade shall not exceed 3 percent.

Maximum and minimum gradients shall conform to Table A-2 below.

**TABLE A-2**

**GRADIENTS**

	<u>Maximum Gradient</u>	<u>Minimum Gradient</u>
Urban Local Undivided (ULU)	8	0.5
Rural Local Undivided (RLU)	8	0.5
Urban Collector Undivided (UCU)	8	0.5
Rural Collector Undivided (RCU)	8	0.5
Turnaround	5	0.5
Intersection Approach	3	0.5
Curb Returns	3	0.5



Minimum crown grades of 0.3 percent allowable with a 3 percent crossfall for paved surfaces and 4% crossfall for unpaved surfaces. Minimum gutter grade must be 0.5 percent to prevent ponding.

The vertical alignment of roads shall be set to serve adjacent properties with access driveways at a grade not steeper than 10 percent as measured from the edge of road to the proposed building area.

The length of vertical curves shall be calculated using the equation  $L=KA$ , using K values as in Table A-3 below.

Where L = a length of vertical curve,

Where K = a constant, and

Where A = the algebraic difference of tangent grades.

The Minimum Stopping Sight Distance is the sum of the distances travelled while reacting to an object in the path of the vehicle and the distance required to stop the vehicle.

**TABLE A-3**  
**LENGTH OF VERTICAL CURVES**

<u>Sag Curve</u>			<u>Crest Curve</u>		
<u>Speed</u> <u>km/h</u>	<u>Min.</u> <u>"K"</u>	<u>Minimum</u> <u>Sight</u> <u>Distance</u>	<u>Speed</u> <u>km/h</u>	<u>Min.</u> <u>"K"</u>	<u>Minimum</u> <u>Site</u> <u>Distance</u>
40	4	45 m	40	4	45m
50	6	65 m	50	7	65 m
60	10	85 m	60	15	85 m

Minimum stopping distances by street classifications:

- |    |                           |       |
|----|---------------------------|-------|
| 1. | Urban Local Undivided     | 650 m |
| 2. | Urban Collector Undivided | 850 m |

#### 4. STANDARD WIDTHS

a)	<u>Urban local undivided</u>	
	Width of right-of-way	21.33 m
	Width of pavement	9.75 m
b)	<u>Urban collector undivided</u>	
	Width of right-of-way	24.38 m
	Width of pavement	12.80 m
c)	<u>Rural local undivided</u>	
	Width of right-of-way	21.33 m
	Width of road (shoulder to shoulder)	8.00 m
d)	<u>Rural collector undivided</u>	
	Width of right-of-way	24.38 m
	Width of road (shoulder to shoulder)	10.00 m
e)	<u>Cul-de-sac</u>	
	Maximum length	150.0 m
	Width of right-of-way	21.33 m
	Width of pavement/travelled surface	9.75 m
	Turning circle right-of-way minimum radius	17.0 m
	Turning circle, with island, width of pavement	12.0 m
	Turning circle, without island, radius of pavement	12.0 m
f)	<u>Lanes</u>	
	Width of right-of-way	7.0 m
	Width of pavement	6.0 m
	Utility corridor	9.0 m
g)	<u>Walkways</u>	
	Walkways may be required at the end of cul-de-sacs or off expanded elbows of crescents or as directed by the Municipal Engineer.	
	Width of right-of-way	3.0 m
	Width of pavement	1.5 m
h)	<u>Sidewalks</u>	
	Sidewalk width in residential zones	3.0 m

5. PAVEMENT STRUCTURE

The Developer shall retain a qualified geotechnical engineering firm acceptable to the District to conduct site investigation and design a pavement structure for the subdivision. Pavement structure layer thicknesses less than shown on the typical sections will not be permitted without approval of the Public Works Superintendent of the District of Mackenzie. This recognises the sandy nature of the in situ material.

6. SIDEWALKS, CURB AND GUTTER

All curbs shall be mountable type. Sidewalks shall be constructed at a minimum on one side of urban arterials and collectors.

7. ROADWAY LIGHTING

Where underground roadway light wiring and ornamental type roadway lighting is included in the subdivision, all materials to be incorporated into the system shall be approved by the District and shall conform to the materials and specifications contained elsewhere in this document as well as the requirements of the Provincial Electrical Inspector.

Ornamental street and walkway lighting shall be provided on all streets within the subdivision as defined in Schedule B, "General Provisions." Provision shall also be made for providing power for future lighting in parks by installing the necessary ducts across highways to the park property line as required by the District.

The roadway lighting system shall be laid out in accordance with the CSA Standard C92.2 for roadway lighting. The minimum average lighting level for mid-block residential streets shall be 4 Lux with 10 Lux at intersections. The average lighting value on residential collector streets shall be increased to 6 Lux in mid-block and at minor intersections and 13 Lux at major intersections.

8. UNDERGROUND WIRING

Where the installation of underground power, cable television and telephone distribution systems with service connections is required in the subdivision, the Developer shall be responsible for meeting all the requirement of the private utility companies and government agencies concerned. The Developer shall obtain permits which may be required to carry out the system installation. Individual power, cablevision and telephone connections shall be provided for each individual parcel in the subdivision. All underground wiring will be installed in accordance with the utility companies and government agencies concerned.

9. NATURAL GAS

The Developer shall be responsible for meeting all the requirements of the local natural gas utility company and the government agencies concerned.

MATERIALS

1. STREETS

a) Supply

The Developer shall be responsible for acquisition of material and shall, prior to commencing work, submit to the Engineer laboratory test reports showing that the materials he intends to supply conform to the specifications.

He shall also be responsible for the negotiations and development of borrow sources, payment of royalties, access rights-of ways, access road construction and maintenance, drainage facilities, and maintenance and reinstatement of the borrow source to the satisfaction of the District, or the authority having jurisdiction. The satisfactory disposal of all waste material shall be the responsibility of the developer.

b) Earth Fill

Earth fill shall be material free of organic and deleterious matter.

c) Topsoil

Topsoil is surface material containing organic components and which, in the opinion of the District, is suitable for landscaping.

d) Subbase

Subbase shall be a pit run gravel, screened if necessary, composed of inert, durable aggregate, uniform in quality and free from soft or disintegrated particles, clay and silt balls, and other deleterious material, and shall conform to the following gradation limits when tested in accordance with ASTM C136 and ASTM C117:

<u>Standard Sieve Size</u>	<u>Gradation Limits (Percent by Weight Passing)</u>
75. mm	100
37.5 mm	60 - 100
9.5 mm	25 - 60
4.75 mm	25 - 50
0.300 mm	5 - 12
0.075 mm	0 - 6

e) Base Course and Surfacing Aggregate

The base course and surfacing aggregate shall be composed on inert, durable, crushed aggregate, uniform in quality, and free from soft or disintegrated pieces. In the absence of satisfactory performance records over a 5 year period for the particular source of aggregate, its soundness shall be tested in accordance with ASTM C88 using magnesium sulphate. Maximum weighted average losses for coarse aggregate shall be 20 percent, and for fine aggregate, 25 percent. The aggregate gradation shall fall within the following limits, when tested in accordance with ASTM C136 and ASTM C117:

BASE COURSE

<u>Standard Sieve Size</u>	<u>Gradation Limits (Percent by Weight Passing) For Nominal Maximum Size</u>	
	<u>25 mm</u>	<u>75 mm</u>
75	---	---
50	---	---
37.5	---	60-100
25	100	---
19	80-100	35-80
9.5	50-100	25-60
4.75	35-70	20-40
2.36	25-50	15-30
1.18	15-35	10-20
0.300	5-20	3-10
0.075	0-5	0-5

SURFACING AGGREGATE

<u>Sieve Size (mm)</u>	<u>Gradation Limits (Percent by Weight Passing)</u>
25	100
19.	85-100
9.5	60-85
4.75	40-70
1.18	20-50
0.300	10-30
0.075	5-15

The Developer shall submit to the District for approval his proposed base course/surfacing aggregate gradation(s) for the project. Upon approval, the gradation curve(s) shall become the project gradation(s). All samples of base course aggregate and surfacing aggregate used on the project shall conform to the following requirements:

1. Deviation between samples and the project gradation shall not exceed the following limits:

<u>Standard Sieve Size</u>	<u>Maximum Variation Limits (Percent by Weight Passing)</u>
4.75 mm and larger	± 5.0 Percent
2.36 mm - 1.18 mm	± 4.0 Percent
0.60 mm - 0.30 mm	± 2.5 Percent
0.15 mm - 0.075 mm	± 1.0 Percent

2. A sample gradations shall fall within the gradation limits.
3. A minimum of 60 percent of all material retained on the 4.75 mm sieve shall have at least one fractured face. The percentage shall be determined by particle count.

f) Perforated Drains

Perforated drains shall be as designed by the District.

g) Drain Rock

Drain rock shall be clean, crushed gravel or pea gravel as approved by the District.

h) Culverts

Sizes and lengths of culverts shall be as shown on the drawings.

Culverts shall be galvanized corrugated steel pipe conforming to the requirements of the current AASHTO Standard Specification for Corrugated Metal Pipe Culverts.

- Minimum thickness shall be:

450 mm diameter and smaller	1.63 mm
525 mm to 750 mm diameter	2.00 mm
900 mm diameter and larger	2.77 mm

i) Sandbags

Sandbags for concrete filled sandbags shall be at least 280 grams burlap approximately 500 mm by 900 mm measured inside the seams when the sack is laid flat.

j) Concrete

Concrete shall have a minimum 28 day compressive strength of 28 MPa. Slump shall not exceed 75 mm. Concrete work shall conform to CAN3-A23.1. Air content shall be maintained at 5-8%.

Dry mix concrete shall not be used without the approval of the District.

k) Granular Aggregate

1. Coarse Aggregate

Coarse aggregate shall be all material retained on a 4.75 mm sieve. It shall consist of crushed stone, crushed slag, crushed gravel, or combination thereof.

The aggregate shall be free from clay coatings, silt, or other deleterious matter. A minimum of 60 percent of the particles by weight shall have one or more fractured faces.

Maximum weight loss for 5 cycles when tested for soundness in accordance with ASTM C88 shall be no more than 18 percent using magnesium sulphate.

Maximum absorption shall be 1.7 percent when tested in accordance with ASTM C127.

The maximum loss in a Los Angeles Abrasion Test shall be 30 percent.

2. Fine Aggregate

Fine aggregate shall be all material passing a 4.75 mm sieve, including mineral fillers. It shall consist of natural material or material manufactured by crushing stone, slag or gravel.

The particles shall be clean, tough, durable, and free from coatings of clay, silt, or other deleterious matter.

When tested for soundness, in accordance with ASTM C88, the maximum loss of 5 cycles shall be no more than 25% when using magnesium sulphate.

Aggregate short of material passing the 0.075 mm sieve shall have approved mineral filler added.

3. Mineral Filler

Mineral filler shall consist of all material passing the 0.075 mm sieve, and shall be non-plastic when tested in accordance with ASTM D424.

It shall be dry and free from organic matter clay particles, or lumps.



l) Asphalt Cement

Asphalt cement shall be an AC5 Type A and conform to the following specifications:

- Penetration @ 25°C, 100 g .5 seconds	110 minimum
- Water %, maximum	0.5
- Ductility @ 25°C, cms, minimum	65
- Solubility in trichloroethylene, percent	99.0 minimum
- Flash point (COC), °C, minimum	235°C
- Thin film oven test, penetration of residue at 25°C, 100 g, 5 sec., 0.1 mm, % of original penetration	48 minimum

Asphalt shall be uniform in character and shall not foam when heated to 177°C.

m) Asphaltic Concrete

Asphaltic concrete shall conform to the following specifications as based on the Marshall method of design:

- Number of blows each fact of test specimen	75
- Percent voids in mineral aggregate	14 minimum
- Percent air voids in mixture, surface and lower course	3-5
- Minimum Marshall load, N @ 60°C	4,500
- Flow index, units of 0.25 mm	8-10
- Minimum index of retained stability after immersion in water @ 60°C for 24 hours	75 percent
- Aggregate gradation and fracture to comply with the BC Ministry of Transportation and Highways (Section 223.8) medium asphalt mix	

n) Primer

Primer shall be MC-30 liquid asphalt, or as approved.

o) Tack Coat

Tack coat shall be SS-1 asphalt emulsion, or as approved.

p) Grass Seed Mixture

Grass seed shall be premium quality have a purity of 95 percent or better and germination rate of 85 percent or better. The species of seed and percentages in the mixture shall be as follows:

- 35 Percent Kentucky Blue Grass
- 55 Percent Creeping Red Fescue
- 10 Percent White Dutch Clover

2. SIDEWALKS, CURB AND GUTTER

a) Base Material

Base Material shall be well graded, 19 mm minus gravel.

b) Concrete

Concrete shall conform to CAN3-A23.1. The mix design shall include the following:

- |                                |                                       |
|--------------------------------|---------------------------------------|
| - Minimum Compressive Strength | - 28 MPa at 28 days                   |
| - Minimum Cement Content       | - 312 Kg/m <sup>2</sup>               |
| - Maximum Aggregate Size       | - 19 mm                               |
| - Slump                        | - not exceeding 90 mm for hand formed |
| - Air Entrainment              | - 5-8%                                |

3. ROADWAY LIGHTING

a) General

Electrical materials used in the roadway lighting system shall be new and shall be approved by and bear the label of the Canadian Standards Association (CSA).

b) Conductors

Conductors shall be copper and if larger than 10 AWG shall be stranded. Conductor gauges shall be as shown on the drawings. Conductors run in rigid conduits or in the interior of roadway light poles shall have Type TW insulation. Conductors run in polyethylene tubing shall have Type TWU insulation.

c) Conduit

Polyvinyl chloride (PVC) conduit shall conform to CSA B196.1 or as approved, rigid unplasticized polyvinyl chloride, sizes as shown on the drawings. Couplings, adaptors and bends shall be of PVC and conform to CSA 196.1, or as approved.

d) Connectors

Insulated connectors shall be Scotchlok as manufactured by the Minnesota Mining and Manufacturing Company Ltd., or as approved. For conductor combinations too large to use Scotchlok connectors, a solderless line connector shall be used, such as connector CL2, manufactured by Thomas and Betts Ltd., or as approved. Bare copper lugs used for connecting ground conductors to ground studs in lighting pole hand poles shall be Thomas and Betts 54106 full compression lug or as approved. The connector serving a ground rod shall be Burndy Type GAR, or as approved.

e) Roadway Lighting Poles

Poles shall be NAPCO Davit Lighting Poles No. 29180-110-00, single 3 metre arm, 2 degree rise with slip fitter tenon to suit mercury luminaire. Davit poles shall have a total height to the tenon of 9 metres, and a centreline radius for the davit of 2.3 metres. The tenon shall be 60 mm OD by 175 mm long. Each pole shall be supplied with a handhole with cover plate and a 6 mm x 600 mm ground stud, complete with 2 nuts and 2 washers. Three shims shall be provided to permit accurate spacing of anchor bolts.

f) Luminaries

Luminaries shall be 105 or 250 watt high pressure sodium with integral regulated output type dual primary (120/240 volt) thermally protected ballast. Luminaries shall be complete with 150 or 250 watt, high pressure sodium lamps. Where specified on the drawings, luminaries shall be supplied with twist-lock receptacles to accept photo-electric control units. All components shall be suitable for operation in temperatures ranging from -40°C to 70°C.

g) Photo-Cell Units

Photo-cell units shall be cadmium sulphide type having externally adjustable sensitivity, and shall be provided with a twist-lock base to match the receptacle provided in the luminaire. Operating voltage shall be 120 volts, and an integrally contained control relay shall be capable of switching at least 1000 volt-amperes. The action of the unit shall be such that in daylight the relay is energized, holding open its normally closed contacts. The unit shall have built-in surge protector and a lightning arrester.

h) Service Panels

Service panels shall be of the pole-mounting or kiosk type as shown on the drawings, and shall be constructed to the details shown on the drawings.

i) Ground Rods

Ground rods shall be 19 mm diameter steel with hot forged point. Top ends shall be galvanized for a minimum distance of 250 mm for 2 metre rods and 450 mm for 3 metre rods.

## WORKMANSHIP

### 1. STREETS

a) Borrow Pit Development

Prior to removal of any material from a borrow pit, the entire site to be excavated shall be cleaned and grubbed and stripped of all unsuitable overburden. Combustible material shall be burned or disposed of as directed by the District.

Borrow pits shall be excavated such that they will be free draining to the lowest corner or to such other location as determined by the District.

b) Aggregate Processing and Placing

The Developer shall provide and maintain in good operating condition all necessary plant, equipment, and tools to produce and place aggregate in conformance with this Schedule. Such plant and equipment shall be of a type to ensure proper construction and maintenance of roadways and access roads, proper development of borrow pits, maximum utilization of borrow pits, production of aggregate to the quality and uniformity specified herein, and adherence to the schedule of completion.

The Developer shall obtain the District's approval of his proposed methods of development and excavation in the borrow pit. Excavation shall be performed in such a manner as to ensure material removed is as uniform as possible.

Should testing indicate that the aggregate gradation does not fall within the specified limits, the Developer shall immediately take all necessary action to alleviate the cause.

c) Stockpiling

Base course shall be stockpiled prior to use at either the crushing site or such other location on the jobsite subject to the approval of the District. Stockpile sites shall be cleared of all vegetation, trees, brush, rocks, and other debris and covered with a uniform layer of pit run gravel prior to deposit of the base course material.

Stockpiles shall be built up in layers not to exceed 1 metre in thickness to a minimum height of 9 metres in such a manner as to prevent any appreciable segregation. End dumping over the edge of the stockpile will not be permitted.

Planks or protected runways for vehicles shall be provided as necessary to prevent contamination of the stockpile.

d) Road Alignment and Grade

The Developer shall be responsible for all layout required to ensure the works are located as shown on the approved drawings.

e) Construction Methods

Construction shall not be undertaken during snow, heavy rain, freezing, or other unsuitable conditions. Aggregate shall not be placed upon a frozen, wet, muddy or rutted subgrade of subbase surface.

Roads and boulevards shall be excavated to the design subgrade cross-section prior to trench excavation for underground utilities and structures.

f) Clearing and Grubbing

All road allowances shall be cleared and grubbed from property line to property line. Waste material shall be disposed of in a manner approved by the District.

All trees and brush shall be cut, and along with stumps, logs, roots, rotten wood and other organic materials, shall be disposed of by burning or other approved means.

The above material shall be removed from the ground surface and to a minimum depth of 300 mm below ground surface.

All other rubbish and debris existing on the site shall be removed and disposed of by burning or other approved means.

Trees shall be felled within the designated clearing area and those falling outside this area shall be cut up and returned to the clearing area for disposal.

On instruction from the District, individual leaning or dangerous trees or snags adjacent to, but outside the designated clearing area, shall be cut and disposed of.

Excavations resulting from removal of tree trunks, roots, or other material shall be filled by the Developer as a part of the clearing and grubbing operation.

g) Burning

Burning shall be carried out at points located centrally in the area being cleared. The fire or fires burning at any one time shall be limited by the ability of the Developer's equipment and organization to provide adequate protection against spreading of fires to adjacent timber or property.

Burning shall be carried out subject to the provisions of the Provincial Acts and Regulations thereto. In the event of Forestry Regulations prohibiting burning, materials to be burned may either be piled until such time as the regulations are rescinded or removed from the site.

Restrictions of federal, provincial, municipal, or other recognized authorities established to control burning in the area shall be complied with. If burning cannot be done on the clearing site, the material shall be hauled to an approved location for burning or disposal. Burning sites, as required, shall be obtained by the Developer.

h) Stripping

Prior to commencing excavation operations, those areas designated by the District shall be stripped of all overburden and topsoil. Overburden shall be disposed of as specified for waste material. Topsoil shall be stockpiled as directed by the District. Stumps, boulders and other deleterious matter shall be removed from the topsoil and disposed of as specified for waste material.

i) Overexcavation

Overexcavation will generally be that additional excavation required by the District as a result of unsuitable natural foundation conditions.

Overexcavation will be replaced with earth fill, rock fill, subbase material, or base course as directed by the District. Replacement fill shall be placed as specified elsewhere herein.

j) Culvert Installation

Trenches for culvert installation shall be excavated to the required depth and grade as specified by the District. A full trench condition shall be provided wherever possible. The bottom of the trench upon which the pipe is to be laid shall be shaped so that at least  $\frac{1}{4}$  of the circumference of the pipe is in contact with the prepared foundation throughout its length. The trench and other preparatory work shall be approved by the District before actual placing of the pipe starts.

Pipe shall be laid beginning at the lower end with the outside laps pointing upgrade and the longitudinal joint at the springline. The sections shall be firmly jointed together, and metal in joints which is not thoroughly protected by galvanizing shall be coated with a suitable asphaltum paint.

Care shall be taken to give the pipe a firm and uniform bearing. Pipe which settles or which is not in true alignment shall, upon instruction from the District, be relaid.

Base course material shall be used to backfill to the top of the pipe. Material shall be deposited equally on both sides of the pipe in layers not exceeding 150 mm in thickness, and shall be thoroughly compacted using mechanical tampers.

The remainder of the trench shall be backfilled to the subgrade elevation with subbase material. Backfill for the first 300 mm over the pipe shall be placed by hand. Backfill shall be placed in layers not exceeding 150 mm in thickness and shall be thoroughly compacted using mechanical tampers.

Inlet and outlet ditches to culverts shall be constructed to the required lines and levels.

k) Subgrade Preparation

In areas where, after stripping, a fill in excess of 150 mm is required to bring the finished subgrade to the design subgrade cross-section, earth fill or rock fill shall be placed as specified elsewhere herein.

In areas where after stripping, a cut or a fill of 150 mm or less is required to bring the finished subgrade to the design subgrade cross-section, the subgrade shall be scarified to a minimum depth of 150 mm below the design subgrade cross-section and all material windrowed to one side. The exposed surface shall then be compacted to 90 percent of Modified Proctor Density (ASTM D1557), the windrowed material moved, and the compaction repeated on the other side.

Windrowed material shall then be brought to its optimum moisture content, shaped to line and grade, and compacted to 95 percent Modified Proctor Density (ASTM D1557).

At transitions between cut and fill areas, the subgrade shall be scarified and recompacted as specified above to a depth of 150 mm for a distance of 15 metres.

The subgrade in cut areas shall be prepared 1 metre wider on each side than the required width of the finished base course. In fill areas embankments shall be constructed to the required width of the finished base course and the specified side slopes. The finished subgrade shall be crowned and sloped as required to prevent ponding of water on the roadway.

Should any soft spots develop during the process of compaction, such areas shall be excavated and refilled.

l) Watering

If weather conditions and construction materials are such that watering may be required, upon direction from the District, the Developer shall maintain suitable watering equipment of the site. Watering shall be performed as directed by the District to control dust and to ensure optimum moisture conditions for earth fill compaction, subgrade preparation, and placing subbase and base course materials.

Water in excess of that required for optimum moisture conditions may be used only with the District's approval, and, if considered necessary, to obtain the specified density.



Water shall be applied uniformly from a pressure type distributor equipped with suitable control apparatus and a spray bar and nozzles similar to those used on asphalt distributors. Splash plate type distributors or distributors with spray bars which discharge jets of water will not be approved by the District.

m) Transportation of Asphaltic Concrete

Asphaltic concrete shall be transported in vehicle with tight metal boxes cleaned of foreign materials.

Inside surfaces of truck boxes shall be lubricated with suitable thin oil or soap, but excessive use of lubricant will not be permitted. Trucks intended for the transport of asphaltic concrete shall be equipped with tarpaulins. Vehicles shall be suitably insulated, as required, to prevent excessive heat loss during transportation.

n) Construction Conditions

Placement of asphaltic concrete shall not be undertaken during snow, heavy rain, freezing, or other unsuitable conditions. Asphaltic concrete shall not be placed upon a frozen, wet, muddy, or rutted base.

o) Preparation of Existing Granular Base

Prior to priming, or placement of asphaltic concrete, the existing granular base shall be prepared by grading, reshaping to the required grade and cross-section, and compacting to 95 percent of Modified Proctor Density (ASTM D1557). Base material shall be added where necessary to adjust to grade and cross-section. During grading, material shall not be bladed off the road base in such a manner as would render the material unusable. Surplus and loose aggregate shall be removed and used elsewhere or disposed of.

p) Responsibility for Base

It shall be the Developer's responsibility to examine the base immediately prior to commencing paving operations and satisfy himself that it is properly prepared to receive the pavement.

q) Adjustment of Service Structures

Existing manholes, catch basins, valve boxes and other service structures, within the area to be paved, shall be adjusted to the property finished grade at the time of paving.

r) Primer

Primer shall be applied on the granular base when the surface is dry or slightly damp and the air temperature above 10°C. The primer shall be uniformly applied with an approved pressure distributor at a rate of 1.0 to 1.5 litres per square metre, and the temperature of the material shall be such that the kinematic viscosity will be between 50 and 150 square millimetres per second.

Primer shall be allowed to cure for a minimum of 24 hours. Traffic shall be kept off primed areas until the primer has been allowed to cure. Additional primer shall be applied to areas requiring priming to fill voids, to coat and bond particles, or as directed by the Engineer. If the primed surface is loose, rolling of the surface with a pneumatic-tired roller may be required.

s) Tack Coat

Tack coat shall be applied to all existing asphaltic concrete which is to be overlain, the edge of curbs, existing asphaltic concrete and structures, where the surface of these structures will be in contact with new asphaltic concrete pavement.

Where the surface course of asphaltic concrete pavement is not placed immediately after the lower course, tack coat shall be applied to the lower course of asphaltic concrete pavement as specified for existing asphaltic concrete surfaces.

Tack coat shall be applied only when the surface is dry and clean, and the air temperature is over 10°C. Care shall be exercised in the application of tack coat to avoid application to areas which will not be paved.

Existing asphaltic concrete surfaces shall be thoroughly cleaned by a power-driven sweeper immediately prior to applying the tack coat.

Tack coat shall be uniformly applied with an approved pressure distributor at a rate of 0.25 litres per square metre. The temperature of the material shall be maintained between 32°C and 38°C or as necessary to permit proper spraying.

Traffic shall, where possible, be kept off tack coat areas.

t) Overlaying Existing Pavement

In areas where existing pavement is to be retained, the new road base adjacent to the existing pavement shall first be constructed as specified in Clause k) "Subgrade Preparation". The lower course of asphaltic concrete shall be placed on the new road base and the existing pavement shall be raised to the same level through placement of a levelling course. Levelling courses shall be placed in multiple lifts where necessary, with the shortest length lift placed first and successive lifts exceeding over the preceding shorter ones. The maximum compacted thickness of any one lift of levelling course shall not exceed 100 mm. Levelling course shall be constructed using the specified asphaltic concrete mix.

Prior to overlaying existing pavement, pavement defects shall be corrected. Cracks greater than 3 mm in width shall be cleaned of loose and foreign materials and filled with liquid asphalt. Defective pavement shall be repaired by cutting the existing pavement back to sound material and providing a neat vertical edge. Pavement shall be removed and the exposed road base shall be recompacted to the specified grade and cross-section. The exposed area shall be filled using the specified asphaltic concrete mix, thoroughly compacted and rolled to a uniform surface.

On completion of the above, the final surface course of asphaltic concrete shall be placed over the full width of the roadway.

u) Transitions

Transitions shall be constructed by cutting and removing the existing pavement to the limits shown on the approved drawings. The exposed road base shall be regraded and base material added as required to attain the specified grade and cross-section. Before placing the asphaltic concrete the exposed road base shall be thoroughly compacted to 95 percent of Modified Proctor Density (ASTM D1557). The pavement thickness shall be shown on the approved drawings.

v) Connection to Existing Pavement

Connections to existing pavement shall be made by cutting back the existing pavement to sound material, and providing a neat vertical face with a straightedge. The new pavement shall be placed tight to the existing pavement and the finished surface shall be flush with the existing pavement. Prior to paving, the exposed face of the existing pavement shall be heated and painted with tack coat.

w) Placing Asphaltic Concrete

Surfaces onto which asphaltic concrete will be placed shall be dry, and cleaned of all loose and foreign materials. Asphaltic concrete shall not normally be laid when the atmospheric temperature is less than 5°C and falling. At temperatures below 5°C, retractable hoods shall be provided on the paver to retain heat. The asphaltic concrete at time of placing shall not be less than 130°C or more than 160°C.

An approved, self-propelled mechanical paver shall be used to spread the asphaltic concrete to the specified thickness. The paver feed shall be adjusted to correspond with the rate of delivery such that stoppages of the paver shall be minimized.

Hand methods may be used, as approved by the District, in narrow areas, irregular sections, intersections, turnouts, or driveways where it is impracticable to spread with a paver.

Minor irregularities in spreading and shaping the paved surface adjacent to existing service structures such as manholes, catch basins, or valve boxes, shall be corrected to the satisfaction of the District.

Where asphaltic concrete is to be placed in more than one lift the lower lift shall be placed, compacted and finished of the full width as shown on the drawings, prior to placement of subsequent lifts. The surface of all lower lifts shall be thoroughly cleaned of dirt or other deleterious material with a power-driven sweeper supplemented by hand sweeping where necessary prior to placement of subsequent lifts.

All transverse and longitudinal joints shall be heated to 65°C immediately prior to application of tack coat and paving. Heating and application of tack coat to longitudinal joints may be omitted if the previously laid pavement has not cooled to less than 50°C. At no time shall an open flame be applied to the asphaltic surface for warming the pavement. Transverse joint in successive lifts shall be offset a minimum of 0.6 metres and in adjacent lanes they shall be offset a minimum of 3 metres. Longitudinal joints in successive lifts shall be offset 150 mm to 200 mm.

x) Compaction of Asphaltic Concrete

Compaction shall commence immediately after the bearing capacity of the asphaltic concrete is adequate to support compaction equipment without undesirable displacement or cracking.

Rollers shall be an approved, self-propelled steel wheeled type, capable of exerting a load on the main roll of at least 4 kg/mm of width, and an approved, self-propelled, pneumatic tired roller. Rollers shall be in good condition and capable of reversing without backlash.

Maximum speed for breakdown rolling shall not exceed 5 km/h, and subsequent rolling, 8 km/h. Speeds shall be maintained at all times such that displacement of asphaltic concrete does not occur.

During the rolling operation, roller wheels shall be kept moist with only enough water to avoid picking up material. Fuel oil, lubricating oil, or kerosene shall not be permitted as lubricants for the roller wheels.

The line of rolling shall not be suddenly changed nor the direction of rolling suddenly reversed, and pronounced changes in direction shall be made only on stable material. Alternate trips of the roller shall be of slightly different lengths.

Longitudinal rolling shall progress towards the crown of the pavement, overlapping at least  $\frac{1}{2}$  the width of the roller with each successive pass. On superelevated curves, and on uncrowned roadways, rolling shall begin on the low side and progress to the high side.

Areas inaccessible to rollers shall be compacted with mechanical and hand tampers to the satisfaction of the Engineer.

Joints shall be carefully constructed and thoroughly compacted to provide a smooth riding surface over the joint.

In general, compaction shall be performed in the following manner:

1. Transverse Joints

Transverse joints shall have a vertical face and shall be rolled immediately after raking is completed. Rolling shall be the same as for longitudinal joints, except overlapping on previously compacted pavement shall be omitted when the courses are of different elevations.

2. Longitudinal Joints

Longitudinal joints have a vertical face and shall be rolled directly behind the paving operation. Joints shall be rolled by passing the roller on the previously compacted lane allowing an over lap of 75 mm to 150 mm on the new lane. A minimum of 2 passes shall be required to thoroughly compact this narrow strip down to and even with the existing lane.

3. Edges

Pavement edges shall be rolled concurrently with the longitudinal joints and shall not be exposed more than 15 minutes before rolling. The roller wheels shall extend 50 mm to 100 mm beyond the edge of the pavement.

4. Breakdown Rolling

Breakdown rolling shall immediately follow the rolling of longitudinal joints and edges. Rollers shall be operated as close to the paver as necessary to obtain adequate density without causing undue displacement. Breakdown rolling shall be performed by vibratory steel wheeled rollers.

When placing more than one course, pneumatic-tired rollers may be used for the breakdown rolling of the lower course, providing that they are immediately followed with steel wheeled rollers.

5. Intermediate Rolling

Intermediate rolling shall be performed by pneumatic-tired rollers, and shall follow the initial rolling as closely as possible. Intermediate rolling shall be continuous until the mix has been thoroughly compacted.

6. Finish Rolling

Finish rolling shall be performed by steel wheeled rollers to remove all marks left by pneumatic rolling. Finish rolling shall be continuous until all roller marks are eliminated and no further compaction is possible.

The mean density of cored samples of the finished pavement, obtained at random locations in accordance with ASTM D3665 shall not be less than 97% of the plant briquette density, with no individual test less than 95%.

y) Miscellaneous Pavement

Miscellaneous pavement shall be all pavement shown on the drawings or specified by the District other than pavement on roadways, lanes and areas where conventional methods and equipment can be used.

Placement and compaction shall be carried out as specified except that methods and equipment may be varied to suit particular conditions. Methods and equipment shall be subject to the District's approval. Compaction shall be carried out using approved self-propelled vibratory steel wheeled rollers.

z) Asphalt Curb

Asphalt curb shall be constructed at the locations shown on the approved drawings.

Surface course asphaltic concrete mix shall be used for construction of asphalt curb. Tack coat shall be applied to the surface of the asphaltic concrete where the curb is to be placed. Asphalt curb shall be placed and thoroughly compacted by an approved extruding machine. The finished asphalt curb surface shall be smooth, true to line and grade and conforming to the cross-section shown on the drawings.

The nominal placement rate shall be 2.40 kg\mm thickness per square metre. Tolerances in the placement rate shall be as follows:

<u>Design Thickness of Any One Course</u>	<u>Maximum Deviation from Nominal Placement Rate</u>
50 mm or less	+ 10 Percent
51 mm to 100 mm	+ 8 Percent
100 mm	+ 6 Percent

aa) Pavement Core Holes

Pavement core holes shall be repaired with the appropriate asphaltic concrete mixture. The asphaltic concrete shall be thoroughly compacted to provide a surface flush with the pavement. Prior to repairing core holes, the exposed face of the pavement shall be painted with tack coat.

ab) Alignment Control

Asphaltic concrete placement procedures and equipment shall be carefully regulated to maintain the finished work within the following tolerances.

1. The finished surface of asphaltic concrete pavement shall be within a tolerance of  $\pm 10$  mm with respect to the designated grade and cross-section.
2. The maximum allowable irregularity in the finished surface of asphaltic concrete pavement shall be 6mm measured from a 3 metre straightedge.

ac) Testing

The District may retain an independent materials testing firm to carry out the following tests:

1. Density tests on subgrade, subbase and base course.
2. Benkleman Bean testing as may be required prior to paving.
3. Asphalt cores for density analysis.

The Developer shall provide the District with a mix design showing the items listed above. The Materials testing firm shall be requested by the District to submit one set of test results direct to the District.

ad) Boulevards

1. General

Boulevards shall be provided in all subdivisions where new highways are created except in A, RR-1, RRC1, M-1, M-2 or M-3 zones.

2. Requirements

Boulevard areas lying between the curb and property lines of road allowances shall be graded and topsoiled as follows:

- a) Unless otherwise approved, boulevards shall be graded to drain to the curb at a minimum slope of 300 mm per metre.
- b) The boulevard area shall be finished by excavating or filling as required to grade from the top elevation of curb to the property line. Fill sections shall be consolidated by rolling.



- c) The top 100 mm of soil shall be good quality topsoil raked free of all roots and other organic material and debris which is not conducive to the growing of grass, and shall contain no rock greater than 25 mm in maximum dimension.
- d) Seeding shall be carried out in the periods 15 June to 15 August. Seeding shall not be undertaken when the ground or topsoil is excessively wet, frozen or in an otherwise unsuitable condition, or during periods of high wind or heavy rainfall.

After topsoiling is complete, grass seed shall be applied by approved means.

Grass seed shall be applied uniformly at the rate of 150 kg/ha.

ae) Clean Up

Immediately prior to the Developer's request to the District for an inspection, all installation shall be cleaned of all debris, rocks, gravel or other materials. Manholes and the sewerage and drainage system shall be similarly rechecked and cleaned and flushed if required by the District.

2. SIDEWALKS, CURB AND GUTTER

a) Area Clearing

For all sidewalks the walkway area shall be cleared to a minimum of 3 metres and graded to provide proper surface drainage.

b) Subgrade and Base Preparation

The subgrade shall be thoroughly compacted to 95 percent of Modified Proctor Density (ASTM D1557) by approved mechanical compactors on completion of excavation. Unstable material below the subgrade level shall be removed and replaced with earth fill or select granular subbase material as specified by the District. This material shall be compacted to 95 percent of Modified Proctor Density (ASTM D1557). In fill areas, backfill material below the subgrade shall be earth fill or select granular subbase as specified by the District. The granular base shall be placed, compacted to 95 percent of Modified Proctor Density (ASTM D1557) and moistened immediately prior to placing concrete.

Base under sidewalks shall in addition include select granular subbase compacted to 95 percent Modified Proctor Density (ASTM D1557).

c) Tolerance

Maximum deviation from the designated horizontal or vertical alignment of any point on the curb and gutter or sidewalk section shall be 6 mm. The maximum deflection from designated deflection from the designated horizontal or vertical alignment shall be 6 mm in 3 metres.

Where elevations or alignment do not conform to the above tolerances, these sections shall be removed and replaced as directed by the District.

d) Sidewalk Thickness

Concrete sidewalk thickness shall be:

- |    |                            |        |
|----|----------------------------|--------|
| 1. | Sidewalk                   | 100 mm |
| 2. | Lane Crossing              | 175 mm |
| 3. | Private Driveway Crossings | 150 mm |

e) Placing Concrete

The District shall be notified at least one day in advance of any concrete pour for sidewalks.

Concrete shall be placed immediately after mixing by means of preset forms or by an approved extruding machine.

Successive batches shall be deposited in a continuous operation. Under no circumstances shall partially set concrete be used.

Concrete shall not be placed during wet weather, nor upon a frozen base, and shall not be placed when it appears likely that the air temperature will fall below 5°C with 24 hours unless special precautions are taken and approved by the District. Concrete shall be kept at a temperature of not less than 13°C for at least 72 hours after placing.

f) Hand Formed Sections

Forms shall produce a true line free from waves to the edge of the sidewalk. Forms shall be thoroughly cleaned and freshly oiled with an approved form oil before concrete is placed. After forms have been set to line and grade, they shall be braced and tied, and checked with a template to ensure proper setting. Concrete shall not be placed until the forms have been inspected and approved by the District.

The concrete placing operation shall be timed to permit edging and finishing in daylight hours. Pours shall be discontinued only at expansion joints. Face forms shall be removed as soon after pouring as is possible without resulting in damage to the curb in order to permit finishing. Under no circumstances shall the face forms remain in place overnight.

g) Extruded Sections

Rails for extruding machine guidance shall be sufficiently rigid and shall be adequately supported to ensure that the weight of the machine will not cause deflection from established line and grade.

h) Expansion Joints

Transverse expansion joints shall be formed at both sides of lanes and crossings, at both ends of all curb returns, and at maximum spacing of every 46 metres for sidewalks and at all other locations designated by the District.

i) Contraction Joints

Contraction joints shall be constructed at maximum 3 metre intervals by cutting a groove through the surface of the concrete to a minimum of  $\frac{1}{4}$  of the depth of the concrete section at the point of cut.

j) Isolation Joints

Isolation joints shall be fabricated around telephone poles, light poles, hydrants, manholes, and all other structures located in the concrete section by wrapping and securing 4 thicknesses of 4 ply Rubberoid roofing material around the structure.

Longitudinal isolation joints shall be formed between sidewalk and existing curbing and where sidewalk is installed directly against a wall or other structure.

k) Edging and Finishing

The surface of the concrete sidewalks shall be finished prior to final set by brushing to provide a uniform non-skid finish. Edging shall conform to existing patterns or as specified by the District. Both sides of all joints and edges shall be finished with a steel edging trowel. Under no circumstances shall the concrete be overworked by trowelling, dusted with dry cement, or finished with a mortar coat.

l) Curing Concrete

As soon as the concrete has obtained its initial set, it shall be sprayed with 2 coats of an approved membrane curing compound conforming to ASTM C309 and containing a fugitive dye. Other methods of curing will be approved only if effective over a period of 7 days.

m) Protecting Concrete

Tarpaulins shall be used to protect freshly finished concrete from dust, rain or frost. Protective coverings used for heating purposes shall be kept clear of the concrete to permit unimpeded circulation of air.

No construction equipment shall be worked adjacent to the curb until the concrete has attained adequate strength. This shall be for at least 7 days or as directed by the District.

n) Frozen Concrete

Where concrete shows evidence of damage due to freezing, the entire section lying between contraction joints shall be removed and replaced at the Developer's expense.

o) Catch Basins and Manholes

Catch basins and manholes frames shall be adjusted horizontally and vertically as necessary to match the finished alignment and grade.

p) Backfill and Clean-up

The gravelled road area adjacent to the gutter shall be filled tight to the gutter as shown on the approved drawings, graded and left in a neat condition.

The boulevard area adjacent to the curb or sidewalk shall be cleared of construction debris and raked clear of all rock exceeding 50 mm in its largest dimension.

q) Asphaltic Concrete Sidewalks

Where asphaltic concrete sidewalks are permitted, the same base preparation shall be used as specified above and the sidewalk shall be surfaced with a 50 mm depth of asphaltic concrete. The specifications shall be the same as for streets as to material.

r) Testing

The Developer shall retain an independent materials testing firm acceptable to the District to carry out compressive tests on the concrete. One test consisting of three 150 mm x 300 mm cylinders may be made for each 180 metres of sidewalk installed. In no case, however, will there be less than one test for concrete placed in one day. One cylinder shall be tested at 7 days, 2 at 28 days. The materials testing firm shall submit one set of test results direct to the District.

3. ROADWAY LIGHTING

a) General

The Developer shall cause to be installed a complete ornamental roadway lighting system in every subdivision except in A, M-1, M-2, M-3, RR-1, or RRC-1 zones. The installation shall include:

1. Services, service equipment and control equipment in service base.
2. Concrete foundation and anchor bolts for roadway light poles as shown on Standard Drawings.
3. Roadway lighting poles, luminaires, lamps, photocells and photocell brackets.
4. Painting of roadway light poles.
5. Everything necessary to provide a complete operating system.

Roadway light poles shall be provided at a maximum interval of 76 metres staggered on both sides of the roadway.

b) Precautions During Construction

Conduits and enclosures shall be capped or closed when electrical work is not actually in progress. A manufactured PVC cap shall be used.

Service panels and other electrical equipment shall be properly protected against the entrance of dust, dirt and moisture, and protected against mechanical injury while rough, dirty, wet or dusty work is in progress. Damage to electrical equipment including marring of painted surface caused by failure to properly protect the equipment shall be promptly repaired by the Developer.

c) Precutting Paved Surfaces

When trenching along or across a paved surface or a concrete sidewalk, pavement or concrete shall first be cut in straight lines parallel to the trench centrelines. The width of pavement cut shall not be greater than that which is necessary for trench excavation. Where, in the opinion of the District, existing pavement is in poor condition that precutting is not warranted, pavement may be cut by trenching equipment. Pavement that has been removed shall be disposed of as waste excavated material.

d) Trenching and Backfill

Trenches shall be excavated to permit cover over conduits 600 mm in boulevards, medians, and under new existing sidewalks, and 900 mm under roadways and driveways.

Conduit shall be laid on a minimum of 75 mm of sand bedding, and covered with a minimum of 125 mm of the same.

Trenches shall be backfilled with subbase material to an elevation 150 mm below the finished surface. In boulevards, trenches may be backfilled with native backfill material. The backfill shall be placed in maximum 150 mm lifts, with each lift compacted at optimum moisture content to 90 percent of Standard Proctor Density (ASTM D698).

During trench backfilling, underground utility warning tape shall be placed 300 mm above conduits.

Trench surfaces shall be finished to a condition at least equivalent to that which existed prior to excavation. For paved surfaces, a minimum compacted thickness of 75 mm of asphaltic concrete shall be placed on a minimum of 75 mm of base material.

e) Waste Excavation Material

Waste excavated material shall be disposed of at a site obtained by the Developer. The material shall not be dumped on private property without the written permission of the property owner.

f) Conduit Installation

1. General

Conduit systems shall be cleaned to remove all moisture and foreign substances before pulling in conductors.

Empty conduits shall be provided with an insulated NO. 12 AWG copper pull wire.

2. Buried Conduit

Buried conduit shall be capped and identified at both ends prior to pouring of concrete or backfilling.

Conduit shall extend a minimum of 75 mm above the top of the concrete base.

PVC conduit bends, sweeps, and offsets shall be made with factory fabricated fittings for sizes larger than 50 mm. A male PVC conduit shall not be installed into a steel female hub or coupling. PVC conduit used with steel hubs or couplings shall be of the female type.

Conduits shall generally be parallel or perpendicular to the roadway, and routed so as to run in a direct line between adjacent poles. Bends, sweeps and offsets shall be made only when necessitated by site conditions. Bends shall be of large radius type wherever possible.

Conduits laid in the same trench with the communication and power cables shall maintain the required minimum spacing throughout.

Conduits laid near underground pipes and underground portion of overhead structure shall maintain the required minimum clearance.

Crossovers shall be kept to a minimum.

Underground utility warning tape shall be installed 300 mm above the conduit.

g) Conductor Installation

No conductor shall be drawn into any raceway until all work of any nature that may cause injury to the conductor or its insulation has been completed. During wire pulling, the conductors shall be fed carefully in to the raceway to prevent twisting, kinking or looping. Only talc, soap, or other CSA approved wire lubricants shall be used to assist in the pulling operations. Grease type lubricants shall not be permitted.

h) Grounding

1. General

The combined ground resistance shall not exceed 10 ohms. This requirement shall be realized by connection to artificial grounding electrodes.

2. Equipment Grounding

The following shall be grounded:

- Non-current carrying parts of electrical apparatus.
- Service panel.
- Metal poles.

Where a ground conductor is below grade or below a concrete slab, splices or connections shall be welded by the thermit process.

3. System Grounding

The neutral of the service voltage shall be grounded at the service switch and also at the service transformer.

i) Unused Openings

Service enclosures shall have only those openings necessary to accommodate conduits at the time of installation. Unused openings in sheet steel panels shall be plugged with press-in plugs. Spare conduits shall be capped.



j) Concrete Pole Bases

Where possible, the hole for the base shall be dug without disturbing the surrounding soil. If the soil remains firm and hole dimensions conform to those specified, no form work need be used except for the top 200 mm of the base.

The pedestal portion of the base shall be neatly formed to the given dimensions. The top of the base shall be trowelled smooth and level, and edges shall be bevelled.

An accurate template shall be used to locate conduits and pole anchors.

Anchor bolts shall be set with a template to suit the poles.

Poles shall not be mounted until 7 days after pouring bases.

Before mounting poles, all formwork shall be removed and backfill placed around the base and compacted with a mechanical tamper to 90 percent of Standard Proctor Density (ASTM D698).

Bases shall be neatly grouted after pole installation ensuring that drain holes are not plugged. Temporary protective covers shall be provided over any concrete pole base which has exposed wiring prior to the installation of the steel pole.

k) Poles

Poles shall be erected plumb, using the shims supplied if required. Plumbing shall be done with a 600 mm spirit level attached to a proper size wedge to allow for taper of poles. No more than 6 shims shall be used for any one pole. Davits and mast arms shall be installed at right angle to the centreline of the road. Poles shall be cleaned after erection.

Exposed portions of the anchor rods and nuts shall be given a liberal coating of Dearborn Chemical Company No-Oxide Grease Type "G Special".

Arrangements shall be made by the Developer to de-energize high potential conductors that are too close to roadway lighting poles during erection. The cost for this shall be borne by the Developer.

If temporary protection is required for erection of works where overhead conductors of 600 volts or less or telephone cables are in contact with or in danger of contacting roadway lighting poles or luminaires during erection, adequate polyethylene conduit sleeves securely taped into place shall be installed to protect the overhead conductors.

The Developer shall be held responsible for and bear the cost of damages done to other facilities caused by this operation.

l) Luminaires

Luminaires shall be cleaned and levelled after pole erection and plumbing is complete.

Luminaires shall be securely fastened to the lighting poles, and oriented to produce the required light distribution.

m) Photo-Electric Controller

Photo-electric controller shall be oriented as required by the manufacturer.

n) Painting

After completion of the pole installation, the Developer shall wire-brush any paint defects to be followed by application of a coat of paint.

Poles and service bases shall receive a final coat of spray paint, the color of which shall be as specified by the District.

Surfaces shall be completely dry before painting. Work shall not be done in temperatures lower than 10°C or when frost is predicted within the next 24 hours.

Existing metal poles, service bases and other materials which are part of the project shall be cleaned, wire brushed where the paint is damaged and repainted.

o) Clean-up

The interior of enclosures, pole handholes, and wiring areas shall be cleaned of dust, dirt and loose materials, vacuum-cleaned, and all water and moisture removed.

All fastening screw holes provided in enclosures shall have a fastening screw installed.

p) Testing and Calibration

1. General

The Contractor shall carry out all adjustments and tests necessary to ensure that the entire electrical installation and all its equipment, material and components are in satisfactory physical condition electrically and perform the intended function and operations. Adjustments required to make the system operate in the manner intended by the District shall be made at no cost to the District of Mackenzie.

At the completion of the job, proper systems operation shall be demonstrated to the District.

2. Conductors

After conductors have been drawn into raceways, but before the conductors are connected or spliced, they shall be checked for insulation resistance, continuity, and freedom from short circuits and grounds.

3. Voltages

Single-phase, 3-wire systems shall be checked to ensure that proper voltage exist between each phase and neutral, and between phases.

Three-phase circuits shall be checked to ensure that phase voltages are equal, and that phase to neutral voltages are equal and correct on three-phase systems.

4. UNDERGROUND WIRING

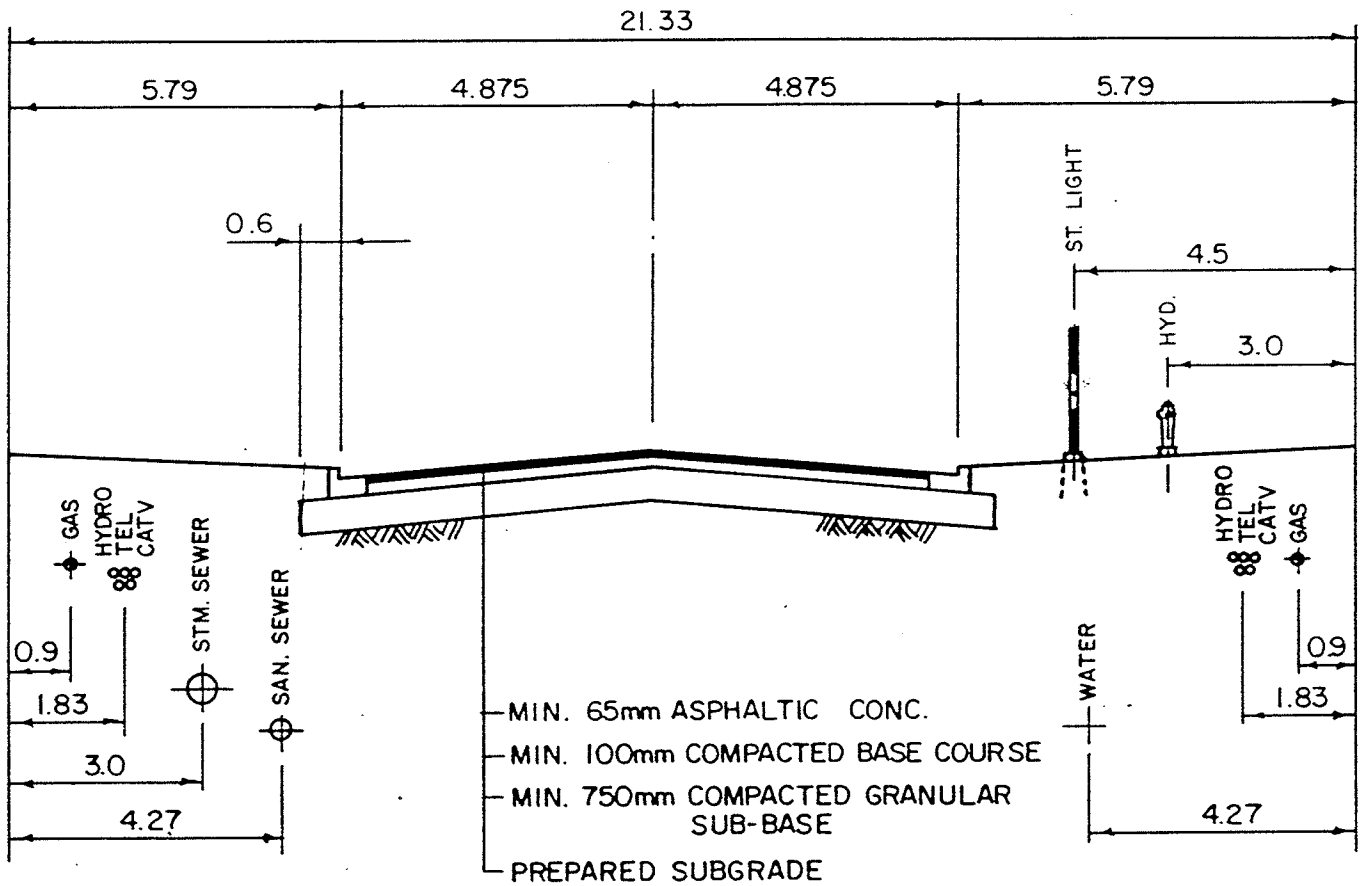
General

The Developer shall cause BC Hydro to install electrical distribution systems to service all parcels in his subdivision, such systems to the standards required by BC Hydro; the Developer shall also install roadway lighting as required by this bylaw.

5. STANDARD DRAWINGS

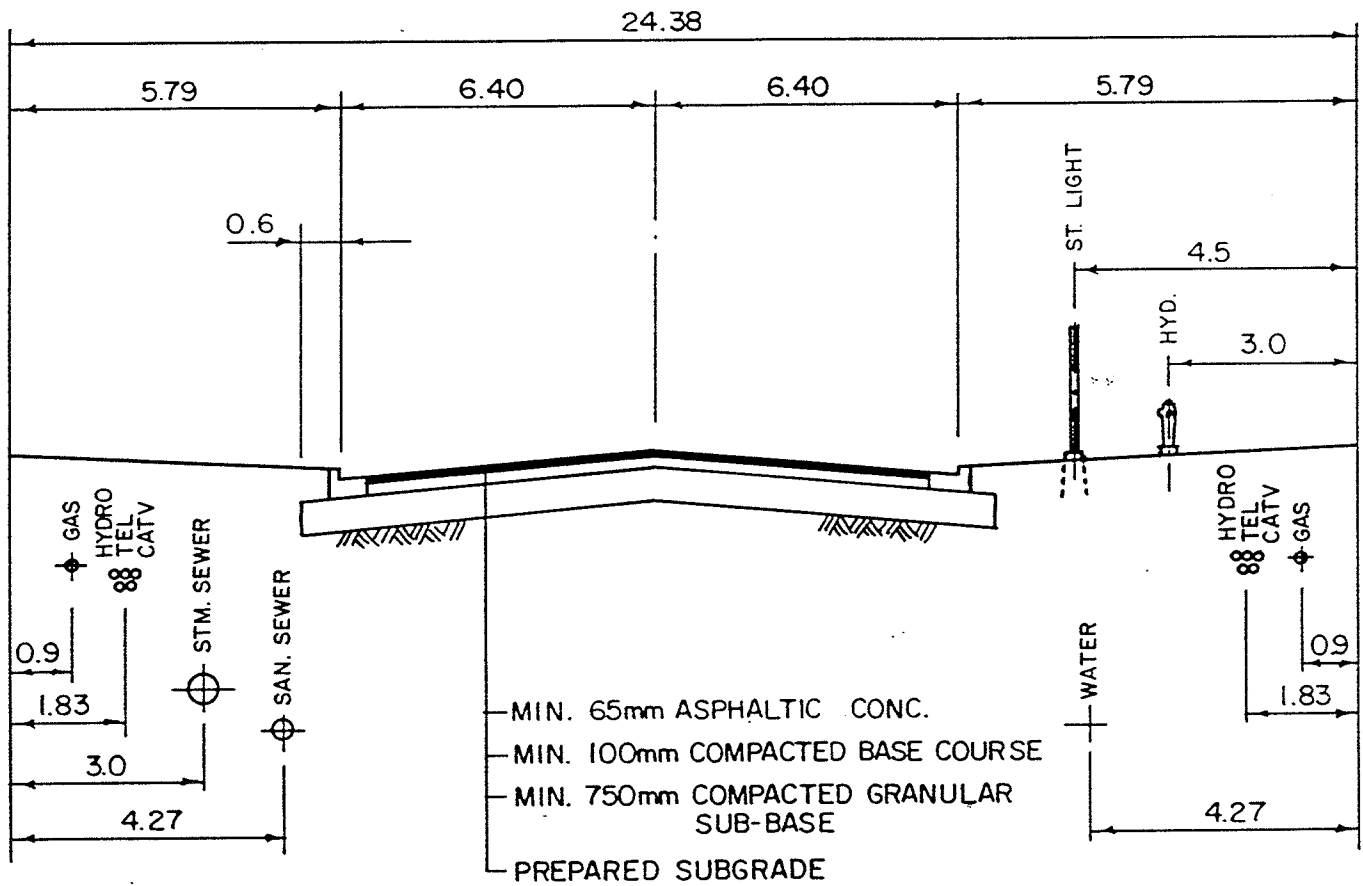
The following standard drawings form part of Schedule C:

- C-100 Typical Section Urban Local Undivided Road
- C-101 Typical Section Urban Collector Undivided Road
- C-102 Typical Cul-de-Sac
- C-103 Typical Sidewalk-Driveway Crossing
- C-104 Curb and Gutter
- C-105 Service Base
- C-106 Concrete Base for Service Base
- C-107 Control Schematic and Wiring Diagram for Roadway Lighting
- C-108 Typical Section Rural Local Undivided Road
- C-109 Typical Section Rural Collector Undivided Road



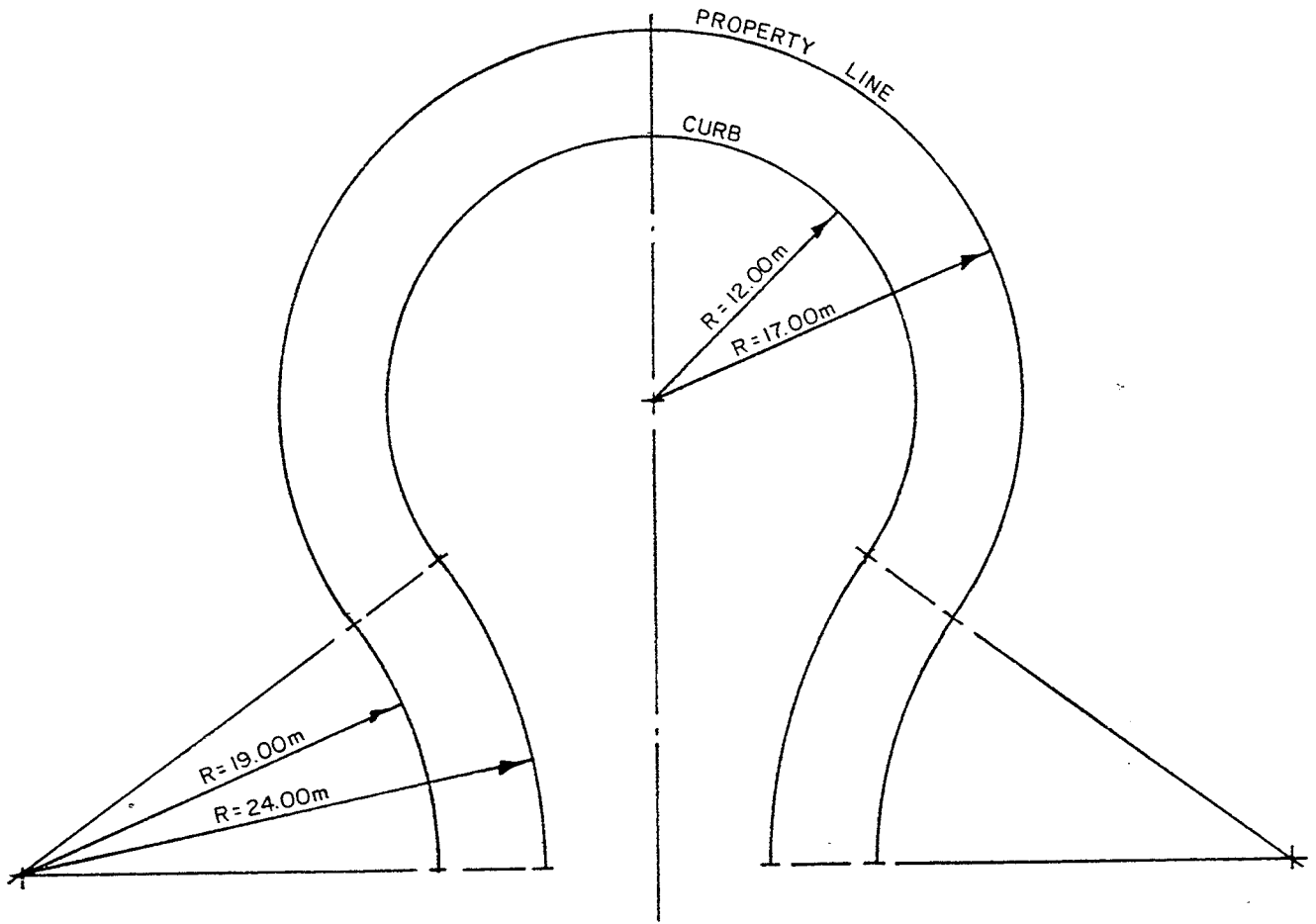
DISTRICT OF MACKENZIE

SUBDIVISION STANDARDS	ISSUED	JULY '89	SCALE	N.T.S.
TYPICAL SECTION	REVISION		STD. DWG. No.	
URBAN LOCAL UNDIVIDED ROAD	REVISION		C - 100	



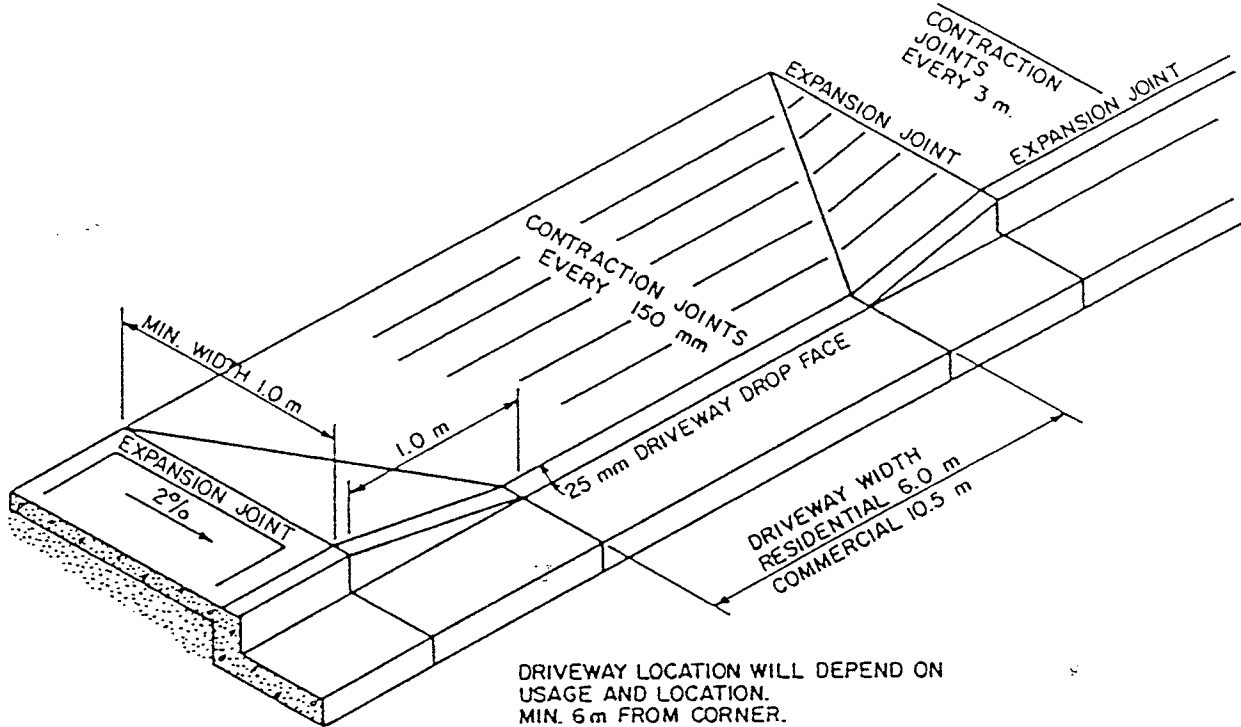
DISTRICT OF MACKENZIE

SUBDIVISION STANDARDS	ISSUED JULY '89	SCALE N.T.S.
TYPICAL SECTION URBAN COLLECTOR UNDIVIDED ROAD	REVISION	STD. DWG. No.
	REVISION	C - 101



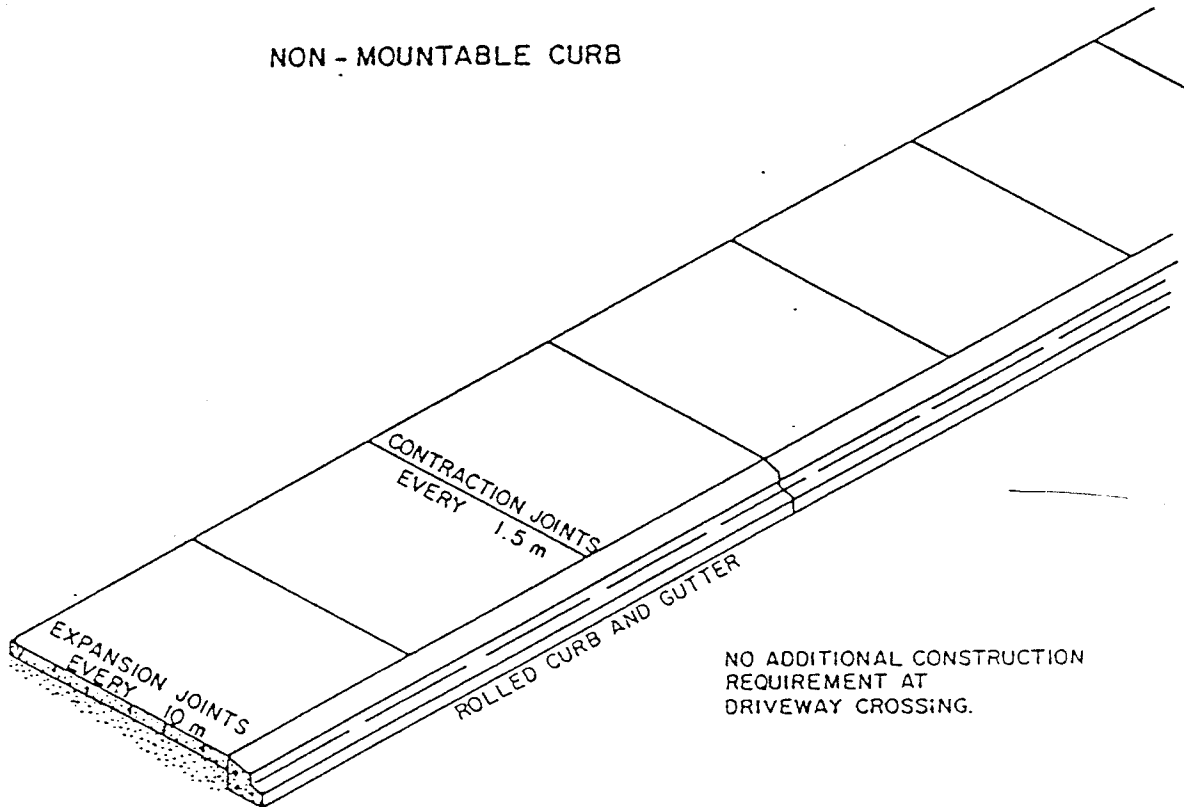
DISTRICT OF MACKENZIE

SUBDIVISION STANDARDS	ISSUED	SCALE N.T.S.
TYPICAL CUL DE SAC GEOMETRY	REVISION	STD. DWG. No.
	REVISION	C - 102



DRIVEWAY LOCATION WILL DEPEND ON USAGE AND LOCATION.  
 MIN. 6 m FROM CORNER.  
 NO DRIVEWAY IN TRUNCATION.  
 OK INSIDE LOT 1.5 m FROM SIDE PROPERTY LINE.

NON - MOUNTABLE CURB

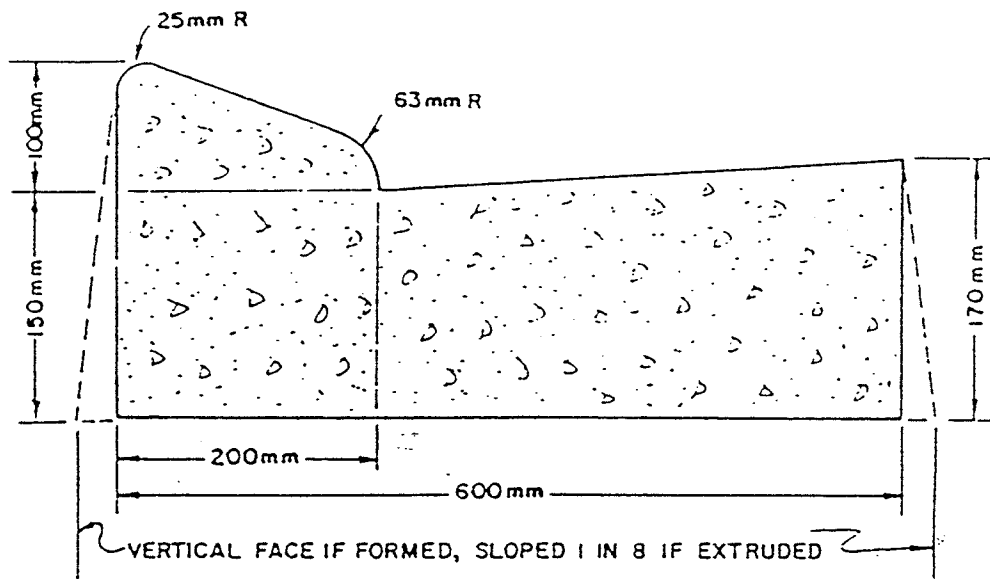


MOUNTABLE CURB

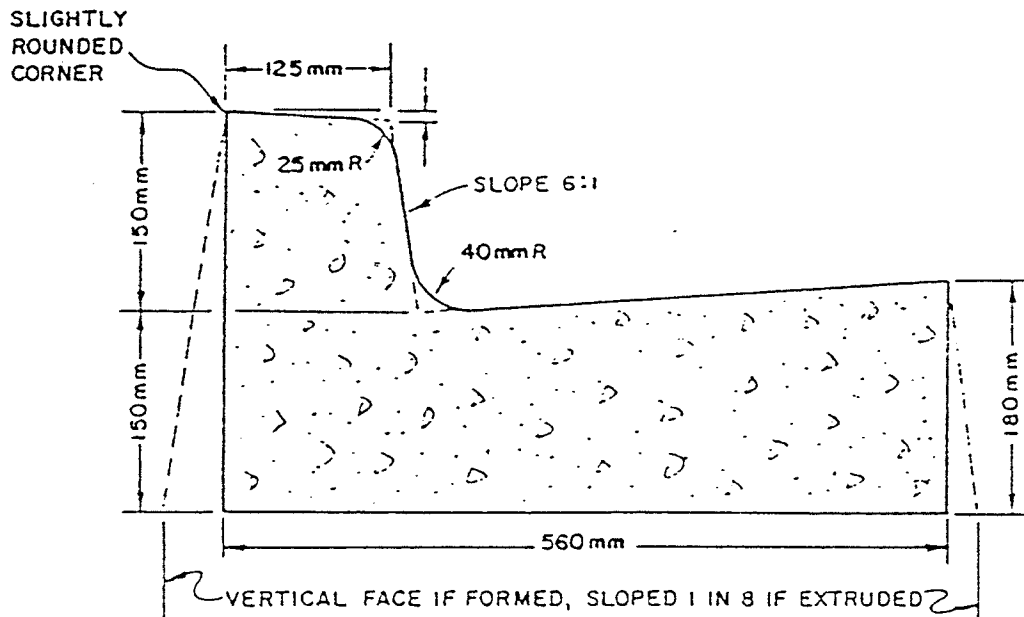
DISTRICT OF MACKENZIE

SUBDIVISION STANDARDS	ISSUED SEPT., 1980	SCALE N.T.S.
	REVISION	STD. DWG. No.
TYPICAL SIDEWALK-DRIVEWAY CROSSING	REVISION	C-103





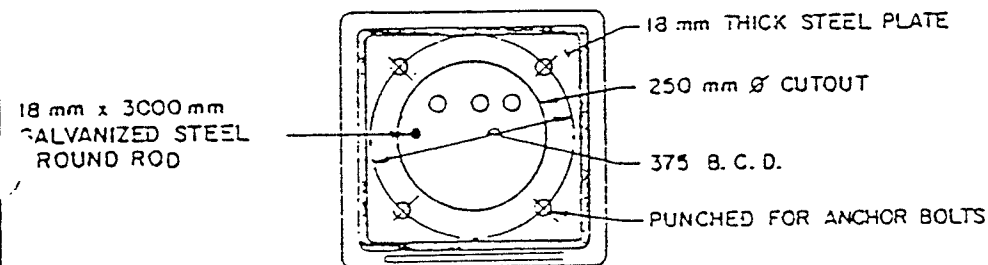
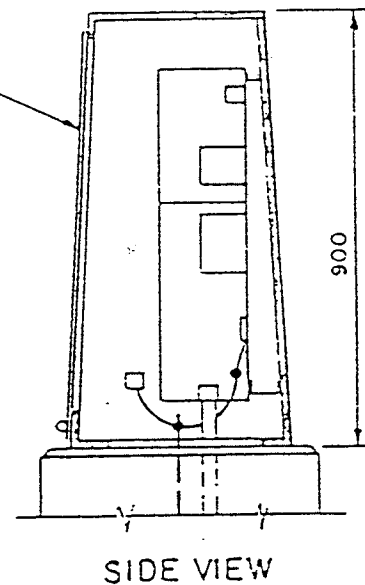
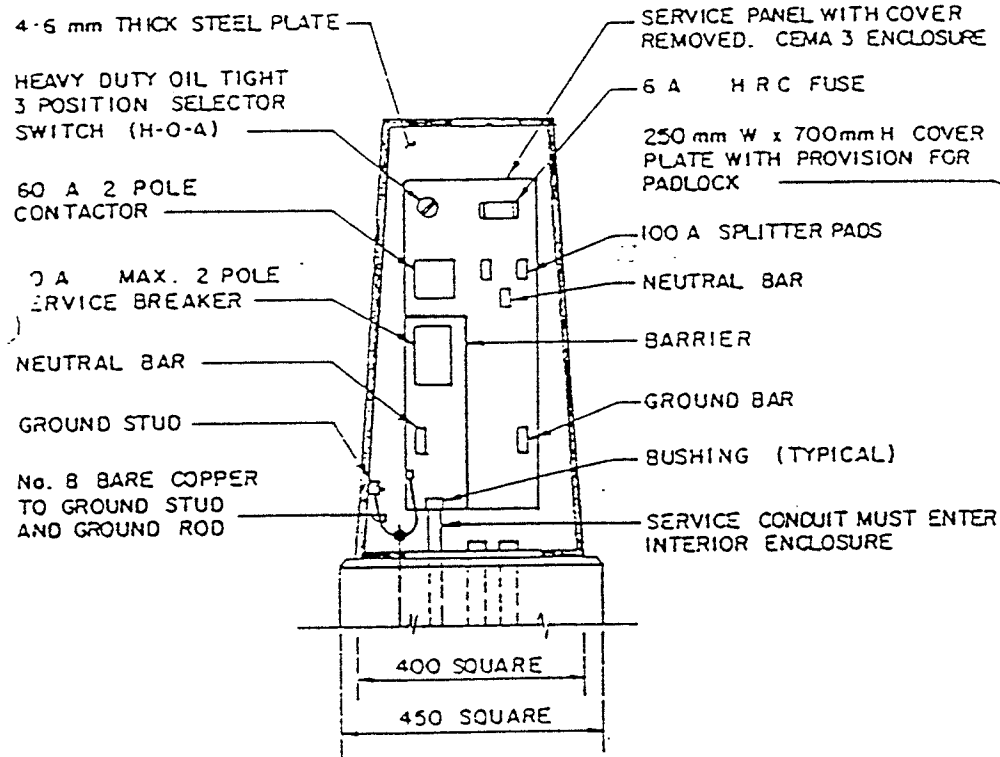
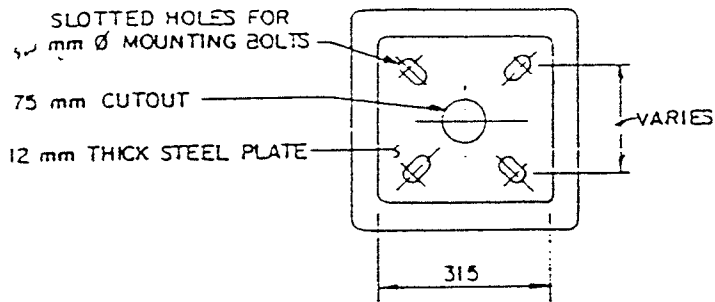
MOUNTABLE ROLL CURB WITH INTEGRAL GUTTER



NON-MOUNTABLE ERECT CURB WITH INTEGRAL GUTTER

DISTRICT OF MACKENZIE

SUBDIVISION STANDARDS	ISSUED SEPT., 1980	SCALE N.T.S.
	REVISION	STD. CWG. No.
	REVISION	C-104
CURB AND GUTTER		



NOTE:  
ALL DIMENSIONS ARE GIVEN IN millimetres  
UNLESS OTHERWISE INDICATED.

DISTRICT OF MACKENZIE

SUBDIVISION STANDARDS

ISSUED SEPT., 1980

SCALE N.T.S.

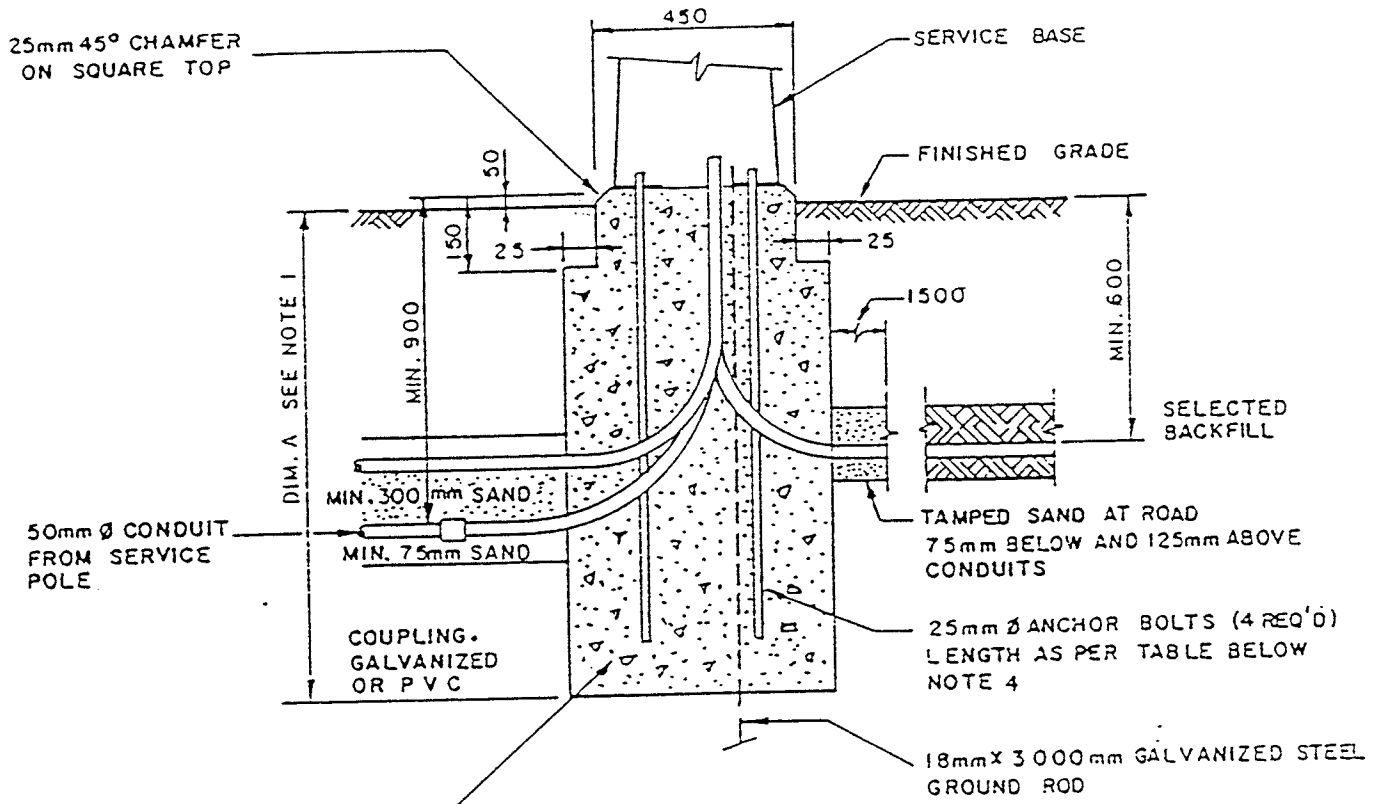
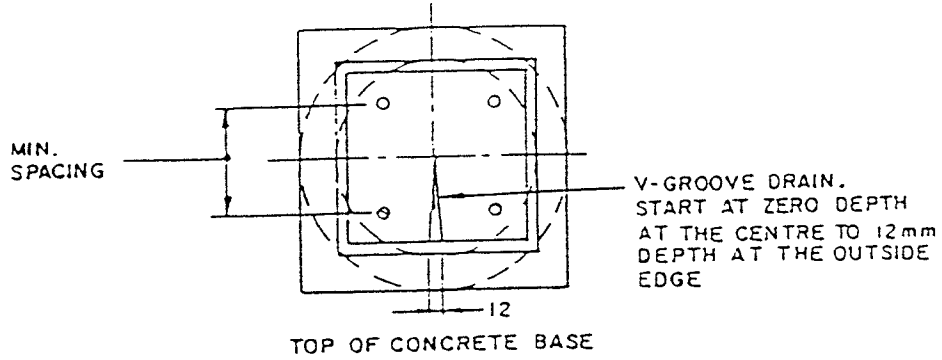
SERVICE BASE

REVISION

STD. DWG. No.

REVISION

C - 105



500mm SQUARE OR CIRCULAR CONCRETE BASE TO HAVE A COMPRESSIVE STRENGTH OF 25 MPa AFTER 28 DAYS

NORMAL POLE HEIGHT	ANCHOR BOLT		BASE DEPTH DIM. A
	MIN. LENGTH	MIN. SPACING	
7.5m - 10.5m	900mm	TO SUIT	1200mm
12 m	1200mm	215mm	1500mm

**NOTES:**

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. CONCRETE DIMENSIONS ARE SUITABLE WHERE THE ORIGINAL SOIL HAS A MINIMUM BEARING CAPACITY OF 14 MPa AND DOES NOT CONSIST OF LOOSE GRANULAR SAND OR GRAVEL.
3. BASE SUITABLE FOR 7.5 m TO 12 m POLE.
4. TOP 300mm OF ANCHOR BOLTS SHALL BE GALVANIZED. NUTS SHALL BE OVERSIZED ACCORDINGLY. CONFIRM EXACT BOLT SPACING AND PROJECTION FROM MANUFACTURER'S SPECIFICATIONS.

**DISTRICT OF MACKENZIE**

SUBDIVISION STANDARDS	ISSUED SEPT, 1980	SCALE N.T.S.
	REVISION	STD. DWG. No.
	REVISION	C - 106

CONCRETE BASE FOR SERVICE BASE

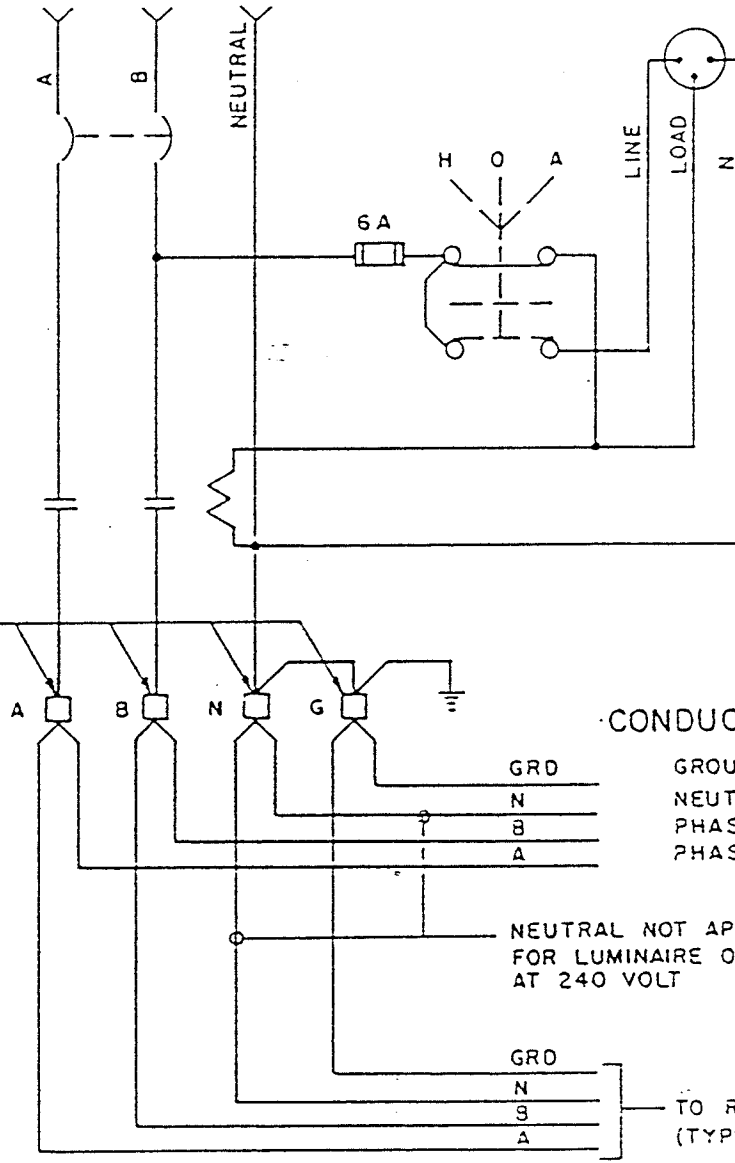
120/240 V POWER SUPPLY

SERVICE BREAKER  
MAX. 2P - 40A

2-POLE CONTACTOR  
MAX. 60 A

TERMINAL BLOCK  
AS REQUIRED

PHOTO-ELECTRICAL  
CONTROL



CONDUCTOR COLOUR CODE

- GROUND - GREEN
- NEUTRAL - WHITE
- PHASE A - RED
- PHASE B - BLACK

NEUTRAL NOT APPLICABLE  
FOR LUMINAIRE OPERATING  
AT 240 VOLT

TO ROADWAY LIGHTS  
(TYPICAL AS REQUIRED)

DISTRICT OF MACKENZIE

SUBDIVISION STANDARDS

CONTROL SCHEMATIC & WIRING DIAGRAM  
FOR ROADWAY LIGHTING

ISSUED SEPT., 1980

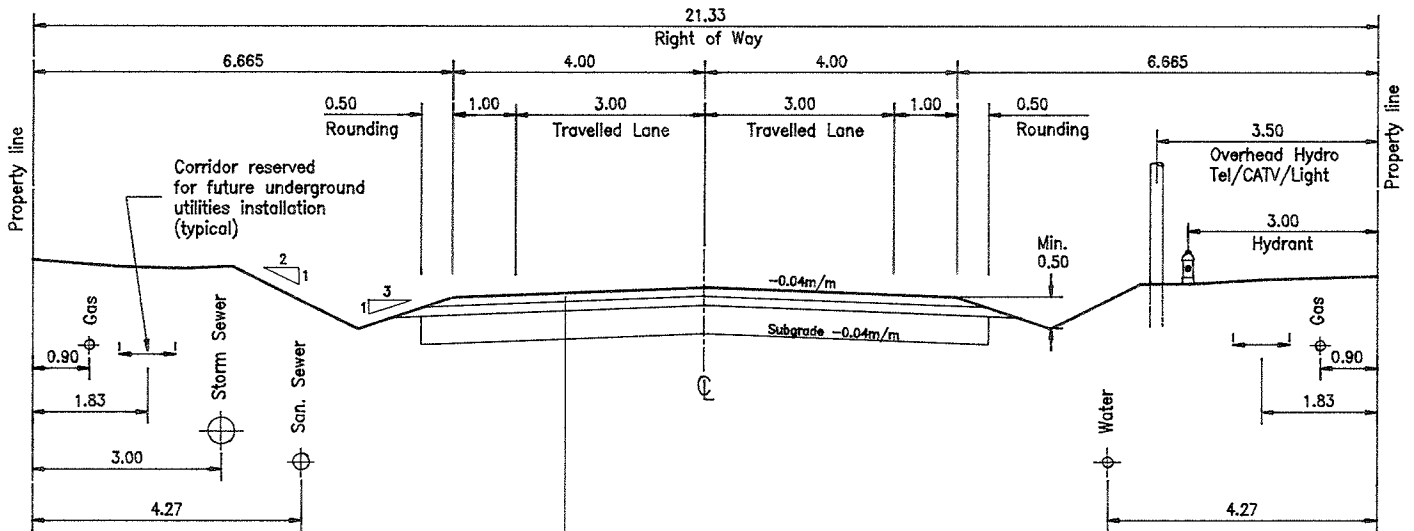
REVISION

REVISION

SCALE N.T.S.

STD. DWG. No.

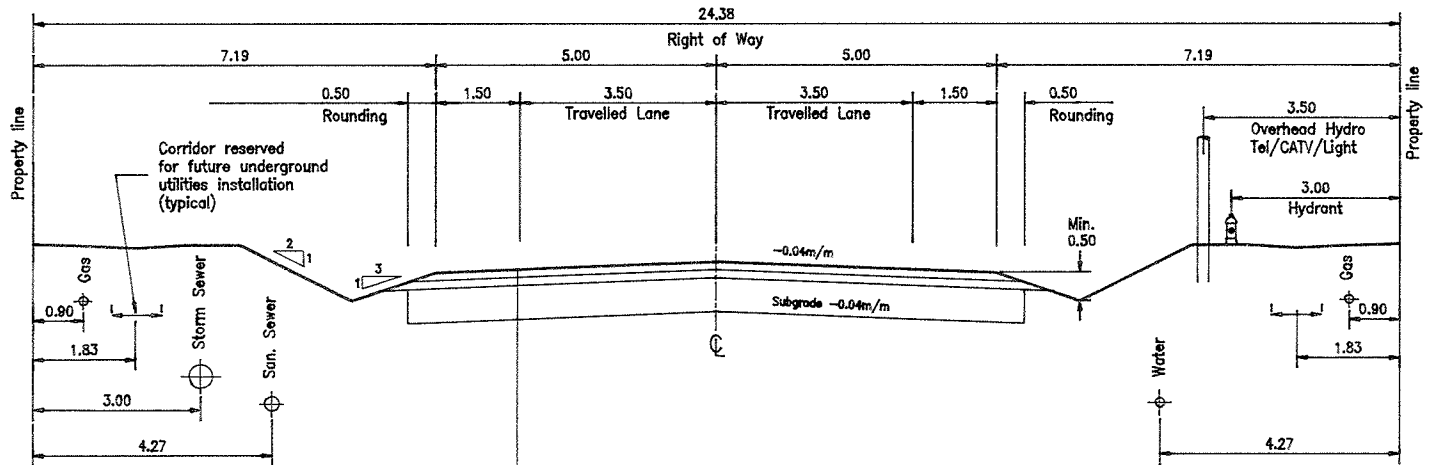
C - 107



- 150mm - 25mm Crushed Surfacing Aggregate
- 150mm - 75mm Crushed Base Course
- Min. 450mm Select Granular Sub-Base in earth (Min. 150mm in rock)
- Prepared Subgrade

DISTRICT OF MACKENZIE

SUBDIVISION STANDARDS	ISSUED	SCALE	N.T.S.
	REVISION	STD. DWG. No.	
TYPICAL SECTION RURAL LOCAL UNDIVIDED ROAD	REVISION	C - 108	



- 150mm - 25mm Crushed Surfacing Aggregate
- 150mm - 75mm Crushed Base Course
- Min. 600mm Select Granular Sub-Base in earth (Min. 150mm in rock)
- Prepared Subgrade

DISTRICT OF MACKENZIE

SUBDIVISION STANDARDS	ISSUED	SCALE	N.T.S.
TYPICAL SECTION	REVISION	STD. DWG. No.	
RURAL COLLECTOR UNDIVIDED ROAD	REVISION	C - 109	

SCHEDULE D  
WATER DISTRIBUTION  
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SCHEDULE D  
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SCHEDULE D

WATER DISTRIBUTION

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SCHEDULE D  
WATER DISTRIBUTION

GENERAL

This Schedule refers to the system of water distribution piping complete with valves, hydrants, service connections and appurtenant structures.

I. SPECIFICATIONS OR STANDARDS

When references to the following abbreviations are made, they refer to Specifications, Standards or Methods of the respective Association. Abbreviations listed herein but not mentioned in the specifications shall be disregarded.

The numbers and letter following the abbreviations denote the Association's serial designation for the Specifications or Standard to which reference is made. All references to these Specifications, Standards or Methods shall, in each instance, be understood to refer to the latest adopted revision, including all amendments.

ANSI American National Standards Institute  
ASA American Standards Association  
ASTM American Society for Testing and Materials  
AWWA American Water Works Association  
CAN3 National Standards of Canada  
CSA Canadian Standards Association  
CUA Canadian Underwriters' Association

DESIGN CRITERIA

I. DESIGN CONSUMPTION

The water distribution system shall be designed according to the following minimum standards:

- Average daily per capita consumption: 570 litres
- Average daily per capita demand: 910 litres
- Peak hourly per capita demand: 1,360 litres
- Fire demand: in accordance with the Water Supply for Public Fire Protection published by the Public Fire Protection Survey Surveys.

Design shall be based on the assumption that the fire demand can be coincidental with maximum daily demand and separately to provide for the peak hourly demand.

## **2. WATER PRESSURE**

Generally, water systems shall be designed for pressures in the range of 275 kPa to 690 kPa. Wherever maximum pressure would otherwise exceed 690 kPa in a subdivision, the Developer shall provide pressure reducing valves on the mains as required by the District. Conversely, wherever the minimum pressure in the mains would fall below 275 kPa, the Developer shall provide whatever facilities are required to maintain a minimum of 275 kPa at peak hour demand conditions. The minimum residual pressure at fire hydrants shall be 135 kPa at fire flow demand conditions. Any pressure regulating station shall provide not less than 1.8 metres headroom and shall be of concrete construction.

## **3. PIPE SIZES**

The minimum water main size shall be 150 mm diameter. The minimum pipe size for service connections shall be 20 mm.

In medium and high density residential, commercial and industrial areas, the minimum size water main shall be 200 mm.

## **4. SERVICE CONNECTIONS**

A service connection shall be provided for each property. The minimum size of service shall be 20 mm diameter. Water service connections shall not be installed in the same trench with the sewer service connections.

Minimum cover on water service connection from the main to the property line shall 3.0 metres.

Services shall be provided with approved corporation valves at the main and curb stop and drain with service box at the property line.

## **5. FIRE HYDRANTS**

Fire hydrants shall be located in general such that all buildings in a residential area can be reached with a hose length of 90 metres or less, in any event not more than 200 metres apart, and a hose length of 75 metres or less in a commercial zone. Additional hydrants may be required by the District at school, apartment, commercial, industrial, or other high value properties. Hydrants shall, where possible, be located at road intersections.

## **6. CLEARANCE AND COVER**

The pipe shall be installed with a minimum cover over the top of the pipe of 2.5 metres and so that the minimum clearance between any water main crossing over or under sewer pipes shall be 450 mm.

Water mains shall be installed with a minimum horizontal separation of 3 metres from sanitary or storm sewer line.

**7. GATE VALVES**

Isolating gate valves shall be installed, either so that the distance between them shall not be greater than 240 metres or to provide service for not more than 20 residential lots between valves; generally 2 valves shall be installed at tee intersections and 3 valves at cross sections. Not more than one hydrant shall be put out of service due to disruption of the water supply.

**8. MAINS**

The water system shall be designed as a loop system and the maximum length of deadend main shall be 150 metres. All mains shall be continued to the extremity of the subdivision to facilitate future extensions where such are anticipated.

**9. FLUSHOUTS**

Flushouts shall be installed as specific points as directed by the District.

**10. AIR RELEASE VALVES**

Air release valves shall be installed at summit points as directed by the District.

**11. FITTINGS**

Generally, all fittings shall be of the hub type and where required to be fitted with tie rods, the lugs shall have suitably cored holes; lugs that are of the "U" type are not acceptable. Valves and other appurtenances requiring valve boxes shall be located so that they are located clear of curbs.

**12. CURVED MAINS**

On a curve, the minimum permissible pipeline radius shall not be less than the manufacturer's recommended minimum. The design drawing shall indicate where the short pipe lengths are required on curves.

**13. ANCHORS**

Where pipe grades are in excess of 20 percent and the length of run exceeds 90 metres, then the pipe shall be suitably anchored to prevent any movement. If the grade exceeds 40 percent then the anchoring shall be installed regardless of the length of run.

**14. THRUST BLOCKS**

Thrust blocks shall be provided on line valves, crosses, bends, plugs and caps. Their size shall be calculated on the basis of undisturbed soil bearing strength of 96 kPa.

## MATERIALS

### I. PIPE

Watermains 300 mm diameter or smaller shall be PVC. Watermains larger than 300 mm diameter shall be ductile iron.

#### a) PVC Pipe

PVC pipe shall conform to either Specification AWWA C900 having a Dimension Ratio (DR) of 18 for a pressure rating of 1.034 MPa or to ASTM D2241, or CSA B137.3, being PVC 1120 with a DR rating of 17 or less.

Dimensions of pipe shall have a cast iron equivalent outside diameter.

All fittings, couplings and adaptors shall conform to AWWA C110 and shall have suitable approved elastomeric transition gaskets.

Pipe shall be marked as set forth in AWWA C900.

The supplier shall submit an affidavit of compliance with the standard specifications and supplementary data.

#### b) Ductile Iron Pipe

Ductile iron pipe shall be in accordance with either ANSI A21.51 or AWWA C151. Pipe shall be suitable for 1.034 MPa working pressure except where pressure or loading conditions require stronger pipe. Ductile iron pipe shall be cement-mortar lined in accordance with AWWA C104. Joints shall be of a push-on type and shall be in accordance with AWWA C111 or shall be a rubber gasket bell and spigot joint or approved equal with provision for conductivity connections to enable electrical thawing. All pipe shall bear the Underwriter's label. The supplier shall submit an affidavit of compliance with the Standard Specifications.

The developer shall retain the services of a qualified corrosion analysis consultant, acceptable to the District, to conduct site investigations and identify corrosion protection measures that may be required. A copy of the corrosion analysis report shall be submitted to the District.

### 2. FITTINGS

Cast iron fittings shall conform to AWWA C110 and shall be either flanged or rubber gasket bell and spigot as required to suit the pipe. Where required to have tie rods, fittings shall be fitted with lugs with cored holes.

### 3. GATE VALVES

Gate valves shall be iron body, bronze mounted, conforming to AWWA C500 and the following supplementary data:

- a) The size shall be as shown on the drawings.
- b) Valves shall be solid wedge gate with non-rising stems.
- c) Ends shall be flanged at junctions with cast iron fittings.
- d) Ends shall be bell at junctions with pipe. Joints shall be formed with a mechanical seal which is the equivalent of that used in jointing the pipe.

- e) The position of the valve in line shall be vertical.
- f) Stem seal shall be o-ring or stuffing box type.
- g) Valves shall open on counter-clockwise rotation of the wrench nut.

#### 4. VALVE BOXES

Valve boxes shall be Terminal City NT Type, or as approved.

Valve boxes shall be a 2 section, adjustable, telescoping type with the top section of cast iron and a locking, cast iron lid. The box section shall have minimum inside diameter of 150 mm. The length shall be suitable for the required depth of bury of the valve.

#### 5. HYDRANTS

Hydrants shall be compression type Terminal City Iron Works Type C71P, or as approved.

The inlet connection shall be 150 mm. The joints shall have a bell and preformed rubber gasket suitable for connection to the pipe being used. The bell shall have harnassing lugs for tie rod anchorage. Hydrants shall have two 65 mm diameter hose outlets and one 100 mm diameter pumper nozzle. Threads for these shall conform to the British Columbia Fire Hose Thread Specification and a 6 threads per inch.

Hydrants shall be painted red above the ground line. Drain outlets shall be provided except where watertable is above the bottom of the hydrant. Depth of bury shall be as required to provide the specified minimum cover on the connecting pipe and the required position of the hydrant relative to the ground line.

Hydrants shall open counter-clockwise.

#### 6. AIR RELEASE VALVES

Air release valves shall be double acting type, Terminal City Iron Works.

Fittings, bushings and unions used in the assembly shall be brass, manufactured to ASA Specification A40-2, using ASTM B-62 bronze. Nipples shall be standard bronze and threaded at both ends.

#### 7. BEDDING GRAVEL

The bedding material shall be clean, well graded or crushed gravel, evenly graded from course to fine, with a maximum size of 25 mm and 90 percent retained on a 0.075 screen. If the trench conditions are dry and otherwise suitable, sand bedding may be used, subject to prior written approval of the District.

#### 8. SERVICE CONNECTIONS

Service connection pipes shall be not less than 20 mm diameter, Type K soft copper conforming to ASTM B88 or as approved. For services larger than 20 mm diameter, the material to be used shall be approved by the District.

Corporation stops shall be Mueller H-12924 or approved equal with thaw wire connectors as required.

Curb stops shall be Mueller H-15219 or approved equal, with drain.

Curb boxes shall be adjustable type have a sidewalk pattern top casting. Lengths shall be to suit the specified cover for the service connection pipe. Stationary rods shall be provided.

Double strap service saddles shall be installed on PVC mains as approved by the District.

## 9. CONCRETE

Concrete work shall conform to CAN3-A23.1, except as modified herein.

Concrete shall develop a minimum compressive strength of 25 MPa at 28 days. Slump shall not exceed 75 mm.

### a) Cement

Cement shall be standard Portland cement or sulphate-resistant Portland cement if required by the District.

### b) Aggregate

Coarse and fine aggregate shall consist of clean, crushed stone, or gravel and natural well graded sand with a maximum size of 25 mm. Coarse aggregate over 9.5 mm shall constitute 40 percent of the mix. Aggregate used shall be subject to the District's approval.

### c) Reinforcement

Reinforcement shall be deformed bars with a minimum yield strength of 300 MPa.

### d) Admixtures

Admixtures shall not be added except with the written authorization of the District.

## WORKMANSHIP

### 1. CLEARING AND GRUBBING

All sewer and/or water piping alignments shall be cleared and grubbed to a sufficient width to allow for proper installation of the system components. Where alignments traverse virgin areas, care shall be taken to ensure that the cleared strip is only wide enough to permit proper excavation and temporary storage of excavated material. All necessary precautions shall be taken to preserve the



indigenous aesthetic values of the location. Waste material shall be disposed of in a manner approved by the District.

All trees and brush, except those selected for preservation, shall be cut, and along with all stumps, logs, roots, rotten wood, and other organic materials shall be disposed of by burning or other approved means.

Topsoil shall be stockpiled as directed by the District.

The above material shall be removed from the ground surface and to a minimum depth of 300 mm below ground surface.

All other rubbish and debris existing on the site shall be removed and disposed of by burning or other approved means.

Trees shall be felled within the designated clearing area and those falling outside this area shall be cut up and returned to the clearing area for disposal.

On instructions from the District, individual leaning or dangerous trees or snags adjacent to but outside the designated clearing area shall be cut and disposed of.

Excavations resulting from removal of tree trunks, roots, or other material shall be filled by the Developer as a part of the clearing and grubbing operation.

## **2. BURNING**

Burning shall be carried out at points located centrally in the area being cleared. The fire or fires burning at any one time shall be limited by the ability of the Developer's equipment and organization to provide adequate protection against spreading of fires to adjacent timber or property.

Burning shall be carried out subject to the provisions of the Provincial Acts and Regulations thereto. In the event of Forestry Regulations prohibiting burning, materials to be burned may either be piled until such time as the regulations are rescinded, or removed from the site.

Restrictions of federal, provincial, municipal, or other recognized authorities established to control burning in the area shall be complied with. If burning cannot be done on the clearing site, the material shall be hauled to an approved location for burning or disposal. Burning sites, as required, shall be obtained by the Developer.

## **3. TRENCH EXCAVATION AND BACKFILL**

### **a) Trenching and Backfilling Equipment**

Mechanical trenching and backfilling equipment may be used except where by so doing damage to trees, buildings, sidewalks, curbs, piping or other existing structures or manmade obstacles above or below ground cannot be voided. Trenches shall be hand excavated and backfilled where such obstacles prevent the use of mechanical equipment.

b) Caution in Excavation

Trenches shall be excavated only as far in advance of the pipe laying operation as safety, traffic and weather conditions permit. Caution shall be exercised with respect to structures, piping, or other manmade obstacles that may exist within the working area and due consideration given to the protection and support of such properties and structures.

c) Precutting Paved Surfaces

When trenching along or across a paved surface, pavement shall first be cut by hand or mechanical means in straight lines parallel to the trench centreline. The total cut width of pavement shall not be greater than that which is necessary for trench excavation under existing soil conditions and shall not, in any case, exceed the specified maximum trench width at the ground surfaces shown on the drawings. Where, in the opinion of the District, existing pavement is in such poor condition that precutting is not warranted, pavement may be cut by trenching equipment. Pavement that has been removed to permit trenching shall be disposed of as waste material and shall not be placed in the trench backfill.

d) Excavated Trench Material

Excavated trench material may be piled alongside the trench provided the working space is adequate for this purpose and provided that by so doing the backfill material does not spill onto private properties adjacent to line of trench there disturbing fences, buildings, shrubs, lawns or other items of value.

Piling of excavated material along the trench shall not unduly restrict cross traffic at road intersections. Material shall be cleared from road intersections and provision made for use of the cross road by traffic as soon as possible after excavation has taken place. Pedestrian traffic to individual properties shall be maintained at all times and timber bridges shall be provided where it is necessary to cross open trenches. Roadways, driveways, and drainage facilities shall not be blocked unnecessarily. The spoil pile shall be located such that hindrance to local traffic is minimal.

In order that excavated material may be piled along the trench, roads may be temporarily closed off to traffic provided that adequate detour traffic routes can be established to move traffic around the construction area, and provided also that street entrances to driveways are not blocked from vehicular traffic for periods in excess of one day.

Where excavated material cannot be piled along the trench in compliance with the above restrictions, it shall be trucked to locations where backfilling is taking place or trucked to stockpile for return to the trench at the time of backfilling. Alternatively, excavated material shall be wasted and replaced with approved material at time of backfilling.

e) Trench Widths

Trenches shall be excavated such that there is no less than 150 mm clearance between the outside of the pipe at its largest section and the trench sheeting or earth wall, and no more than 375 mm clearance between the pipe and the earth wall regardless of the existence of trench support works. The above conditions shall govern from the bottom of the trench to a distance 100 mm above the top of the pipe at its largest section. Trench widths above this level shall be maintained within the allowable limits shown on the drawings.

Ledge rock, boulders, and large stones shall be removed to provide a clearance of at least 150 mm below and on all sides of the pipe and fittings.

f) Bracing and Sheeting

Trenches shall be sheeted and braced in accordance with the requirements of the Workers' Compensation Board or as may be necessary to protect life, property, and structures adjacent to the work, the work itself, or to maintain trench widths within the specified limits. Trench sheeting and bracing shall be located no closer than 150 mm to the widest section of any installed pipe.

Whenever possible, vertical trench timber or sheeting shall be placed so that it does not extend below the springline of the pipe being installed. When it is necessary to place sheeting or timber below the pipe springline, as in the case of overexcavation for trench bottom stabilization, sheeting shall be raised in 600 mm lifts and all backfill placed below the level of the pipe springline shall be thoroughly compacted on each lift to fill the void left by the raising sheeting.

Trench sheeting and bracing shall be removed where its removal will not result in damage to adjacent structures, otherwise it shall be left in place. When sheeting and bracing is left in place, it shall be cut so that no sheeting remains closer than 900 mm to existing ground surface.

Where sheeting or timber is removed from a trench in which backfill is to be compacted, it shall be removed in a manner which permits compaction of the backfill in the manner specified.

g) Dewatering

Ground and surface water shall be controlled to the extent that excavation and pipe installation can proceed in the specified manner and such that trench bottom is not disturbed to the detriment of the pipe installation. Trench water shall not be permitted to enter the pipe being installed unless approval is received from the District.

The necessary pumps, well points, or other equipment shall be employed to keep excavations free of water. Caution shall be exercised to make sure that foundation problems with existing structures and works under construction do not result from the selected method of dewatering excavations. Discharge from pumps, well points, or other dewatering equipment shall be located and controlled such that loss, damage, nuisance, or injury to the public does not result.

**h) Trench Bottom Conditions**

Trench shall be maintained such that pipe can be installed without getting water, muck, silt, gravel, or other foreign material into the pipe. Material remaining in the trench bottom on completion of machine excavating which has been disturbed or softened by workmen or trench water shall be removed before bedding material is placed. The trench bottom shall be firm and capable of supporting the pipe to be installed, otherwise the bottom shall be stabilized by means of overexcavation or special foundation designed to support the pipe as hereinafter described.

When the material in the trench bottom is found to be unstable or otherwise unsuitable for pipe support or the support of appurtenant structures, the trench shall be overexcavated to the level at which stable material is encountered and the excavation backfilled to the level of normal bedding with base gravel material. This material shall be compacted with approved mechanical compactors in lifts having a maximum depth of 300 mm to provide a thoroughly consolidated pipe base. Bedding material, as specified for normal pipe bedding, may be employed for this purpose to a maximum depth of 300 mm below the normal depth of bedding.

**i) Backfill Within Pipe Zone**

The pipe zone is defined as that portion of the trench between the bottom level of the pipe bedding and a level 300 mm above the top of the installed pipe. Bedding of the pipe and backfill of the trench within the pipe zone shall be carried out as specified under MATERIALS, Section 7, "Bedding Gravel" and WORKMANSHIP, Section 4, "Water Piping", Subsection a), "Bedding".

**j) Concrete Fill**

Concrete shall be used for pipe base, encasement, or backfill as directed by the District. Concrete shall have adequate time to set before backfill material is placed.

**k) Placing Backfill**

In order that consolidation of backfill is not hampered, trench water, if present, shall be removed prior to commencement of backfilling. To prevent damage to the installed pipe, backfill shall be placed in the trench by rolling down a slope and not by pushing it over the edge of the trench and allowing it to drop vertically. Every effort shall be made to plan the backfilling operation such that exposure of backfill material to wet weather is kept to a minimum. The trench shall be backfilled as close to the pipe laying operation as conditions permit and trench excavations shall not be left open overnight without the written permission of the District.

**l) Backfill Above Pipe Zone**

Materials and methods employed in backfilling trenches above the pipe zone shall depend on the location of the trench with respect to travelled and untravelled surfaces, and in particular on the type of material existing on the surface in which the trench is excavated.

Travelled surfaces are gravelled, or paved, roadways, lanes, driveways, parking areas, road shoulders, walkways, or other gravelled, or paved, surfaces which vehicular or pedestrian traffic normally travel.

Subject to provisions contained elsewhere herein, backfill above the pipe zone and surface restoration of trenches shall be carried out in accordance with the following paragraphs:

1. Untravelled Surfaces

In untravelled surfaces, unless otherwise specified, trench backfill above the pipe zone shall be native backfill material. Backfill may initially be built up to a height above original ground level equal to 10 percent of the trench depth and allowed to settle. Prior to acceptance, however, the trench surface shall be restored to its original level and to a condition which at least is equivalent to that which existed prior to construction unless the approval of the District is given to leaving trench surfaces in a bermed condition.

2. Gravel Travelled Surfaces

In travelled surfaces which exist as gravel surfaces, trench backfill above the pipe zone to a level 850 mm below the original trench surface shall, unless otherwise specified, be native backfill material. The top 850 mm of backfill shall comprise a 750 mm layer of subbase material surfaced with a 100 mm layer of base course.

3. Paved Travelled Surfaces

When trenches have been excavated in existing paved surfaces which are to be repaved, trench backfill shall be mechanically compacted imported or native granular backfill material to a level 915 mm below finished surface grade. The remainder of the trench shall be backfilled with 750 mm of compacted subbase material, 100 mm of base course material and finished with a minimum thickness of 65 mm of compacted hot asphalt mix.

If the edges of the cut pavement have become ragged as a result of the construction operation, pavement shall be recut to form a straight line and the base compacted prior to placing new pavement. The edges of the existing pavement shall be thoroughly cleaned and coated with an approved bituminous bonding agent prior to placing the hot asphalt mix. The asphalt shall be thoroughly compacted using an approved steel wheeled roller having a minimum weight of 7.3 tonnes or a vibratory compactor. The finished grade of the asphalt surface shall conform with that of the existing surface such that no rises, depressions, or ridges result from the repaving process.

**m) Imported Backfill Material**

Where excavated trench material is not suitable for backfill, it shall be hauled out and disposed of and imported backfill material shall be provided and placed.

n) Compaction of Backfill

Subject to the provision contained elsewhere herein, compaction of backfill above the pipe zone shall be obtained by using approved, mechanical, power-driven compactors. Compaction shall be carried out with the soil at optimum moisture content such that compaction to 90 percent of Standard Proctor Density (ASTM D698) is obtained. Backfill shall be compacted in lifts of not greater than 300 mm uncompacted depth.

o) Road Shoulder Gravel

Trenches in road shoulders adjacent to paved surfaces shall be resurfaced with shoulder gravel placed to a minimum depth, equivalent to the thickness of the adjacent pavement.

p) Disposal of Waste Excavated Material

Surplus excavated material shall be removed from the trench area at the time of backfilling and shall not be left along the trench following completion of the backfilling operation.

Waste material which is not required for the works, shall be disposed of at sites obtained by the Developer. Waste material shall not be dumped on private property without the written permission of the owner of the property.

q) Restoration

Surfaces adjacent to the trench or otherwise which have been disturbed by the trenching or backfilling operation shall be restored to a condition which is at least the equivalent of that which existed prior to construction and shall be maintained in this condition until the project has been accepted by the District of Mackenzie. All surplus material, equipment, tools, coverings, lumber, and all other rubbish resulting from the construction shall be removed from the site immediately after completion.

Working areas are those areas which are affected by the construction operation but which lie outside the specified limits of trench excavation. Working areas shall be restored in the following manner:

1. Travelled Surfaces

Working areas in untravelled surfaces shall be restored to their original condition.

2. Gravelled Surfaces

Working areas in gravelled surfaces shall be restored by scarifying and regarding the surface or, if necessary, by regravelling the surface with material which is equivalent to that which existed prior to commencement of construction.

r) **Trench Settlement During Guarantee Period**

The Developer shall replace materials and rectify all failures that occur as a result of settlement of trench backfill or collapse of trench walls during the guarantee period.

Trenches in which backfill settles shall be refilled with the specified backfill material, and paved surfaces that are adjacent to trenches or on trench backfill, which fail during this period, shall be replaced or repaired in an approved manner.

4. **WATER PIPING**

a) **Bedding**

Prior to installing pipe, a cushion of bedding material shall be placed in the trench bottom and compacted to grade by approved hand tampers or mechanical means to form a firm pipe base. This cushion shall cover the full width of the trench bottom and have a minimum depth of 100 mm on completion of compaction. In rock excavation, the minimum depth of bedding below the pipe shall be 150 mm. Bell or coupling holes shall be dug such that the full barrel of the pipe is supported throughout its length by the bedding material. After the pipe is in position, bedding material shall be placed around the pipe to the limits shown on the drawings. This material shall be compacted in lifts, each having a maximum compacted depth of 150 mm.

b) **Pipe Alignment and Depth of Cover**

The pipe shall be laid on line in accordance with the approved drawings. The minimum depth of cover on mainpipes measured from the top of the installed pipe to ground surface adjacent to the trench shall be 3.0 metres.

c) **Pipe Alignment**

The pipe shall be laid on line in accordance with the approved drawings.

d) **Pipe Cutting**

Pipe cutting shall be done in the manner recommended by the pipe manufacturer employing tools designed for this purpose.

e) **Pipe Installation**

Pipe shall be checked before being lowered into the trench to ensure that no foreign material, manufacturer's defects, or cracks exist that might prevent the proper jointing of the pipe or its operation. Pipe and fittings shall be carefully lowered into the trench by means of derricks, ropes, or other approved tools or equipment in a manner that will prevent damage to the pipe and injury of workmen.

Pipe shall be jointed in strict accordance with the manufacturer's recommended practice. The open end of the pipe in the trench shall be suitably covered to prevent entrance of trench water and other material during periods when pipe is not being installed.

Precaution shall be taken to ensure that displacement of the pipe in the trench does not occur through soil displacement or flotation due to the presence of trench water. Pipe that has been displaced shall be removed from the trench and relaid.

Where applicable, polyethylene encasement of ductile iron pipe shall be carried out in accordance with AWWA C105, Method A. Precautions shall be taken to ensure that there is no contact between the pipe and surrounding backfilling and bedding material.

**f) Joints at Rigid Structures**

A flexible joint shall be provided at locations where the pipe is held in fixed position by a rigid support or structure. The distance from the support or structure shall depend on the diameter and type of pipe being installed and shall be in accordance with the pipe manufacturer's recommendations.

**g) Pipe at Fittings**

Short lengths of pipe shall be installed on both sides of all fittings and valves and at all hydrants.

**h) Horizontal and Vertical Curves**

Pipe on horizontal and vertical curves shall be laid true to the curve of the radius shown on the approved drawings. Variations in vertical curves and grades within the allowable joint deflection may be allowed by the District.

**i) Deflection**

Unless otherwise specified, the amount of pipe deflection at joints and couplings shall not exceed that recommended by the manufacturer.

**j) Connections to Existing Piping**

Connections shall be made to existing piping at locations shown on the drawings. Caution shall be exercised in uncovering existing pipe to ensure that no damage occurs.

**k) Cathodic Protection Test Stations**

Where applicable, when installing ductile iron pipe, cathodic protection test stations shall be installed at 600 metre intervals as shown on the approved drawings.



**l) Flushing**

The pipe shall be cleaned of dirt and other foreign materials. The pipe shall be flushed at water velocities of 1 metre per second or as high a velocity as can be obtained from the available water courses. Flushing water shall be discharged to water courses or ditches that have sufficient capacity to carry the flow. When installing services, services shall be flushed clean prior to placing of the curb box and backfill thereof.

**m) Chlorination**

On completion of the flushing operation, main pipes and services shall be chlorinated. Chlorination procedures shall conform to AWWA C651.

On completion of chlorination, the entire piping system shall be thoroughly flushed, filled with water, and left in a condition ready for use.

**5. SERVICE CONNECTIONS**

**a) Pipe in Common Trench**

Where designated, or on instruction from the District, water service pipe shall be installed with sewer service connection pipe in a common trench. In such cases, the specified minimum cover shall be maintained on the water service pipe even though the sewer service pipe may be installed at lesser depth. This shall be done by deepening a portion of the trench to the depth necessary to provide minimum cover on the water service pipe.

**b) Tapping Main Pipe**

Taps shall be made in the main pipe by experienced workmen using tools in good repair with the proper adaptors for the size of main being tapped. Pipe shall be tapped while under internal water pressure unless otherwise approved by the District. Pipe saddles shall be used where recommended by the pipe manufacturer for all service connections to 150 mm or 200 mm diameter pipe, and for all service connections 25 mm diameter and larger.

**c) Pipe Installation**

The trench bottom shall be graded to form a continuous support along the service pipe. All rocks or projections which might prove detrimental to the pipe shall be removed.

The pipe shall be connected to the corporation stop and a gooseneck formed as shown on the drawings. Pipe shall be installed in a straight line between

the gooseneck and the terminus of the service, with a minimum cover of 3.0 metres below finished grade.

Copper pipe shall be cut with square ends, with the proper tools. Care shall be taken to prevent the pipe from kinking or buckling on short radius bends. Joints shall be made using the specified couplings. Sweated joints shall not be made.

Pipe installed in an augered hole shall be protected with a cap or plug to prevent the entrance of foreign material into the pipe.

**d) Curb Stop and Box**

The curb stop shall be installed as shown on the approved drawings or in the locations directed by the District.

A 300 mm length of copper pipe, flattened on one end, shall be installed on the property side of the curb stop to prevent entrance of foreign material.

The curb box shall be installed plumb and held in position by timber bracing across the trench to prevent displacement on backfilling or as a result of settlement of the backfill.

**e) Thaw Wire**

Thaw Wire shall be installed on water service connections as shown on the approved drawings and as directed by the District. Thaw wire shall be stripped bare of insulation, attached to the corporation stops, placed in the trench at a 600 mm minimum depth below finished grade and at a minimum 300 mm separation from the service pipe, and terminated above finished grade and attached to the curb box.

**f) Backfill in Pipe Zone**

After the pipe has been installed, select backfill material shall be placed and compacted by hand to a minimum depth of 150 mm over the pipe.

**6. VALVES, FITTINGS AND APPURTENANCES**

**a) Valve Boxes**

Each valve shall be provided with a valve box which shall be installed plumb and centered over the key nut of the valve. The valve box shall be set such that traffic loads are not transmitted to the valve. Valve box covers shall be set flush with the existing road surface, or as otherwise designed by the District. Valve boxes shall provide for adjustment of the cover to a level of 150 mm higher or 150 mm lower than the installed level for future adjustment of the road or ground surface. The box shall be supported in place by timber to prevent displacement on settlement of backfill. Backfill around the box shall be compacted to prevent excess settlement and displacement by traffic.

b) Hydrants

Hydrants shall be installed as shown on the approved drawings and shall be located as directed by the District. No portion of the pump or hose nozzle cap shall be less than 450 mm from the gutter face of the curb.

Hydrants shall be set plumb and such that the pumper nozzle faces, and is at right angles to, the road centreline unless otherwise directed by the District. Hydrants shall be set with the ground flange 50 mm above finished ground or sidewalk surface unless otherwise directed by the District. Care shall be taken in installing the connection pipe from the main to the hydrant to ensure that the hydrant is set at the specified level.

c) Hydrant Drainage

A porous drainage area shall be provided at the base of each hydrant. The granular drainage material shall extend from bottom of the trench to at least 150 mm above the drain outlet and for a distance of at least 300 mm around the hydrant barrel.

d) Thrust Blocking

Concrete thrust blocking shall be provided at all fittings, crosses, tees, bends, caps, plugs, reducers. It shall be placed between undisturbed soil and fitting. The area of thrust block bearing shall be as shown on the drawings. Care shall be taken to ensure that concrete for thrust blocking does not interfere with the operation of flange bolts and nuts or prevent proper operation of hydrant drains.

e) Fittings

Fittings shall be installed at locations shown on the approved drawings or as directed by the District.

Fittings shall be properly jointed to water pipe. The fittings shall be adequately supported on bedding material so as to reduce the transmission of any undesirable load or stress on the adjoining pipe.

7. CONCRETE

a) Concrete Installation

Mixing, placing, and compacting shall be carried out in such a manner as to produce a good quality, homogeneous concrete conforming to the dimension shown on the drawings. Continuous moist curing shall be utilized for 7 days after placing.

b) Reinforcement

Reinforcement shall be free of any bond reducing coating. It shall be securely tied and placed with a minimum cover of 35 mm, except that, when concrete is placed against the ground, the cover shall be 75 mm.

c) Joints

The surface of the joint shall be thoroughly cleaned, with all laitance removed, and the surface thoroughly saturated with water before placement of new concrete.

d) Finish

Surfaces shall be screeded and shall be given a wood float finish unless otherwise noted on the approved drawings.

8. TESTING

a) Leakage Tests

Following final trench backfilling, leakage tests shall be performed on all installed piping. Tests shall be conducted in the presence of the District.

Testing procedures shall be submitted to the District for approval.

Leakage tests shall be carried out between valved sections of the installation such that every valve in the system is tested for leakage in the shut-off position.

Leakage tests shall be performed in the following manner. The section to be tested shall be filled with water and all air expelled from the piping. It is recommended that the test section be filled with water for at least 24 hours prior to testing. By pumping water into the test section, the pressure within the piping shall be increased to 0.7 MPa or 1-1/2 times the system operating pressure at the point of test, whichever is the greater. This pressure shall be maintained constantly in the pipe throughout the duration of the test by the addition of makeup water. The duration of the test shall be a minimum of 2 hours. The quantity of water pumped into the test section to maintain the specified pressure over the period of test shall be considered to be the leakage.

Piping will not be accepted until the leakage is less than the maximum allowable leakage determined from the following formula:

$$L = \frac{ND \times \text{the Square Root of } P}{4060} \text{ in which}$$

L = the number of bolted, mechanical or push-on joints in the test section

D = the nominal diameter of the pipe in millimetre, and

P = the average test pressure during the leakage test in megapascals.

Should any test disclose leakage greater than that specified above, the Developer shall locate and repair the defect and retest the section to ensure that the leakage is within the allowable limits.

For a section of pipe installed with couplings, the number of joints are equal to the number of pieces of pipe.

**b) Service Connection Testing**

Service connections shall be tested in conjunction with the water main piping, or be testing at the normal hydrostatic pressure after the main has been completely installed and tested. The service shall be inspected visually for leaks before backfilling. The duration of test shall be at least 15 minutes.

**9. CLEAN-UP**

The working area shall be maintained in an orderly manner and shall not be encumbered with equipment, materials, or debris.

Clean-up shall be a continuing process from the start of the work to final acceptance of the project. The Developer shall at all times, and without further order, keep property on which work is in progress free from accumulations of waste materials or rubbish caused by employees or by the work. Accumulations of waste materials which might constitute a fire hazard will not be permitted. Spillage from the Developer's hauling vehicles on travelled public or private roads shall be promptly cleaned up. On completion of construction, the Developer shall remove all temporary structures, rubbish and waste materials resulting from his operations.

**10. STANDARD DRAWINGS**

The following standard drawings form part of Schedule "D".

- D-100 Service Connection Record Card
- D-101 Typical Section Urban Local Undivided Street
- D-102 Typical Section Urban Collector Undivided Street
- D-103 Location of Service Connections
- D-104 Typical Trench Section for Underground Utility Installation
- D-105 Thrust Block Details
- D-106 Service Connection Location Details
- D-107 Hydrant Connection Details
- D-108 Typical Blow-Off for Dead End Water Mains

ADDRESS OF PROPERTY

THE DISTRICT OF MACKENZIE

ROLL NUMBER		LEGAL DESCRIPTION					
LOT	BLK.	D.L.	1/4	SEC.	T.P.	PLAN	

Municipal Services Record

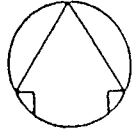
MASTER LEGAL MAP

NOTE: THIS IS A REDUCTION OF A RECORD CARD. FOR AS BUILT RECORD PURPOSES FULL SIZED CARDS CAN BE OBTAINED FROM THE APPROVING OFFICER.

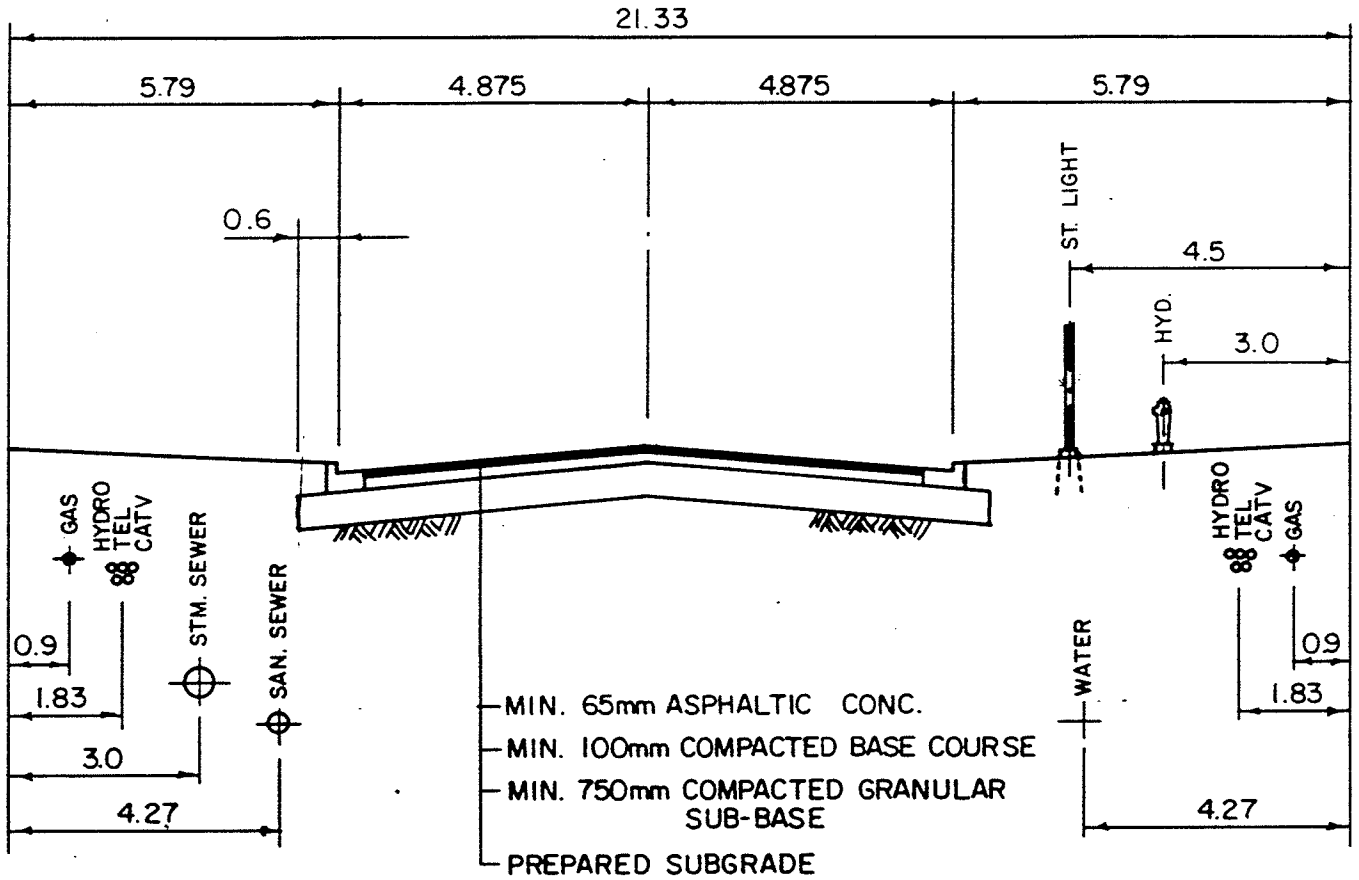
DISTRICT OF MACKENZIE  
 SUBDIVISION STANDARDS  
 SERVICE CONNECTION RECORD CARD  
 ISSUED SEPT., 1980  
 REVISION  
 SCALE N.T.S.  
 STD. DWG. No.  
 D-100

	WATER	SANITARY SEWER	STORM SEWER
DATE OF APPLICATION			
PERMIT NUMBER			
INSTALLATION DATE			
SIZE OF SERVICE			
LOCATION AT P.L.			
INVERT AT P.L.			
LENGTH OF CONNECTION			
METER SIZE & TYPE			
DEPTH OF MAIN			
DIST. FROM WYE TO M.H.			
MEASURED FROM M.H. No.			
RISER			
TYPE OF PIPE			

CONNECTION LOCATIONS SKETCH  
 WATER \_\_\_\_ SANITARY \_\_\_\_ STORM .....

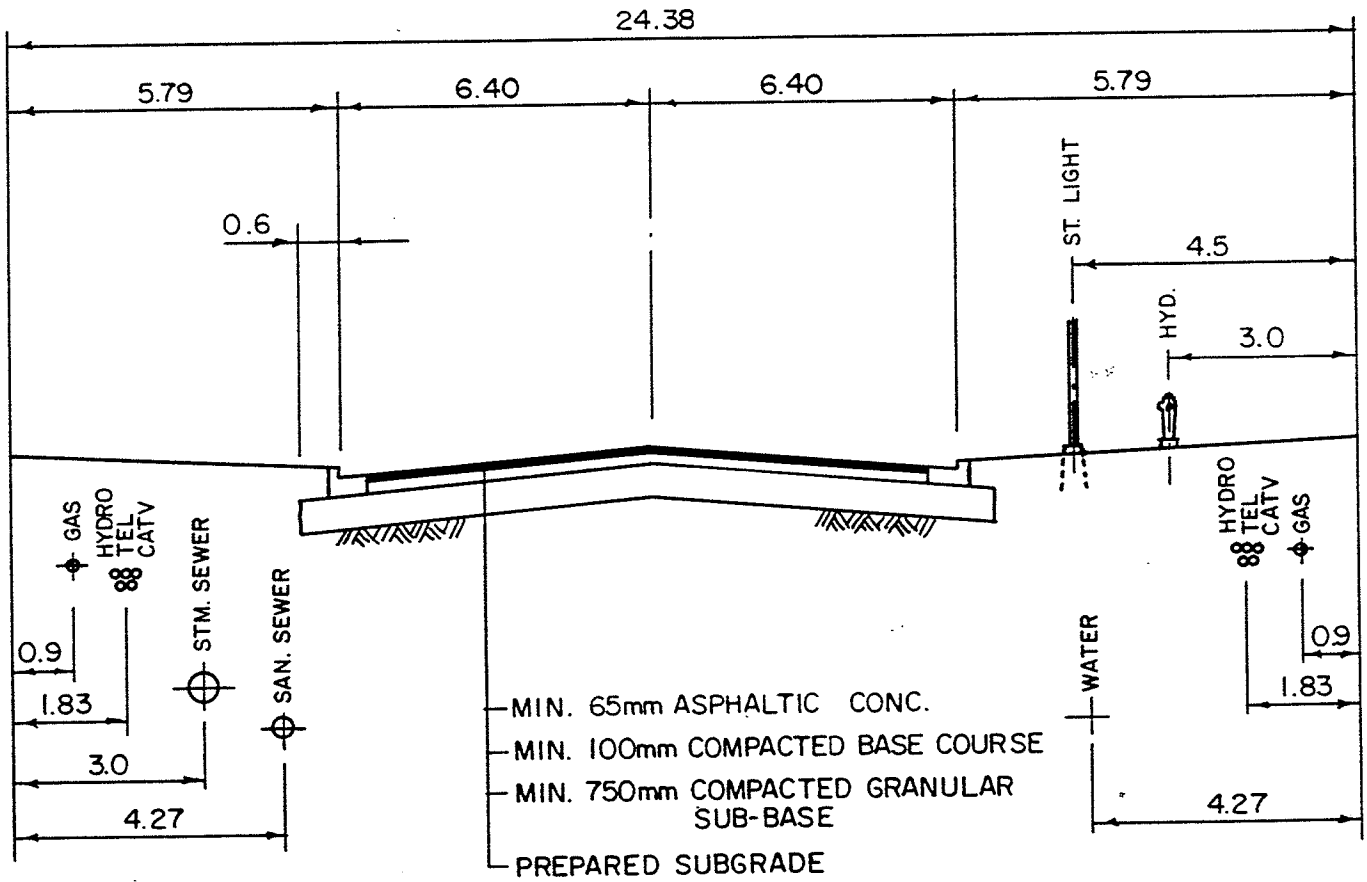


CULVERT INSTALLATIONS			
DATE	PERMIT No.	SIZE/TYPE	FOOTAGE



DISTRICT OF MACKENZIE

SUBDIVISION STANDARDS	ISSUED	JULY '89	SCALE	N.T.S.
TYPICAL SECTION URBAN LOCAL UNDIVIDED ROAD	REVISION		STD. DWG. No.	
	REVISION		D-101	



DISTRICT OF MACKENZIE

SUBDIVISION STANDARDS

ISSUED JULY '89

SCALE N.T.S.

TYPICAL SECTION  
URBAN COLLECTOR UNDIVIDED ROAD

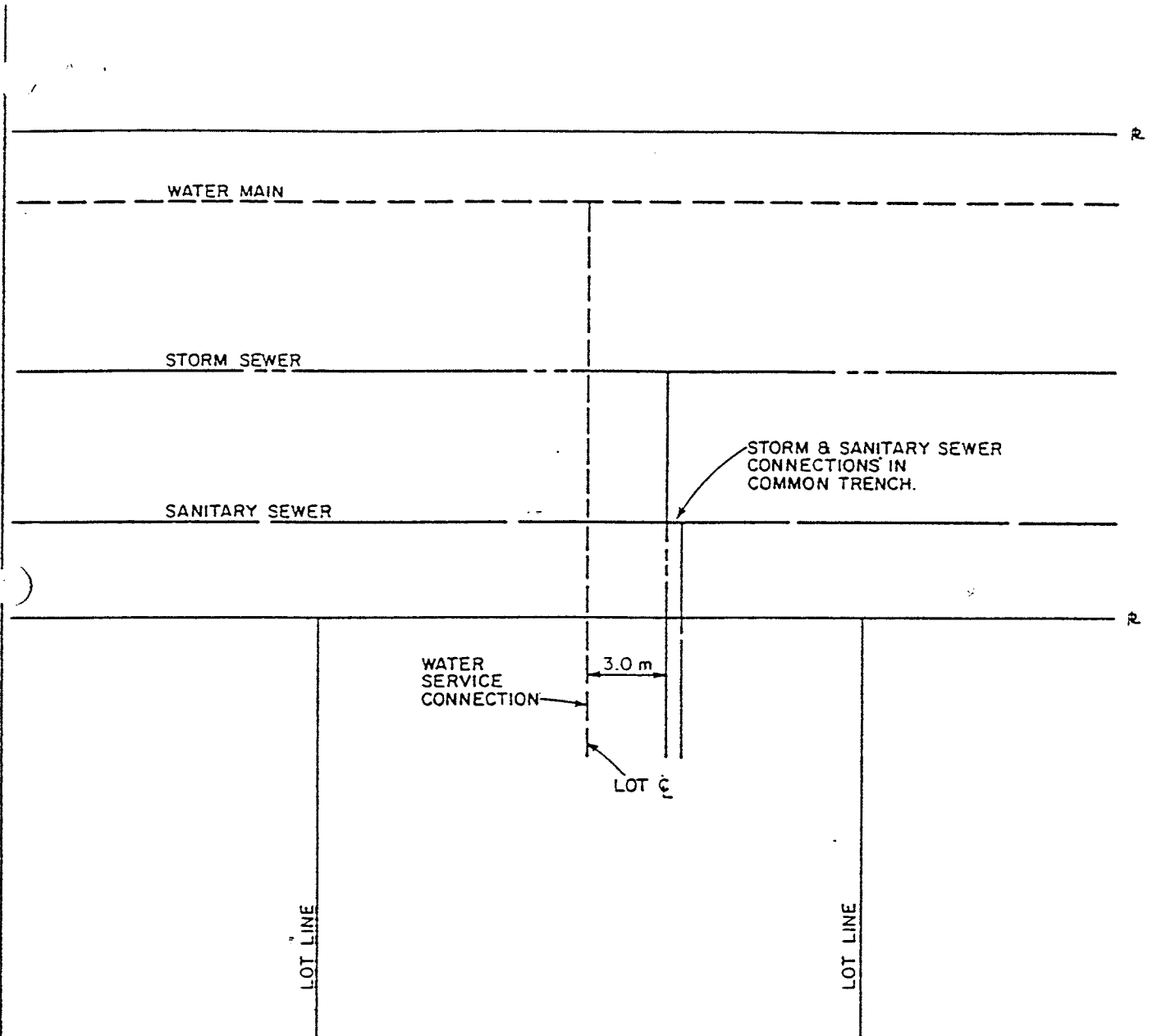
REVISION

STD. DWG. No.

REVISION

D-102

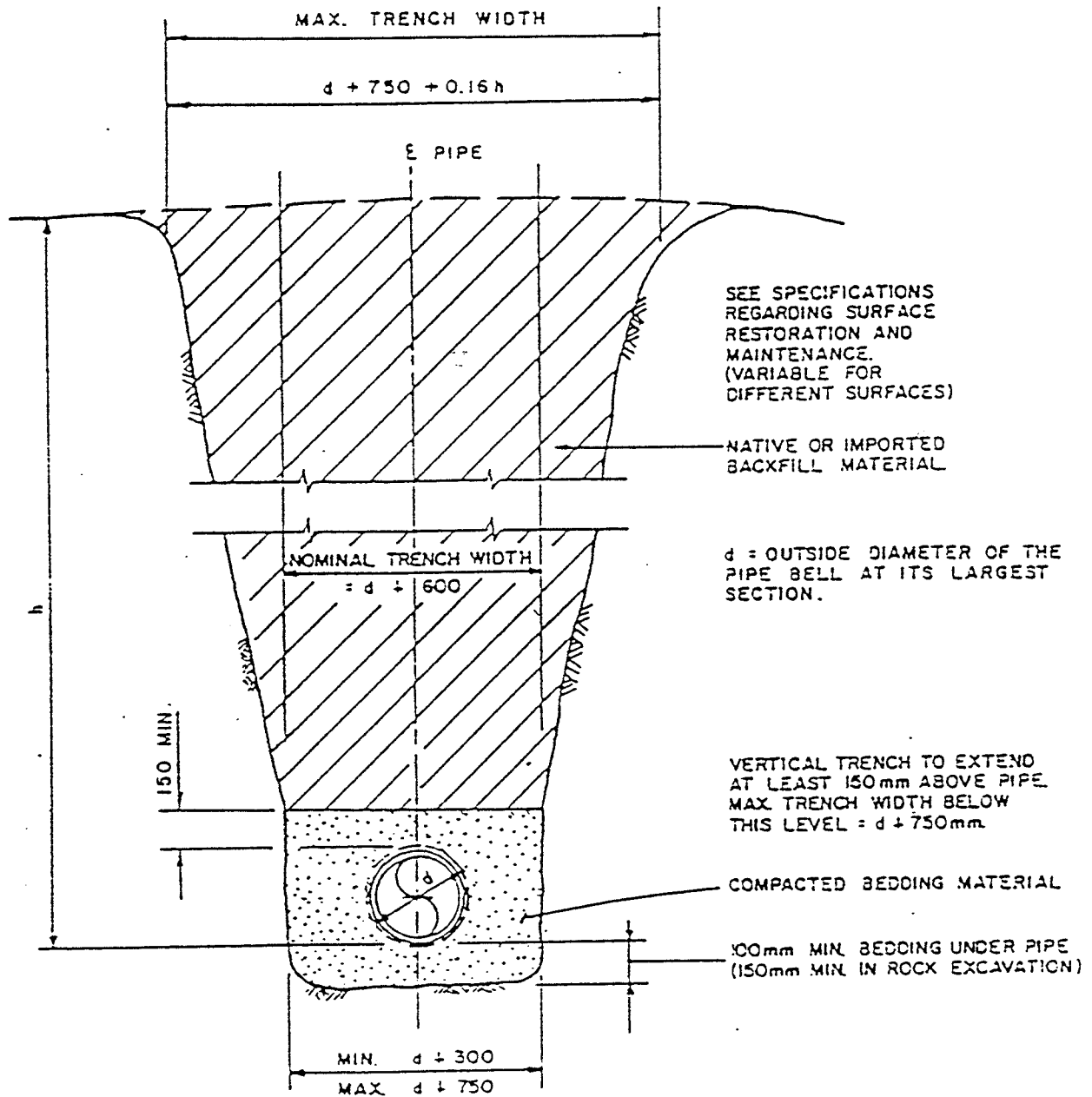




NOTE:  
 SERVICE CONNECTIONS FOR DRAINAGE AND SEWER SHALL BE MEASURED FROM THE CENTRE OF THE LOT. FOR SLOPED LOTS THE SEWER CONNECTIONS SHALL BE LOCATED ON THE LOWEST SIDE OF CENTRE.

DISTRICT OF MACKENZIE

SUBDIVISION STANDARDS	ISSUED SEPT., 1980	SCALE N.T.S.
	REVISION	STD. DWG. No.
LOCATION OF SERVICE CONNECTIONS	REVISION	D-103



NOTE:  
ALL DIMENSIONS ARE GIVEN IN  
millimetres

DISTRICT OF MACKENZIE

SUBDIVISION STANDARDS

ISSUED SEPT., 1980

SCALE N.T.S.

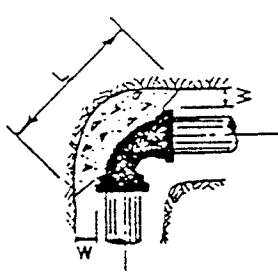
TYPICAL TRENCH SECTION FOR  
UNDERGROUND UTILITY INSTALLATION

REVISION

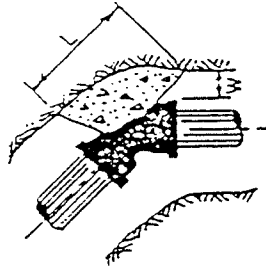
STD. DWG. No

REVISION

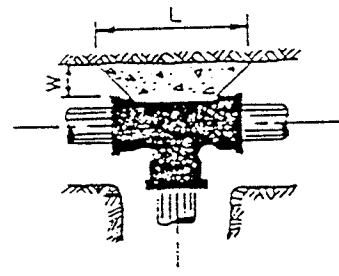
D-104



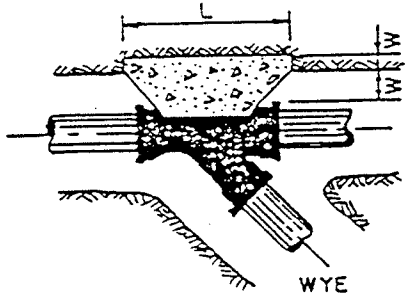
HORIZONTAL 90° BEND



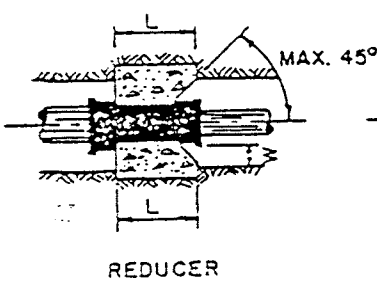
HORIZONTAL 45° BEND



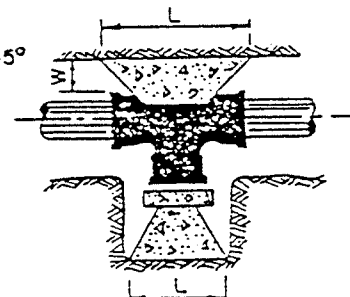
TEE



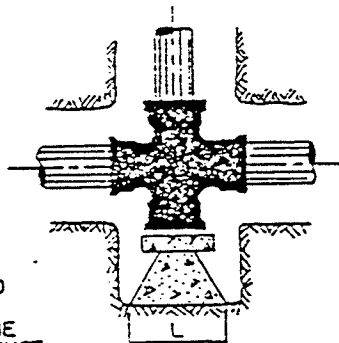
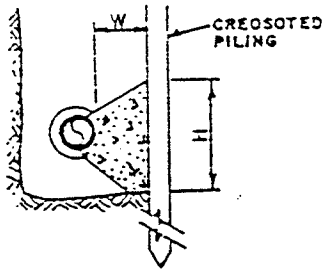
WYE



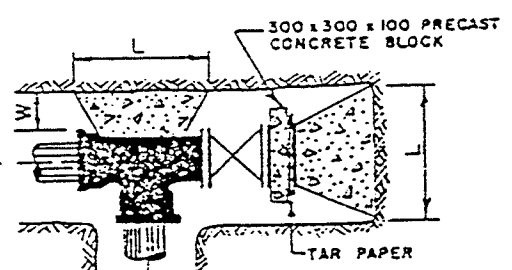
REDUCER



TEE WITH PLUG



CROSS WITH PLUG



TEE WITH VALVE

NOTES:

1. WHERE GROUND CANNOT BE EXCAVATED TO FREE STANDING UNDISTURBED SOIL SMALL PLANK SHEET PILING SHALL BE DRIVEN TO PROVIDE UNDISTURBED THRUST AREA PILING TO BE DRIVEN PRIOR TO EXCAVATING FOR THRUST BLOCK. PILING SHOULD BE USED ONLY BELOW THE PERMANENT WATER TABLE.

2. ALL DIMENSIONS ARE GIVEN IN millimetres UNLESS OTHERWISE INDICATED.

MINIMUM THRUST AREAS FOR FITTINGS AT 1030 kPa PRESSURE AND FOR SOILS WITH MIN. BEARING OF 95 kPa (NOT TO BE USED FOR SOFT CLAY, MUCK, PEAT ETC.)												
TYPE OF FITTING	FITTING SIZE		OUTSIDE OF FITTING TO BEARING FACE	RECESS IN TRENCH MALL	LENGTH	HEIGHT	TYPE OF FITTING	FITTING TO BEARING FACE		RECESS IN TRENCH MALL	LENGTH	HEIGHT
	D	W						D	W			
90° bend	150	300	300	W	920	460	cross	150	300	300	510	460
	200	350			1270	510		200	350		760	510
	250	380			1450	760		250	380		990	760
	300	400			1550	920		300	400		1220	920
	350	400										
45° bend	150	300	300	W	460	460	45° wye	150	300	300	460	460
	200	350			610	510		200	350		610	510
	250	380			760	760		250	380		760	760
	300	400			920	920		300	400		920	920
22 1/2° bend	150	300	300	W	460	320	reducer*	150	300	300	460	320
	200	350			610	300		200	350		610	300
	250	380			840	340		250	380		760	340
	300	400			920	440		300	400		920	440
tee	150	300	300	W	610	460	caps and plugs (if not bolted)	150	300	300	460	460
	200	350			760	510		200	350		610	510
	250	380			990	760		250	380		760	760
	300	400			1220	920		300	400		920	920

\*DIMENSIONS APPLY TO THE LARGER DIAMETER END OF FITTING

DISTRICT OF MACKENZIE

SUBDIVISION STANDARDS

ISSUED SEPT., 1980

SCALE N.T.S.

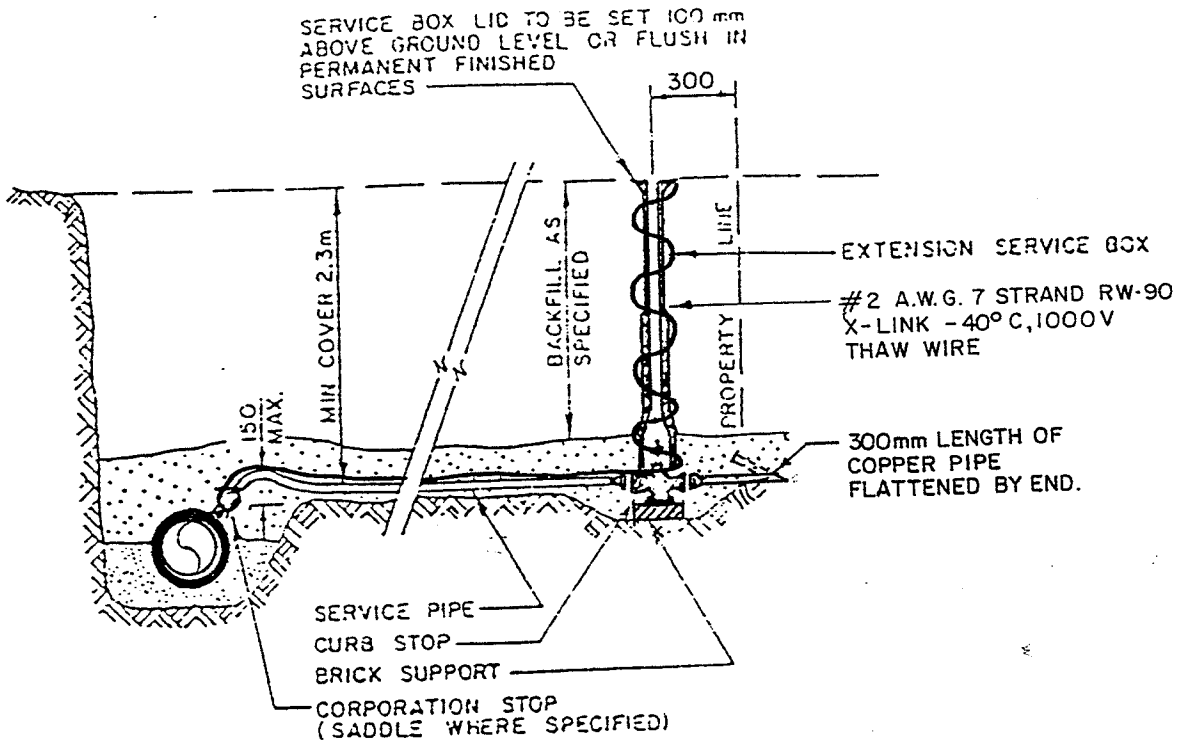
THRUST BLOCK DETAILS

REVISION

STD. DWG. No.

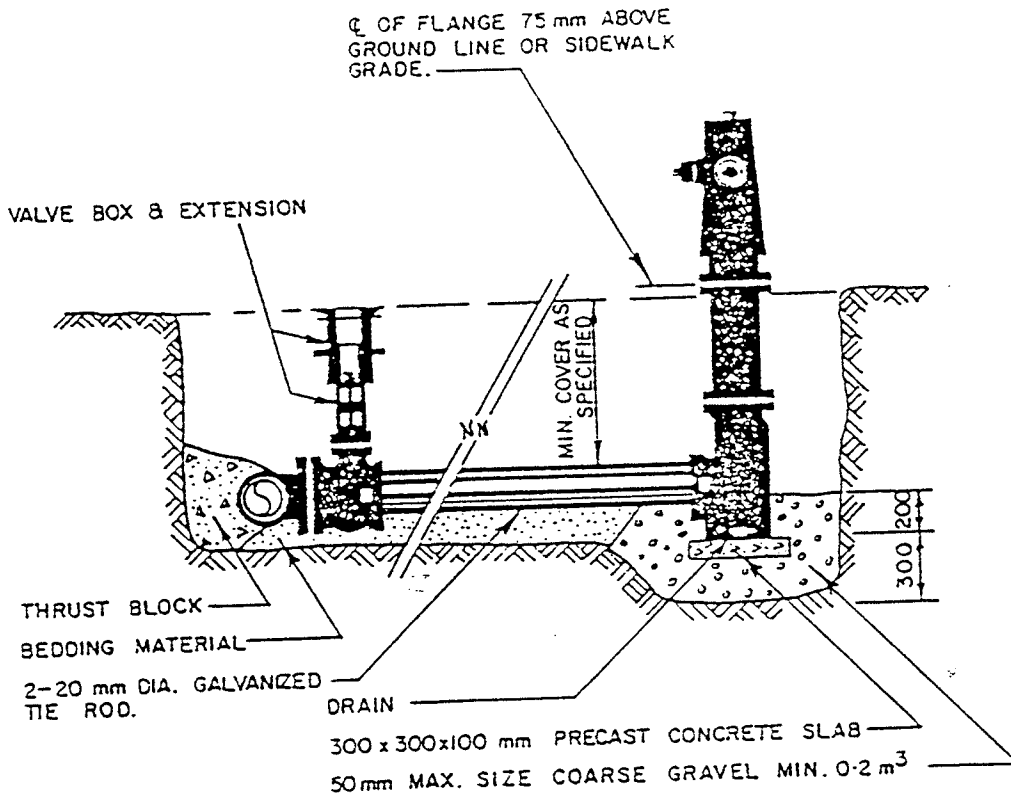
REVISION

D-105

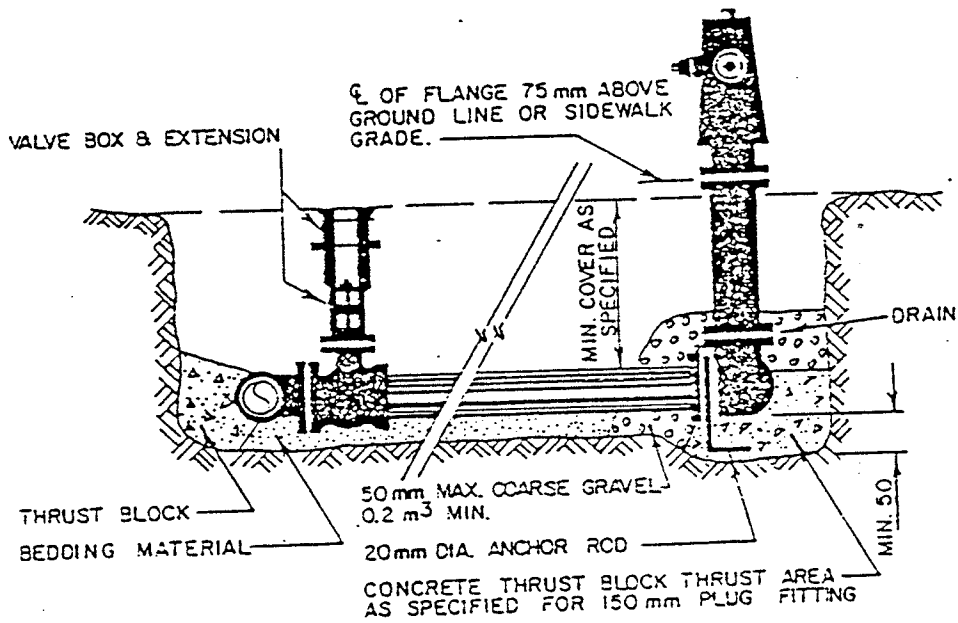


NOTE:  
ALL DIMENSIONS ARE GIVEN IN millimetres  
UNLESS OTHERWISE INDICATED.

DISTRICT OF MACKENZIE		
SUBDIVISION STANDARDS	ISSUED JULY '89	SCALE N.T.S.
WATER SERVICE CONNECTION	REVISION	STD. DWG. No.
	REVISION	D-106



HYDRANT CONNECTION WITH TIE RODS



HYDRANT CONNECTION WITH THRUST BLOCK

NOTES:

1. HOSE AND PUMPER NOZZLE MUST FACE CURB.
2. WHEN MAIN IS BETWEEN HYDRANT AND PROPERTY LINE, THE HYDRANT MUST BE A SPECIAL ORDER.
3. ALL DIMENSIONS ARE GIVEN IN millimetres UNLESS OTHERWISE INDICATED.

DISTRICT OF MACKENZIE

SUBDIVISION STANDARDS

HYDRANT CONNECTION DETAILS

ISSUED SEPT, 1980

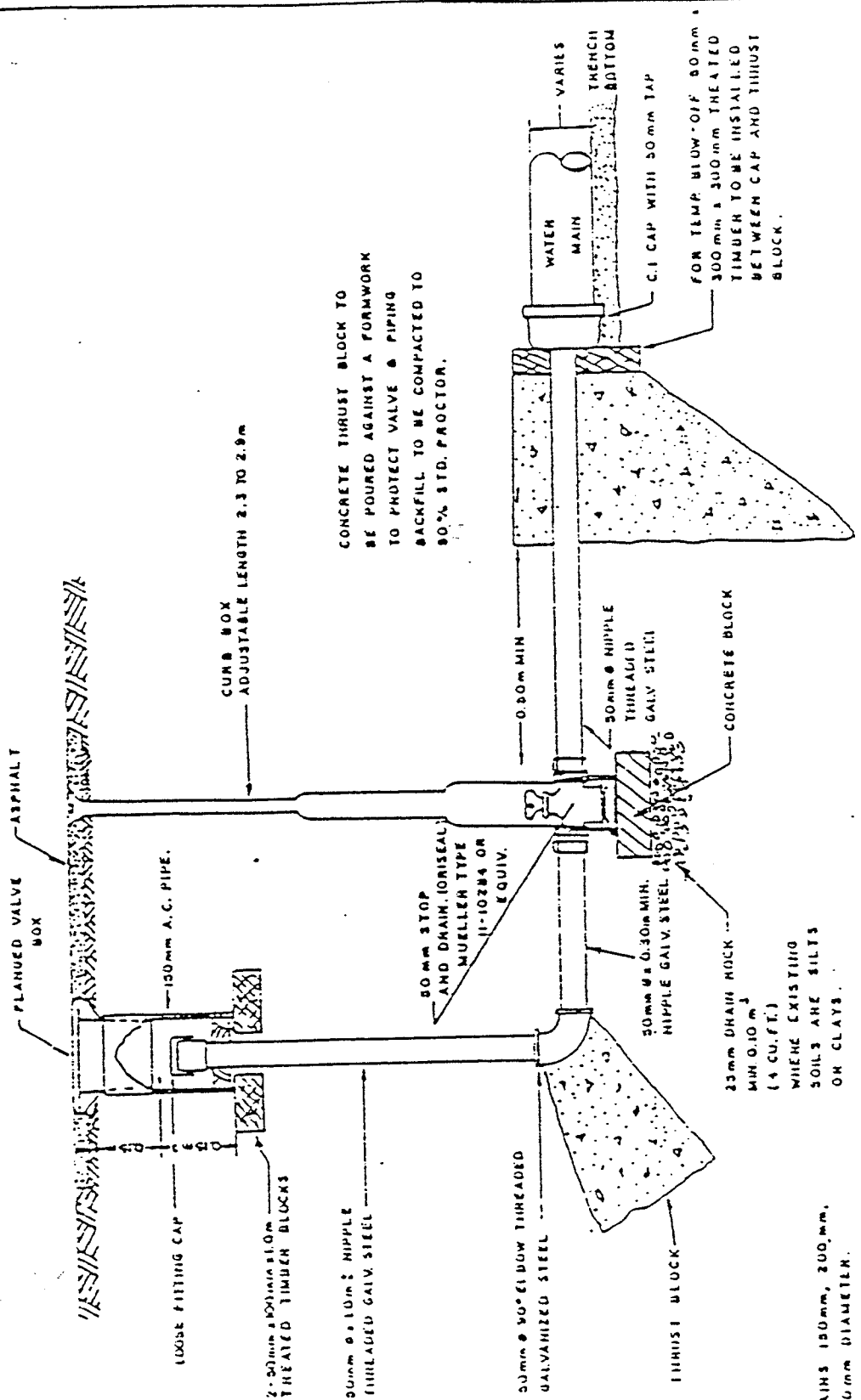
REVISION

REVISION

SCALE N.T.S.

STD. DWG. No

D-107



NOTE:  
 1. FOR MAINS 150mm, 200mm, AND 250mm DIAMETER, LARGER MAINS REQUIRE SPECIAL DESIGN.  
 2. VALVE COVER IS NOT LOCATED IN PAVEMENT, THE COVER SHOULD BE SURROUNDED WITH 10mm DIA. x 40mm THICK ASPHALT.

DISTRICT OF MACKENZIE

SUBDIVISION STANDARDS	ISSUED SEPT., 1980	SCALE N.T.S.
	REVISION	STD. DWG. No.
TYPICAL BLOW-OFF FOR DEAD END WATER MAINS	REVISION	D-108

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SEWAGE COLLECTION  
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SCHEDULE E  
SEWAGE COLLECTION

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SCHEDULE E  
SEWAGE COLLECTION

GENERAL

This Schedule refers to clearing and grubbing, trench excavation and backfill, sanitary sewer mains, manholes, service connections, testing and clean-up.

**1. SPECIFICATIONS OR STANDARDS**

When references to the following abbreviations are made, they refer to Specifications, Standards or Methods of the respective Association. Abbreviations listed herein but not mentioned in the specifications shall be disregarded.

The numbers and letters following the abbreviations denote the Association's serial designation for the Specifications or Standard to which reference is made. All references to these Specifications, Standards or Methods shall, in each instance, be understood to refer to the latest adopted revision, including all amendments.

ANSI American National Standards Institute  
ASTM American Society for Testing and Materials  
CAN3 National Standards of Canada  
CSA Canadian Standards Association

DESIGN CRITERIA

**1. DESIGN FLOW**

Sewage flows for residential areas shall be computed using a population density of 40 persons per hectare and an average sewage flow of 280 litres per capita per day with a peaking factor as established from the Harman Curve. An allowance for infiltration of 6 cubic metres per hectare per day will be added to the average sewage flow to obtain the design flow.

**2. HYDRAULICS**

The minimum pipe size shall be 200 mm diameter. Manning Formula with a roughness coefficient of 0.013 shall be used for the sewer design.

Minimum velocity at full flow shall be 0.67 metres per second except for sewers with curved alignment which shall have a minimum velocity of 0.76 metres per second.

Terminal sections of sewers shall have a minimum grade of 0.5 percent.

Where velocities exceed 4.5 metres per second special provisions shall be made to protect pipes from scouring.

Anchoring shall be provided where grades exceed 15 percent.

The minimum radius for curved alignment is 60 metres except for sewers with curved alignment which shall have a minimum velocity of 0.76 metres per second.

### 3. MANHOLES

Manholes shall be located at every change of grade, alignment, or size at terminal points and at each end of a curved alignment. Maximum interval between manholes is 120 metres.

A drop structure shall be provided for a sewer entering a manhole at an elevation of 950 mm or greater above the manhole invert. Drops between 200 mm and 450 mm should be avoided by adjusting sewer grades where possible. There shall be a drop of 30 mm in the flow channel within manholes located at changes in sewer alignment.

### 4. MINIMUM COVER

The minimum cover shall be 2.7 metres to permit service connections to cross over them or at such greater depth as may be necessary to afford adequate depth for servicing the adjacent lots.

### 5. SERVICE CONNECTIONS

A sanitary sewer service connection shall be installed to each property at an elevation that will provide drainage at basement floor level. Minimum size of a service shall be 100 mm. Minimum grade for service connections shall be 2 percent. The design of service connections for use other than single family dwellings shall be submitted to the District for approval.

## MATERIALS

### 1. PIPE AND FITTINGS

Sewer pipe and fittings employed on mains shall be PVC or concrete pipe as described below.

PVC pipe shall be in accordance with ASTM D3034, SDR 35 for 200 mm diameter or greater.

Non-reinforced concrete pipe shall be in accordance with ASTM C14, Class 3. Reinforced concrete pipe shall conform to ASTM C76, Class 3.

Pipe shall, in addition to the above, be specified to meet the actual installed loading conditions. Concrete pipe larger than 450 mm diameter shall be reinforced.

Joints for sanitary sewer pipes and fittings shall be capable of meeting specified exfiltration and infiltration tests.

100 mm and 150 mm diameter service connection pipe shall be PVC, SDR 28 to CSA B182.1. Sanitary sewer service connection pipe shall be green in color.

## 2. BEDDING GRAVEL

The bedding material shall be clean, well graded or crushed gravel, evenly graded from coarse to fine, with a maximum size of 25 mm and 90 percent retained on a 0.075 mm screen. If the trench conditions are dry and otherwise suitable, sand bedding may be used, subject to prior written approval of the District.

## 3. MANHOLES

Manholes shall conform to the typical details shown on the drawings. Manholes shall, unless otherwise specified, be of preformed 1050 mm inside diameter reinforced concrete, conforming to ASTM C478, complete with 19 mm galvanized steps at 300 mm centres. Concrete lids shall be designed to withstand H-20 highway loading conditions.

Base shall be 25 MPa concrete with minimum thickness of 150 mm. Brickwork shall be one to three courses of bricks used to support the cast iron frame and cover. Manhole frames and covers shall be of cast iron, conforming to ASTM 448, as manufactured by Mainland Foundry to Pattern 3R-13 and 12A. Bearing surfaces between the frame and cover shall be machined. The clear opening in frames shall be not less than 500 mm. Covers shall have embossed, in letters 50 mm high by 6 mm deep, the words "SANITARY SEWER". The surface of the lettering shall be flush with the remainder of the pattern embossed on the lids. Two lifting holes 22 mm in diameter shall be cored in each cover.

## 4. CONCRETE

Concrete work shall conform to CAN3-A23.1, except as modified herein.

Concrete shall develop a minimum compressive strength of 25 MPa at 28 days. Slump shall not exceed 75 mm.

## WORKMANSHIP

### 1. CLEARING AND GRUBBING

All sewer and/or water piping alignments shall be cleared and grubbed to a sufficient width to allow for proper installation of the system components. Where alignments traverse virgin areas, care shall be taken to ensure that the cleared strip is only wide enough to permit proper excavation and temporary storage of excavated material. All necessary precautions shall be taken to preserve the indigenous aesthetic values of the location. Waste material shall be disposed of in a manner approved by the District.

All trees and brush, except those selected for preservation, shall be cut, and along with all stumps, logs, roots, rotten wood, and other organic materials shall be disposed of by burning or other approved means.

Topsoil shall be stockpiled as directed by the District.

The above material shall be removed from the ground surface and to a minimum depth of 300 mm below ground surface.

All other rubbish and debris existing on the site shall be removed and disposed of by burning or other approved means.

Trees shall be felled within the designated clearing area and those falling outside this area shall be cut up and returned to the clearing area for disposal.

On instructions from the District, individual leaning or dangerous trees or snags adjacent to but outside the designated clearing area shall be cut and disposed of.

Excavations resulting from removal of tree trunks, roots, or other material shall be filled by the Developer as a part of the clearing and grubbing operation.

## 2. BURNING

Burning shall be carried out at points located centrally in the area being cleared. The fire or fires burning at any one time shall be limited by the ability of the Developer's equipment and organization to provide adequate protection against spreading of fires to adjacent timber or property.

Burning shall be carried out subject to the provisions of the Provincial Acts and Regulations thereto. In the event of Forestry Regulations prohibiting burning, materials to be burned may either be piled until such time as the regulations are rescinded, or removed from the site.

Restrictions of federal, provincial, municipal, or other recognized authorities established to control burning in the area shall be complied with. If burning cannot be done on the clearing site, the material shall be hauled to an approved location for burning or disposal. Burning sites, as required, shall be obtained by the Developer.

## 3. TRENCH EXCAVATION AND BACKFILL

### a) Trenching and Backfilling Equipment

Mechanical trenching and backfilling equipment may be used except where by so doing damage to trees, buildings, sidewalks, curbs, piping, or other existing structures or manmade obstacles above or below ground cannot be avoided. Trenches shall be hand excavated and backfilled where such obstacles prevent the use of mechanical equipment.

b) Caution in Excavation

Trenches shall be excavated only as far in advance of the pipe laying operation as safety, traffic, and weather conditions permit. Caution shall be exercised with respect to structures, piping, or other manmade obstacles that may exist within the working area and due consideration given to the protection and support of such properties and structures.

c) Precutting Paved Surfaces

When trenching along or across a paved surface, pavement shall first be cut by hand or mechanical means in straight lines parallel to the trench centreline. the total cut width of pavement shall not be greater than that which is necessary for trench excavation under existing soil conditions and shall not, in any case, exceed the specified maximum trench width at the ground surface shown on the drawings. Where, in the opinion of the District, existing pavement is in such poor condition that precutting is not warranted, pavement may be cut by trenching equipment. Pavement that has been removed to permit trenching shall be disposed of as waste material and shall not be placed in the trench backfill.

d) Excavated Trench Material

Excavated trench material may be piled alongside the trench provided the working space is adequate for this purpose and provided that by so doing the backfill material does not spill onto private properties adjacent to line of trench thereby disturbing fences, buildings, shrubs, lawns, or other items of value.

Piling of excavated material along the trench shall not unduly restrict cross traffic at road intersections. Material shall be cleared from road intersections and provision made for use of the cross road by traffic as soon as possible after excavation has taken place. Pedestrian traffic to individual properties shall be maintained at all times and timber bridges shall be provided where it is necessary to cross open trenches. Roadways, driveways, and drainage facilities shall not be blocked unnecessarily. The spoil pile shall be located such that hindrance to local traffic is minimal.

In order that excavated material may be piled along the trench, roads may be temporarily closed off to traffic provided that adequate detour traffic routes can be established to move traffic around the construction area, and provided also that street entrances to driveways are not blocked from vehicular traffic for periods in excess of one day.

Where excavated material cannot be piled along the trench in compliance with the above restrictions, it shall be trucked to locations where backfilling is taking place or trucked to stockpile for return to the trench at the time of backfilling. Alternatively, excavated material shall be wasted and replaced with approved material at time of backfilling.

**e) Trench Widths**

Trenches shall be excavated such that there is no less than 150 mm clearance between the outside of the pipe at its largest section and the trench sheeting or earth wall, and no more than 375 mm clearance between the pipe and the earth wall regardless of the existence of trenching support works. The above condition shall govern from the bottom of the trench to a distance 100 mm above the top of the pipe at its largest section. Trench widths above this level shall be maintained within the allowable limits shown on the drawings.

Ledge rock, boulders, and large stones shall be removed to provide a clearance of at least 150 mm below and on all sides of the pipe and fittings.

**f) Bracing and Sheeting**

Trenches shall be sheeted and braced in accordance with the requirements of the Workers' Compensation Board or as may be necessary to protect life, property, and structures adjacent to the work, the work itself, or to maintain trench width within the specified limits. Trench sheeting and bracing shall be located no closer than 150 mm to the widest section of any installed pipe.

Whenever possible, vertical trench timber or sheeting shall be placed so that it does not extend below the springline of the pipe being installed. When it is necessary to place sheeting or timber below the pipe springline, as in the case of overexcavation for trench bottom stabilization, sheeting shall be raised in 600 mm lifts and all backfill placed below the level of the pipe springline shall be thoroughly compacted on each lift to fill the void left by the raising sheeting.

Trench sheeting and bracing shall be removed where its removal will not result in damage to adjacent structures, otherwise it shall be left in place. When sheeting and bracing is left in place, it shall be cut so that no sheeting remains closer than 900 mm to existing ground surface.

Where sheeting or timber is removed from a trench in which backfill is to be compacted, it shall be removed in a manner which permits compaction of the backfill in the manner specified.

**g) Dewatering**

Ground and surface water shall be controlled to the extent that excavation and pipe installation can proceed in the specific manner and such that trench bottom is not disturbed to the detriment of the pipe installation. Trench water shall not be permitted to enter the pipe being installed unless approval is received from the District.

The necessary pumps, well points, or other equipment shall be employed to keep excavations free of water. Caution shall be exercised to make sure that foundation problems with existing structures and works under construction do not result from the selected method of dewatering excavations. Discharge from pumps, well points, or other dewatering equipment shall be located and controlled such that loss, damage, nuisance, or injury to the public does not result.

**h) Trench Bottom Conditions**

Trenches shall be maintained such that pipe can be installed without getting water, muck, silt, gravel, or other foreign material into the pipe. Material remaining in the trench bottom on completion of machine excavating which has been disturbed or softened by workmen or trench water shall be removed before bedding material is placed. The trench bottom shall be firm and capable of supporting the pipe to be installed, otherwise the bottom shall be stabilized by means of overexcavation or special foundation designed to support the pipe as hereinafter described.

When the material in the trench bottom is found to be unstable or otherwise unsuitable for pipe support or the support of appurtenant structures, the trench shall be overexcavated to the level at which stable material is encountered and the excavation backfilled to the level of normal bedding with base gravel material. This material shall be compacted with approved mechanical compactors in lifts having a maximum depth of 300 mm to provide a thoroughly consolidated pipe base. Bedding material, as specified for normal pipe bedding, may be employed for this purpose to a maximum depth of 300 mm below the normal depth of bedding.

**i) Backfill Within Pipe Zone**

The pipe zone is defined as that portion of the trench between the bottom level of the pipe bedding and a level 300 mm above the top of the installed pipe. Bedding of the pipe and backfill of the trench within the pipe zone shall be carried out as specified in MATERIALS, Section 2, "Bedding Gravel" and WORKMANSHIP, Section 4, "Sanitary Sewer Piping", Subsection a), "Bedding".

**j) Concrete Fill**

Concrete shall be used for pipe base, encasement, or backfill as directed by the District. Concrete shall have adequate time to set before backfill material is placed.

**k) Placing Backfill**

In order that consolidation of backfill is not hampered, trench water, if present, shall be removed prior to commencement of backfilling. To prevent damage to the installed pipe, backfill shall be placed in the trench by rolling down a slope and not by pushing it over the edge of the trench and allowing it to drop vertically. Every effort shall be made to plan the backfilling operation such that exposure of backfill material to wet weather is kept to a minimum. The trench shall be backfilled as close to the pipe laying operation as conditions permit and trench excavations shall not be left open overnight without the written permission of the District.

**l) Backfill Above Pipe Zone**

Materials and methods employed in backfilling trenches above the pipe zone shall depend on the location of the trench with respect to travelled and



untravalled surfaces, and in particular on the type of material existing on the surface in which the trench is excavated.

Travelled surfaces are gravelled, or paved, roadways, lanes, driveways, parking areas, road shoulders, walkways, or other gravelled, or paved, surfaces over which vehicular or pedestrian traffic normally travel.

Subject to provisions contained elsewhere herein, backfill above the pipe zone and surface restoration of trenches shall be carried out in accordance with the following paragraphs:

1. Untravalled Surfaces

In untravalled surfaces, unless otherwise specified, trench backfill above the pipe zone shall be native backfill material. Backfill may initially be built up to a height above original ground level equal to 10 percent of the trench depth and allowed to settle. Prior to acceptance, however, the trench surface shall be restored to its original level and to a condition which at least is equivalent to that which existed prior to construction unless the approval of the District is given to leaving trench surfaces in a bermed condition.

2. Gravel Travelled Surfaces

In travelled surfaces which exist as gravel surfaces, trench backfill above the pipe zone to a level 850 mm below the original trench surface shall, unless otherwise specified, be native backfill material. The top 850 mm of backfill shall comprise a 750 mm layer 850 mm of subbase material, surfaced with a 100 mm layer of base course material.

3. Paved Travelled Surfaces

When trenches have been excavated in existing paved surfaces which are to be repaved, trench backfill shall be mechanically compacted native backfill material to a level 915 mm below finished surface grade. The remainder of the trench shall be backfilled with 750 mm of compacted subbase material, 100 mm of base course material and finished with a minimum thickness of 65 mm of compacted hot asphalt mix.

If the edges of the cut pavement have become ragged as a result of the construction operation, pavement shall be recut to form a straight line and the base compacted prior to placing new pavement. The edges of the existing pavement shall be thoroughly cleaned and coated with an approved bituminous bonding agent prior to placing the hot asphalt mix. The asphalt shall be thoroughly compacted using an approved steel wheeled roller having a minimum weight of 7.3 tonnes or a vibratory compactor. The finished grade of the asphalt surface shall conform with that of the existing surface such that no rises, depressions, or ridges result from the repaving process.

m) Imported Backfill Material

Where excavated trench material is not suitable for backfill, it shall be hauled out and disposed of and imported backfill material shall be provided and placed.

n) Compaction of Backfill

Subject to the provision contained elsewhere herein, compaction of backfill above the pipe zone shall be obtained by using approved, mechanical, power-driven compactors. Compaction shall be carried out with the soil at optimum moisture content such that compaction to 90 percent of Standard Proctor Density (ASTM D698) is obtained. Backfill shall be compacted in lifts of not greater than 300 mm uncompacted depth.

o) Road Shoulder Gravel

Trenches in road shoulders adjacent to paved surfaces shall be resurfaced with shoulder gravel placed to a minimum depth, equivalent to the thickness of the adjacent pavement.

p) Disposal of Waste Excavated Material

Surplus excavated material shall be removed from the trench area at the time of backfilling and shall not be left along the trench following completion of the backfilling operation.

Waste material which is not required for the works, shall be disposed of at sites obtained by the Developer. Waste material shall not be dumped on private property without the written permission of the owner of the property.

q) Restoration

Surfaces adjacent to the trench or otherwise which have been disturbed by the trenching or backfilling operation shall be restored to a condition which is at least the equivalent of that which existed prior to construction and shall be maintained in this condition until the project has been accepted by the District of Mackenzie.

Working areas are those areas which are affected by the construction operation but which lie outside the specified limits of trench excavation. Working areas shall be restored in the following manner:

1. Travelled Surfaces

Working areas in untravelled surfaces shall be restored to their original condition.

2. Gravelled Surfaces

Working areas in gravelled surfaces shall be restored by scarifying and regarding the surface or, if necessary, by regravelling the surface with material which is equivalent to that which existed prior to commencement of construction.

r) **Trench Settlement During Guarantee Period**

The Developer shall replace materials and rectify all failures that occur as a result of settlement of trench backfill or collapse of trench walls during the guarantee period.

Trenches in which backfill settles shall be refilled with the specified backfill material, and paved surfaces that are adjacent to trenches or on trench backfill, which fail during this period, shall be replaced or repaired in an approved manner.

4. **SANITARY SEWER PIPING**

a) **Bedding**

Prior to installing pipe, a cushion of bedding material shall be placed in the trench bottom and compacted to grade by approved hand tampers or mechanical means to form a firm pipe base. This cushion shall cover the full width of the trench bottom and have a minimum depth of 100 mm on completion of compaction. In rock excavation, the minimum depth of bedding below the pipe shall be 150 mm. Bell or coupling holes shall be dug such that the full barrel of the pipe is supported throughout its length by the bedding material. After the pipe is in position, bedding material shall be placed around the pipe to the limits shown on the drawings. This material shall be compacted in lifts, each having a maximum compacted depth of 150 mm.

b) **Pipe Alignment and Grade**

The pipe shall be laid on line and grade. Batter boards or sight rails shall be erected across the trench at intervals not exceeding 15 metres. The centreline of the pipe shall be marked on these boards and a string line stretched between them. Alignment of the pipe shall be maintained by plumbing down from this line. The pipe shall be kept on grade by sighting across the batter boards to a boning rod resting on the invert of the pipe. Each pipe shall be plumbed and sighted for line and grade as it is installed.

Construction tolerances for sewer pipes shall be  $\pm 6$  mm in elevation and 1/10 of pipe diameter but not exceeding 50 mm in alignment.

c) **Pipe Installation**

Pipe shall be checked before being lowered into the trench to ensure that no foreign material, manufacturer's defects, or cracks exist that might prevent the proper jointing of the pipe or its operation as a sewer. Pipe and fitting shall be carefully lowered into the trench by means of derricks, ropes, or other approved tools or equipment in a manner that will prevent damage to the pipe and injury of workmen.

Pipe shall be jointed in strict accordance with the manufacturer's recommended practice. Sufficient pressure shall be applied in making the joint to assure that the distance between the end of the pipe installed and the

pipe in place is within the tolerances recommended by the pipe manufacturer. Once the joint is home, restraint shall be applied to the pipe by tamping of backfill or placement of temporary blocking to assure that the pipe does not creep and dislodge the joint. At the end of the days work, or if the work is shut down for an extended period throughout the day, the last pipe shall be blocked to prevent creep in the pipeline and plugged to prevent entry of foreign material.

d) Service Connection Junctions

Connections of services to the sewer shall be made using tee or wye fittings. Service saddles may be used only with the approval of the District.

e) Connections to Existing Sewers

Caution shall be exercised in uncovering existing pipe to ensure that no damage occurs. Connections to the existing system shall not be made until all sewers have been tested and flushed to the satisfaction of the District. If requested by the District, plugs shall be installed until road construction is completed to prevent the eroding of material into the downstream system.

f) Cleaning and Flushing

On completion, sewer pipe shall be cleaned by flushing or the use of mechanical equipment as necessary to remove foreign material from the pipe.

5. SEWER SERVICE CONNECTIONS

a) Grade

Service connections shall be installed at a grade of not less than 20 mm per metre. Service pipe shall be installed at an uniform grade between the terminus at the property line and the junction fitting (or upper end of a service drop) at the sewer.

b) Pipe Installation

Pipe shall be checked before being lowered into the trench to ensure that no foreign material, manufacturer's defects, or cracks exist that might prevent the proper jointing of the pipe or its operation. Pipe and fittings shall be carefully lowered into the trench in a manner that will prevent damage to the pipe and injury of workmen.

Pipe shall be jointed in strict accordance with the manufacturer's recommended practice. Sufficient pressure shall be applied in making the joint to assure that the distance between the end of the pipe installed and the pipe in place is within the tolerances recommended by the pipe manufacturer.

c) Capping Services

Approved watertight caps shall be installed on sanitary sewer services at the terminus of each service.

d) Marking Service Terminus

A 38 mm x 89 mm marker stake shall be placed at the service terminus as shown on the standard drawing to facilitate future location of the service pipe. This stake shall extend from a point approximately 150 mm above ground to the invert of the service pipe except in locations where the extension of the stake above ground surface would prove hazardous, in which case the stake shall be cut off flush with ground surface. The stake shall be marked in an approved manner to show the depth of the service pipe invert below the top of the stake and shall be painted yellow.

6. SEWER MANHOLES

a) Concrete Bases

All water shall be removed from the excavations prior to placing base concrete. The base shall be constructed such that the first section of a precast section can be set plumb with uniform bearing throughout its full circumference.

If material in the bottom of the trench is unsuitable for support, the bottom shall be overexcavated for firm base and backfilled to the required grade with thoroughly compacted base gravel.

b) Precast Sections

Precast sections shall be placed plumb with joints mortared to exclude any entrance of ground water.

c) Frames and Covers

Frames shall be set on a concrete brick base as shown on the drawings. Brick shall be mortared in an approved manner and the inside and outside face of the brick shall be "battered" with mortar such that a neat, even finish results. Frames shall be firmly embedded in mortar and shall be set to provide a cover surface which is even with and true to the contour of the road.

d) Manhole Steps

Manhole steps shall be placed as shown on the drawings.

e) Manhole Channelling

Manhole channelling shall be constructed as shown on the drawings. Wherever possible, channelling shall be formed using half sections of pipe or fittings. When pipe is set in the manhole base, the base shall be placed immediately following installation of the main sewer pipe to prevent

settlement of the pipe. Particular care shall be taken when constructing manhole bases to ensure that the invert levels of pipe entering and leaving the manhole are set at the proper elevations. Invert levels of pipe at the manhole shall be checked by the Developer prior to and following placement of base concrete around the pipe. This shall be done by means of batter board, sight rail, or level instrument. Variation in manhole inverts from established grade or elevation shall be corrected. Construction tolerances shall be no more than 50 mm horizontal alignments.

**f) Drop Structures**

Manhole drop structures shall be constructed as shown on the drawings, where vertical drop into the manhole exceeds 450 mm.

**g) Stubs**

Blind stub sections for connection of future sewers and service connections to the manholes shall be installed where shown on the drawings. The stub shall consist of one short length of the specified size of pipe installed in the manhole and plugged with a removable, watertight plug as shown on the drawings. Where stubs are installed, the bottom of the manhole shall be channelled to the stub entrance.

**7. CONCRETE**

**a) Concrete Installation**

Mixing, placing and compacting shall be carried out in such a manner as to produce a good quality, homogeneous concrete conforming to the dimensions shown on the drawings. Continuous moist curing shall be utilized for 7 days after placing.

**b) Reinforcement**

Reinforcement shall be free of any bond reducing coating. It shall be securely tied and placed with a minimum cover of 35 mm, except that, when concrete is placed against the ground, the cover shall be 75 mm.

**c) Joints**

The surface of the joint shall be thoroughly cleaned, with all laitance removed, and the surface thoroughly saturated with water before placement of new concrete.

**d) Finish**

Surfaces shall be screeded and shall be given a wood float finish unless otherwise noted on the approved drawings.

## 8. GROUND WATER INFILTRATION

With the exception of surface water entrance to the manhole through lifting holes or beneath the cast iron cover, manholes shall be constructed watertight.

## 9. TESTING

### a) Lamping and Inspection

The Developer shall provide all materials, equipment, labour, and supervision necessary, and shall carry out tests on the sewers in accordance with the specifications in the presence of the District.

Gravity sewers, other than service connections, shall be lamped from manhole-to-manhole to check alignment and grade of the main sewer pipe. Lamping shall be carried out by employing lights or mirrors, or if necessary, pulling an approved light through the sewer pipe from manhole-to-manhole. Variation in line or grade of pipe and any jointing, pipe cleaning, or other deficiencies discovered during the inspection shall be rectified. During this test, manhole construction and invert elevations shall be checked, and any variations shall be rectified.

### b) Leakage Testing

Main sanitary sewers and service connections, manholes and appurtenant structures thereon shall be constructed such that the leakage as evidenced by exfiltration or infiltration tests is less than that calculated using the following formula:

$$\text{Allowable Leakage in litres} = \frac{\text{HDL}}{850} \text{ where}$$

- H = duration of tests in hours,
- D = inside diameter of the pipe in millimetres, and
- L = length of pipe in the test section in metres.

The above leakage limit shall constitute the total maximum allowable leakage of any test section of the sanitary sewer. Where surface connections exist along the test section, the allowable leakage from the surface pipe calculated by use of the above formula shall be added to that of the main sewer to arrive at the total allowable leakage. No additional leakage allowance shall be made for manholes existing along the test section.

The Developer shall advise the District 24 hours in advance of the leakage test being applied and the District may elect to witness the test.

In lieu of the water test for exfiltration, the sewer main and service connections in each section may be tested by a low pressure air test. Manholes shall be tested by either the exfiltration test utilizing water or by a low pressure air test where specific approval of the test procedure has been approved by the District.

The air test shall be conducted by wetting the inside perimeter of the pipes in the test section, then increasing the pressure in the test section to 30 kPa above the average groundwater pressure and observing the rate of pressure drop.

Before the commencement of the test period the internal air pressure in the test section shall be maintained 30 kPa above the average ground water pressure for at least 5.0 minutes. The air pressure must be regulated to prevent the pressure inside the test section from exceeding 35 kPa above the average ground water pressure.

The test period shall commence when the pressure decreases to 28 kPa above the average ground water pressure and shall end when the pressure decreases to 21 kPa above the average ground water pressure. During this test period additional air shall not be added to the test section. If the test period is less than:

- 2 minutes and 32 seconds for 100 mm pipe
- 3 minutes and 50 seconds for 150 mm pipe
- 5 minutes and 6 seconds for 200 mm pipe
- 6 minutes and 22 seconds for 250 mm pipe
- 7 minutes and 39 seconds for 300 mm pipe
- 8 minutes and 56 seconds for 350 mm pipe
- 9 minutes and 35 seconds for 375 mm pipe
- 10 minutes and 12 seconds for 400 mm pipe
- 11 minutes and 34 seconds for 450 mm pipe
- 12 minutes and 45 seconds for 500 mm pipe
- 13 minutes and 45 seconds for 525 mm pipe

the sewer shall be deemed to have failed the test and it shall be retested upon completion of repairs to any leaks. The District reserves the right to withdraw permission to use this test procedure at any time and to require the Contractor to carry out the exfiltration test utilizing water.

### c) Manholes

Manholes shall be tested by filling them with water to grade or to a maximum of 2.5 metres above invert when there shall be no measurable leakage.

## 10. CLEAN-UP

The working area shall be maintained in an orderly manner and shall not be encumbered with equipment, materials, or debris.

Clean-up shall be continuing process from the start of the work to final acceptance of the project. The Developer shall at all times, and without further order, keep property on which work is in progress free from accumulations of waste materials or rubbish caused by employees or by the work. Accumulations of waste materials which might constitute a fire hazard will not be permitted. Spillage from the Developer's hauling vehicles on travelled public or private roads shall be promptly cleaned up. On completion of construction, the Developer shall remove all temporary structures, rubbish and waste materials resulting from his operations.



## II. STANDARD DRAWINGS

The following standard drawings form part of Schedule "E":

- E-100 Service Connection Record Card
- E-101 Typical Section Urban Local Undivided Street
- E-102 Typical Section Urban Collector Undivided Street
- E-103 Location of Service Connections
- E-104 Typical Trench Section for Underground Utility Installation
- E-105 Typical Residential Sewer Connection
- E-106 Service Connection Location Details
- E-107 Typical Manhole Detail for Sewers 375 mm or Less
- E-108 Drop Manhole Type I and Type II
- E-109 Manhole Cover and Frame
- E-110 Harman Peaking Factor Curve

ADDRESS OF PROPERTY

THE DISTRICT OF MACKENZIE

ROLL NUMBER		LEGAL DESCRIPTION					
LOT	BLK.	D.L.	1/4	SEC.	T.P.	PLAN	

Municipal Services Record

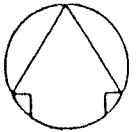
MASTER LEGAL MAP

NOTE: THIS IS A REDUCTION OF A RECORD CARD FOR AS BUILT RECORD PURPOSES FULL SIZED CARDS CAN BE OBTAINED FROM THE APPROVING OFFICER.

DISTRICT OF MACKENZIE  
 SUBDIVISION STANDARDS  
 SERVICE CONNECTION RECORD CARD

	WATER	SANITARY SEWER	STORM SEWER
DATE OF APPLICATION			
PERMIT NUMBER			
INSTALLATION DATE			
SIZE OF SERVICE			
LOCATION AT P.L.			
INVERT AT P.L.			
LENGTH OF CONNECTION			
METER SIZE & TYPE			
DEPTH OF MAIN			
DIST. FROM WYE TO M.H.			
MEASURED FROM M.H. No.			
RISER			
TYPE OF PIPE			

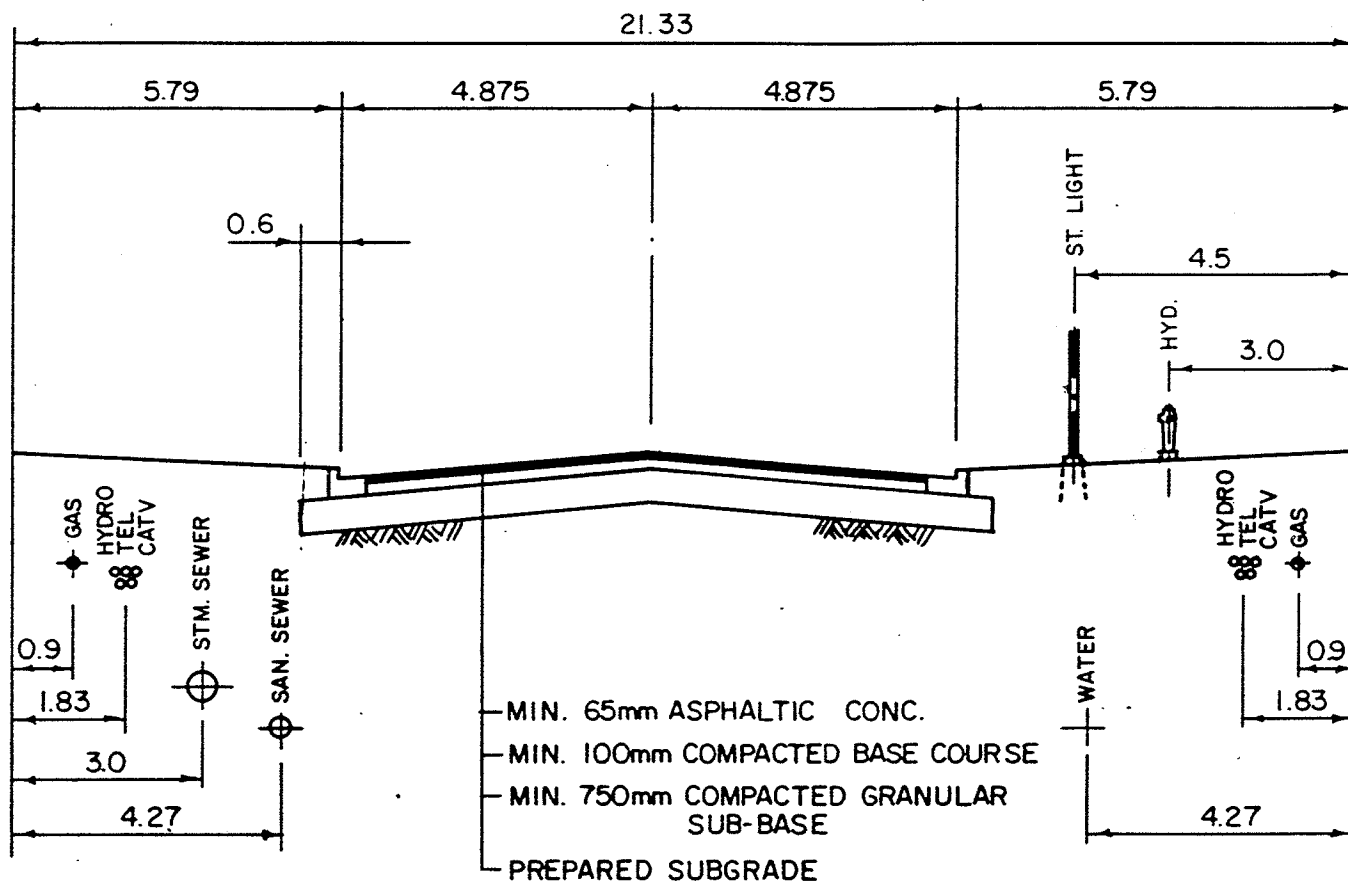
CONNECTION LOCATIONS SKETCH  
 WATER \_\_\_\_\_ SANITARY \_\_\_\_\_ STORM .....



CULVERT INSTALLATIONS

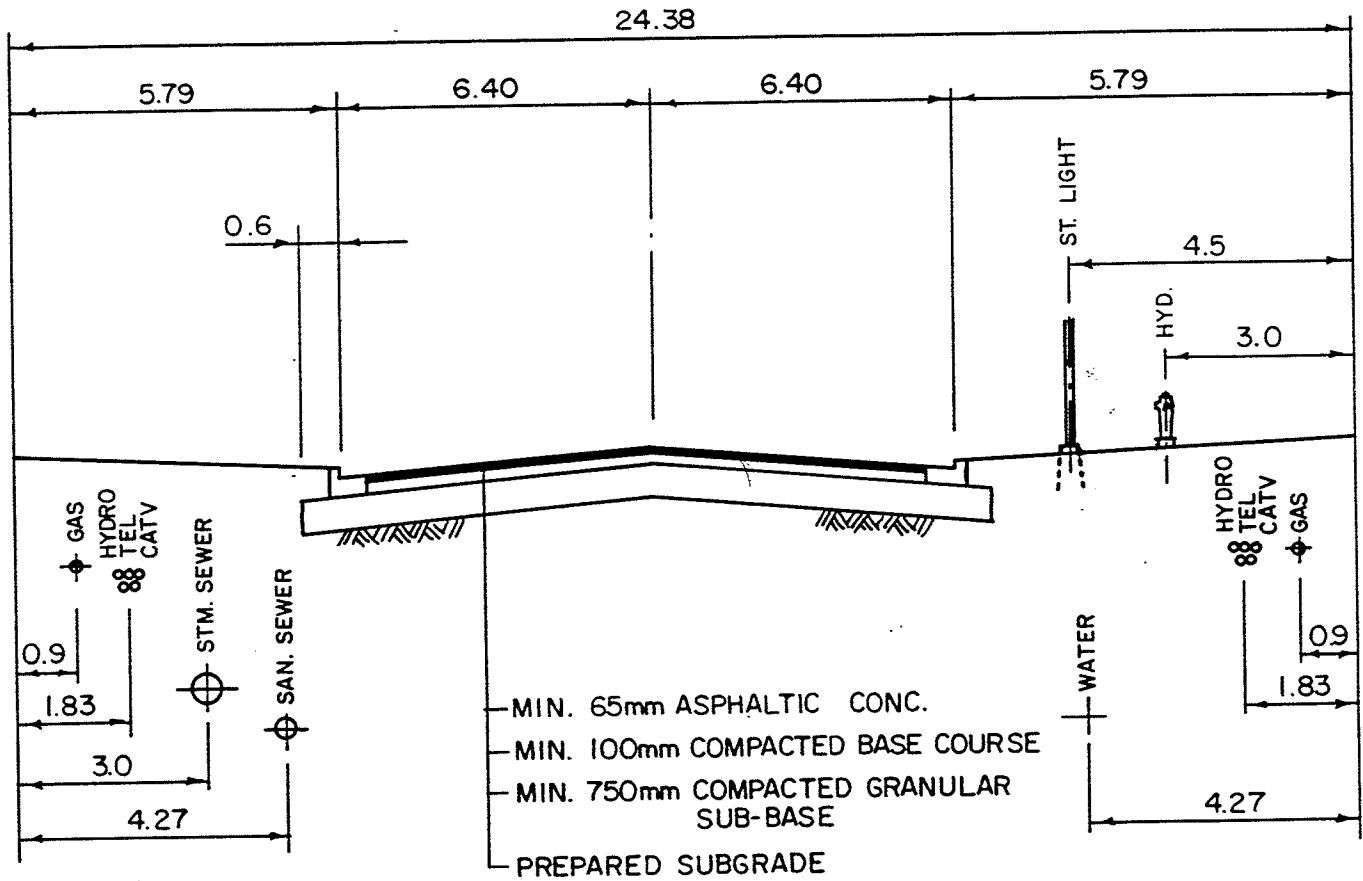
DATE	PERMIT No.	SIZE/TYPE	FOOTAGE

ISSUED	SEPT, 1980	SCALE	N.T.S.
REVISION		STD. DWG. No.	
REVISION		E-100	



DISTRICT OF MACKENZIE

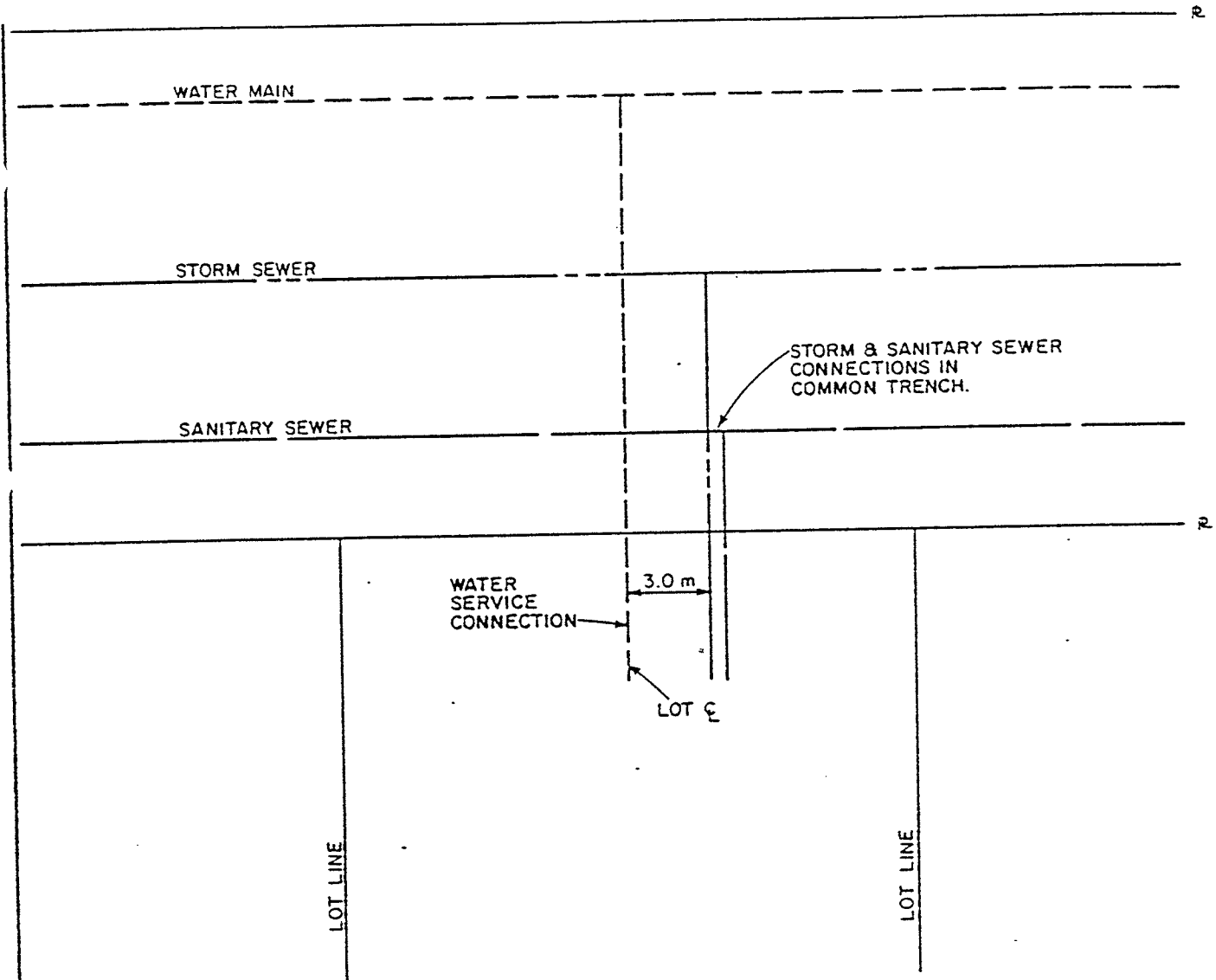
SUBDIVISION STANDARDS	ISSUED	JULY '89	SCALE	N.T.S.
	REVISION		STD. DWG. No.	
TYPICAL SECTION URBAN LOCAL UNDIVIDED ROAD	REVISION		E - 101	



MIN. 65mm ASPHALTIC CONC.  
 MIN. 100mm COMPACTED BASE COURSE  
 MIN. 750mm COMPACTED GRANULAR SUB-BASE  
 PREPARED SUBGRADE

DISTRICT OF MACKENZIE

SUBDIVISION STANDARDS	ISSUED	JULY '89	SCALE	N.T.S.
	REVISION		STD. DWG. No.	E-102
TYPICAL SECTION URBAN COLLECTOR UNDIVIDED ROAD	REVISION			

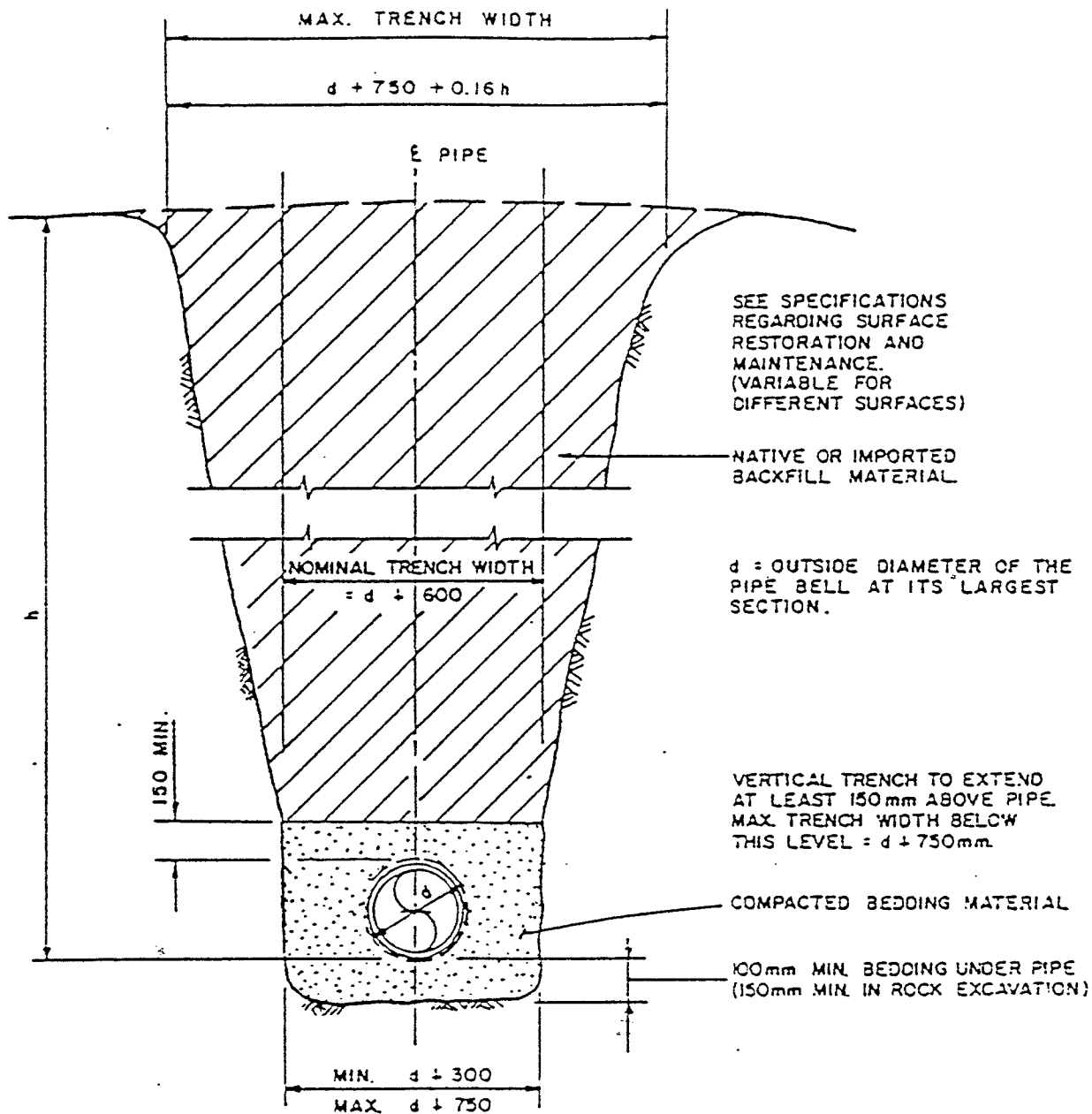


**NOTE:**

SERVICE CONNECTIONS FOR DRAINAGE AND SEWER SHALL BE MEASURED FROM THE CENTRE OF THE LOT. FOR SLOPED LOTS THE SEWER CONNECTIONS SHALL BE LOCATED ON THE LOWEST SIDE OF CENTRE.

**DISTRICT OF MACKENZIE**

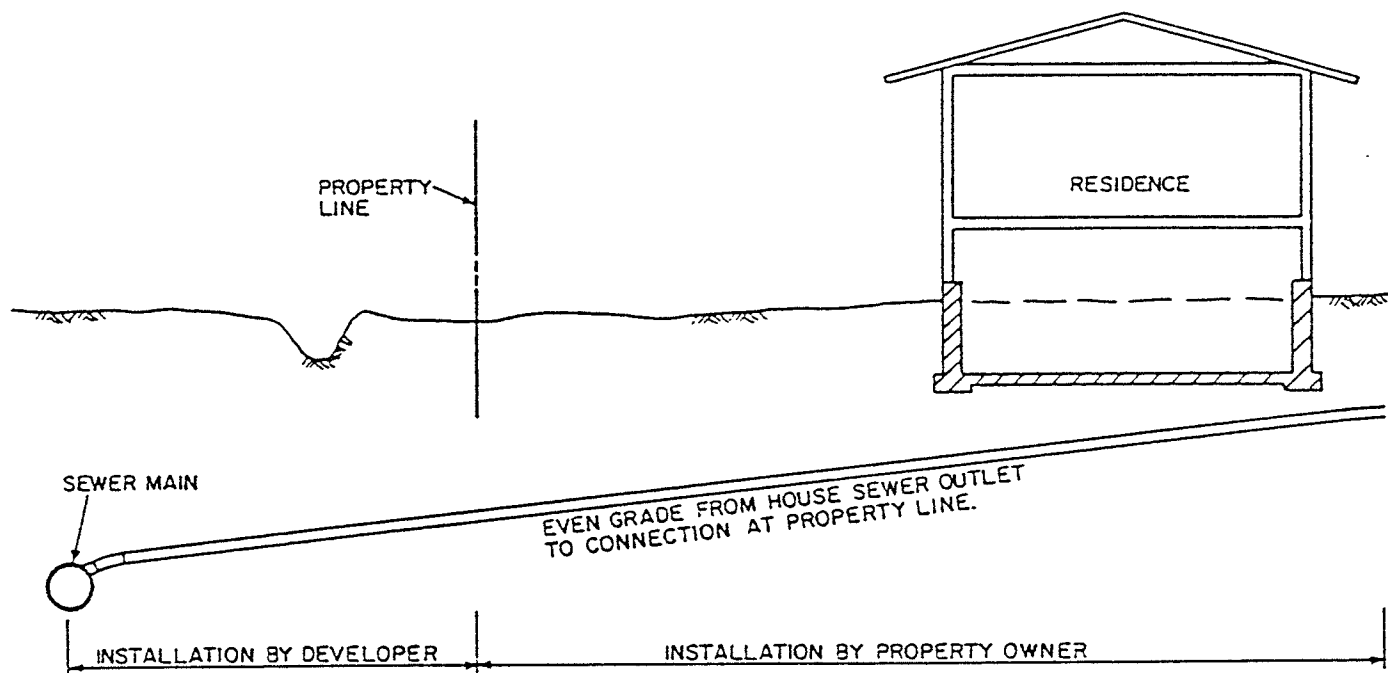
SUBDIVISION STANDARDS	ISSUED SEPT., 1980	SCALE N.T.S.
LOCATION OF SERVICE CONNECTIONS	REVISION	STD. DWG. No.
	REVISION	E - 103



NOTE:  
 ALL DIMENSIONS ARE GIVEN IN millimetres

DISTRICT OF MACKENZIE

SUBDIVISION STANDARDS TYPICAL TRENCH SECTION FOR UNDERGROUND UTILITY INSTALLATION	ISSUED SEPT., 1980	SCALE N.T.S.
	REVISION	STD. DWG. No.
	REVISION	E-104



NOTES:

1. THE SECTION FROM THE HOUSE SEWER OUTLET TO THE PROPERTY LINE INCLUDING THE CONNECTION TO THE EXIST. SERVICE LINE IS THE PROPERTY OWNER'S RESPONSIBILITY.
2. MIN. PIPE DIA. IS 100 mm.
3. MIN. PIPE COVER AT PROPERTY LINE IS 2.5 m.
4. SAND BEDDING REQUIRED FOR ALL TYPES OF PIPE FROM 100 mm BELOW THE PIPE TO THE SPRINGLINE.
5. RAINWATER AND FOUNDATION DRAINS ARE NOT TO BE CONNECTED TO THE SANITARY SEWER.
6. MIN. GRADE FOR 100 mm DIA. PIPE IS 1.25% OR 12.5 mm/m.
7. ANY CHANGE IN DIRECTION TO BE MADE WITH WYES OR 1/8 BENDS.

DISTRICT OF MACKENZIE

SUBDIVISION STANDARDS

ISSUED SEPT., 1980

SCALE N.T.S.

TYPICAL RESIDENTIAL SEWER CONNECTION

REVISION

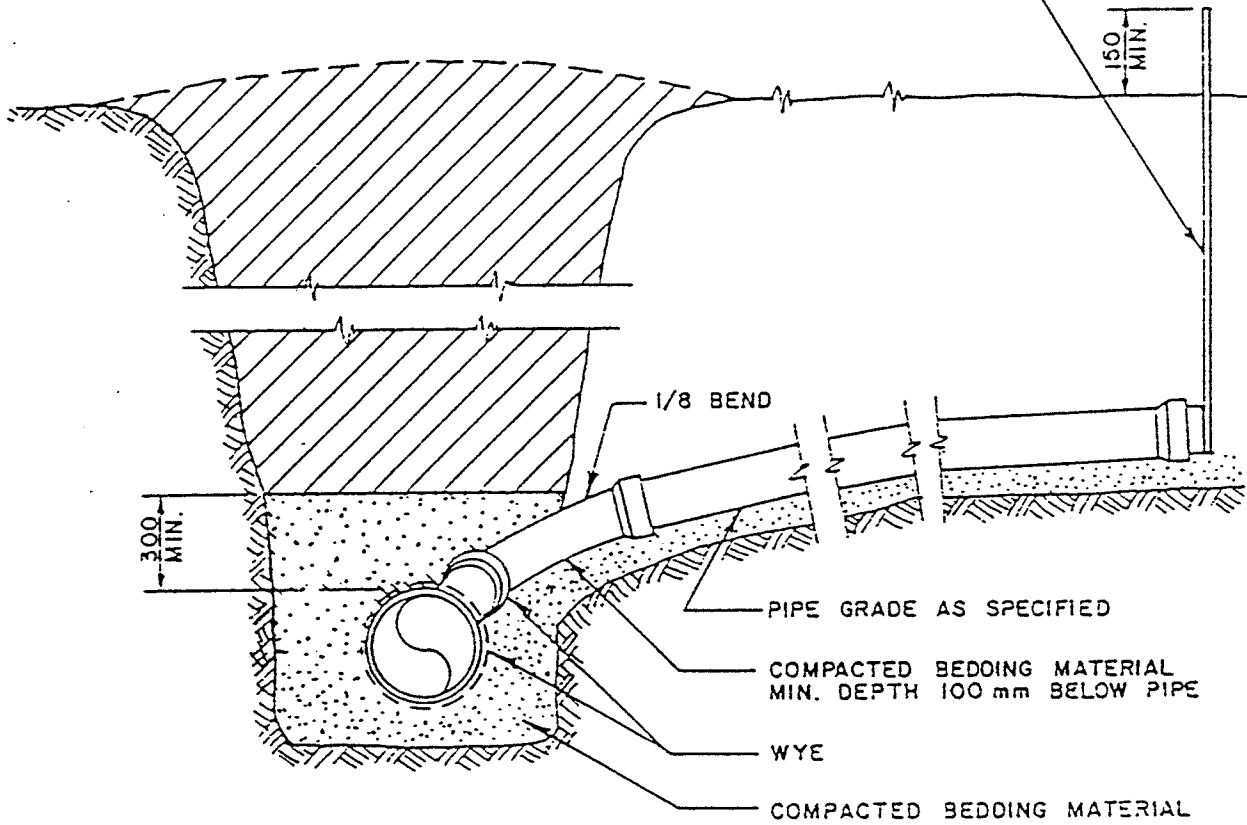
STD. DWG. No.

REVISION

E - 105

IF THE SERVICE IS IN A LOCATION WHERE THE STAKE MAY BE A HAZARD TO PEDESTRIAN OR VEHICULAR TRAFFIC, IT SHALL BE BROUGHT TO GROUND SURFACE.

38 x 89 mm STAKE PAINTED YELLOW, WITH DEPTH FROM TOP OF STAKE TO INVERT OF SERVICE, PAINTED ON TO THE NEAREST 10mm STAKE TO BE LOCATED ON PROPERTY LINE OR EASEMENT LINE.



NOTE:

1. ALL DIMENSIONS ARE GIVEN IN millimetres UNLESS OTHERWISE INDICATED.
2. MINIMUM SERVICE CONNECTION DIAMETER TO BE 100 mm.

DISTRICT OF MACKENZIE

SUBDIVISION STANDARDS

ISSUED SEPT., 1980

SCALE N.T.S.

SERVICE CONNECTION  
LOCATION DETAILS

REVISION

STD. DWG. No.

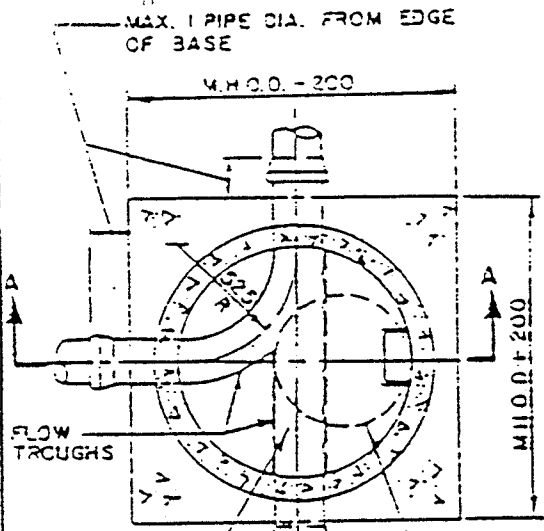
REVISION

E - 106



ALL PIPES TO BE GROUTED  
FLUSH WITH INSIDE OF  
MANHOLE WALL

MANHOLE COVER & FRAME  
MANHOLE COVER TO SUIT  
GRADE OF ROAD SURFACE  
CONCRETE COVER SLAB  
TO BE REINFORCED TO  
MEET H2O LOADING  
REQUIREMENTS



MAX. 1 PIPE DIA. FROM EDGE  
OF BASE

M.H.O.D. - 200

M.H.O.D. - 200

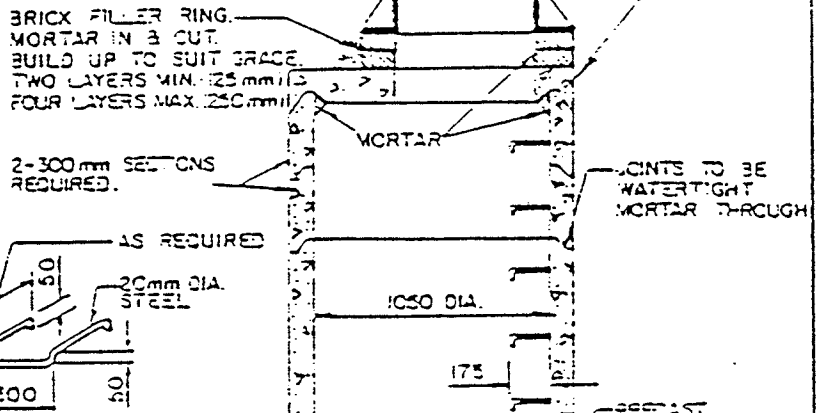
FLOW TROUGH

SECTION  
A-A

PROVIDE PLUGGED STUB FOR  
ALL FUTURE EXTENSIONS

LOCATION OF COVER & RUNGS TO  
SUIT MUNICIPAL STANDARDS

PLAN



BRICK FILLER RING  
MORTAR IN 3 CUT  
BUILD UP TO SUIT GRADE  
TWO LAYERS MIN. 125 mm THK  
FOUR LAYERS MAX. 250 mm THK

MORTAR

2-300 mm SECTIONS  
REQUIRED.

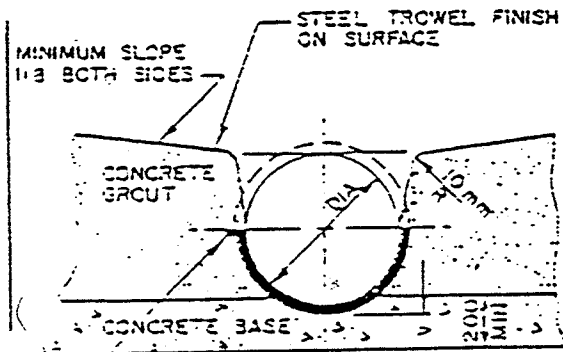
AS REQUIRED

20mm DIA.  
STEEL

300

40

RUNG DETAIL  
GALVANIZE AFTER  
FABRICATION



MINIMUM SLOPE  
1/8 BOTH SIDES

STEEL TROWEL FINISH  
ON SURFACE

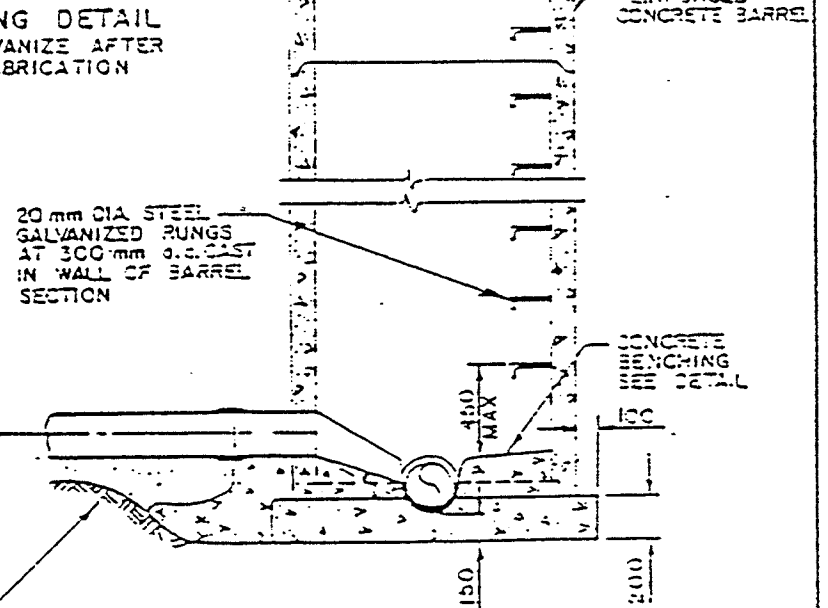
CONCRETE  
GROUT

CONCRETE  
BASE

150  
MIN

WHERE POSSIBLE USE  
HALF SECTIONS, OR  
BREAK OUT TOP HALF  
OF PIPE

INVERT CHANNELLING IN MANHOLE



20 mm DIA. STEEL  
GALVANIZED RUNGS  
AT 300 mm o.c. CAST  
IN WALL OF BARREL  
SECTION

CONCRETE  
FINISHING  
SEE DETAIL

100

150

200

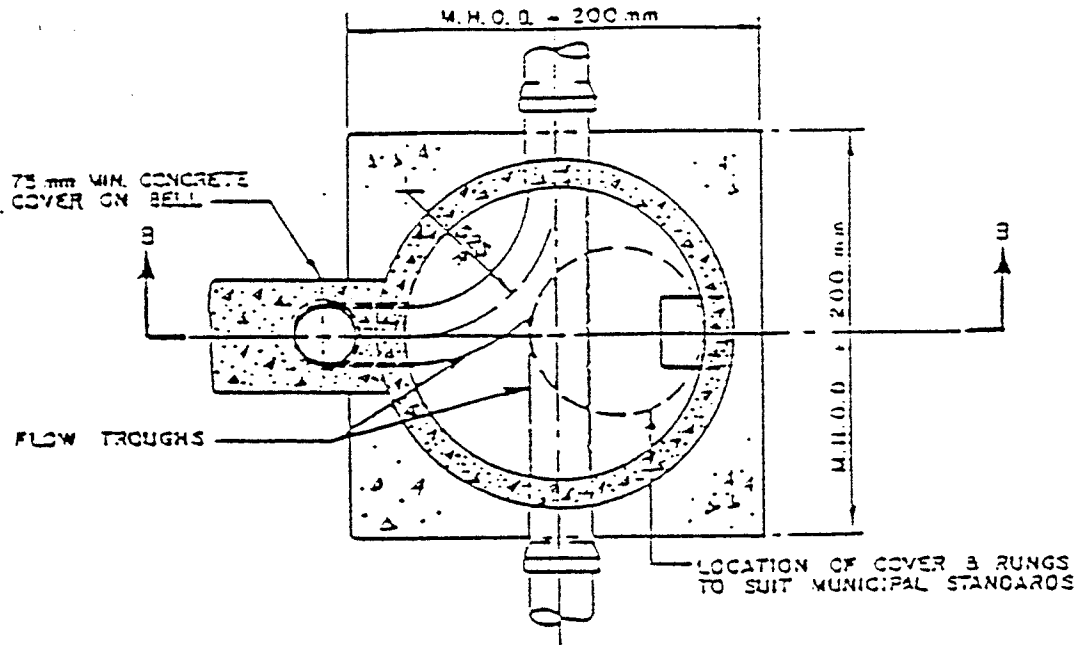
WHERE MANHOLE BASE EXCAVATION EXTENDS BEYOND BASE  
DIMENSION, THE OVER EXCAVATION SHALL BE FILLED WITH  
CONCRETE TO 100 mm BELOW THE BOTTOM OF THE PIPE &  
FOR THE WIDTH OF THE TRENCH

SECTION A-A  
TYPICAL MANHOLE  
PRECAST REINFORCED CONCRETE BARREL

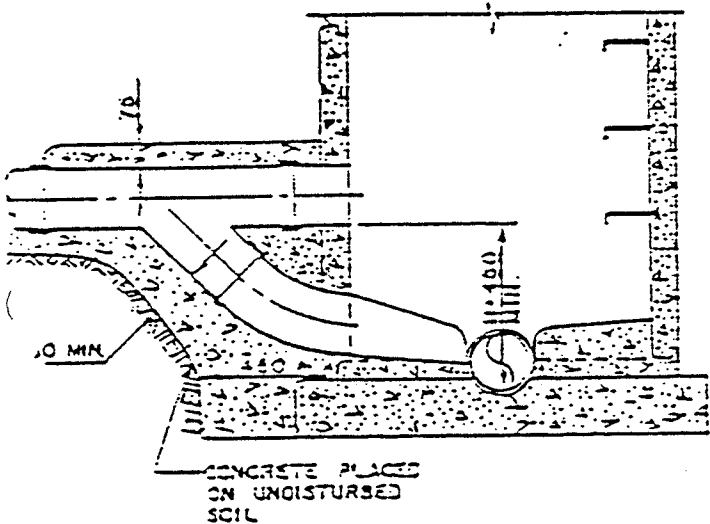
- FOR DETAILS ON DROP TYPE MANHOLES SEE DWG. E-109.
- ALL DIMENSIONS ARE GIVEN IN millimetres UNLESS OTHERWISE INDICATED.

DISTRICT OF MACKENZIE

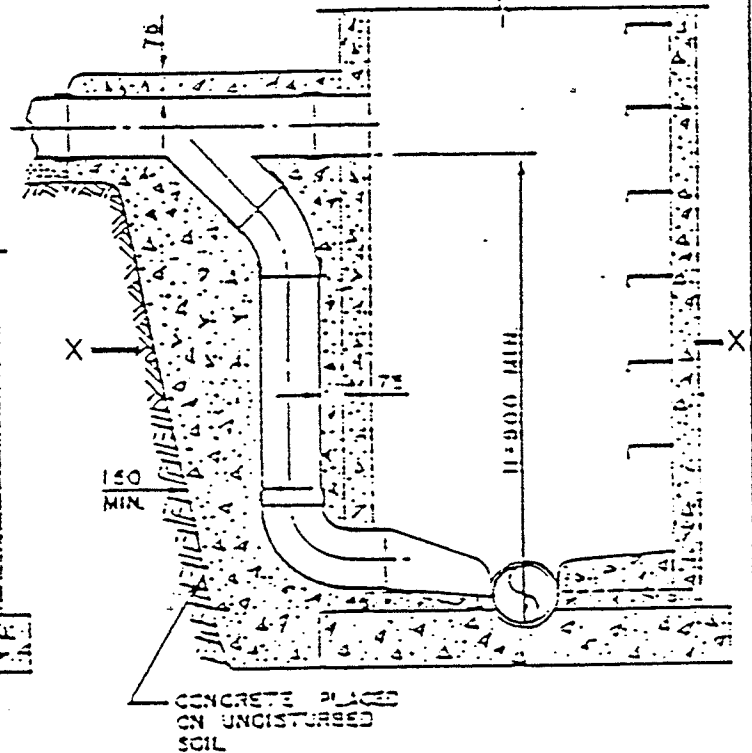
SUBDIVISION STANDARDS	ISSUED SEPT., 1980	SCALE N.T.S.
TYPICAL MANHOLE DETAIL FOR SEWERS 375 mm OR LESS	REVISION	STD DWG No.
	REVISION	E-107



PLAN AT "X-X" SHOWING DROP



SECTION B-B  
DROP MANHOLE TYPE II



SECTION B-B  
DROP MANHOLE TYPE I

1. SEE DWG. E-107 FOR DETAILS ON INVERT CHANNELLING IN MANHOLE.
2. ALL DIMENSIONS ARE GIVEN IN millimetres UNLESS OTHERWISE INDICATED.

DISTRICT OF MACKENZIE

SUBDIVISION STANDARDS

DROP MANHOLE  
TYPE I AND TYPE II

ISSUED SEPT., 1980

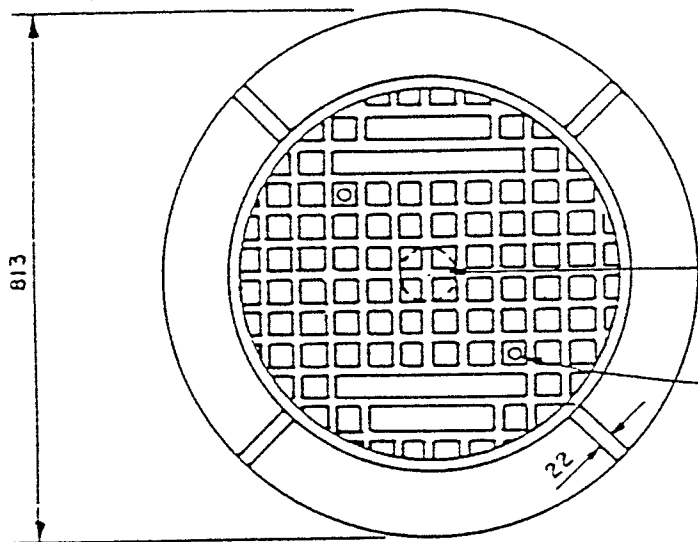
REVISION

REVISION

SCALE N.T.S.

STD. DWG. No.

E-108

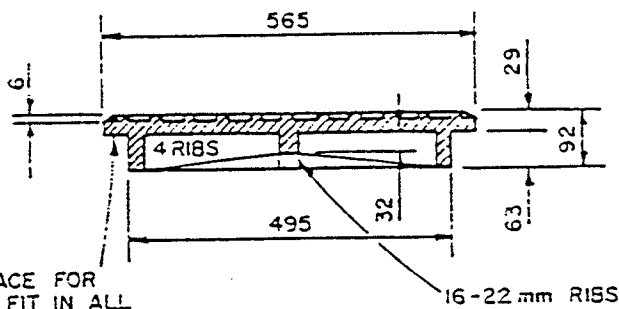


NOTE:  
 LETTERING SHALL BE 25 mm FLATTENED  
 FACE GOTHIC LETTERING WITH FACE OF  
 LETTERS RAISED TO THE SAME LEVEL  
 AS THE TOP OF THE RIBS

MANUFACTURES SYMBOL 90 mm MAX.  
 DIMENSION, CIRCLE OR SQUARE

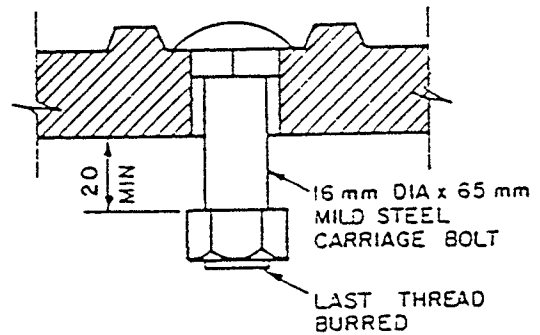
22 mm DIA. HOLE FOR CARRIAGE BOLT  
 TWO REQ'D AS SHOWN

PLAN

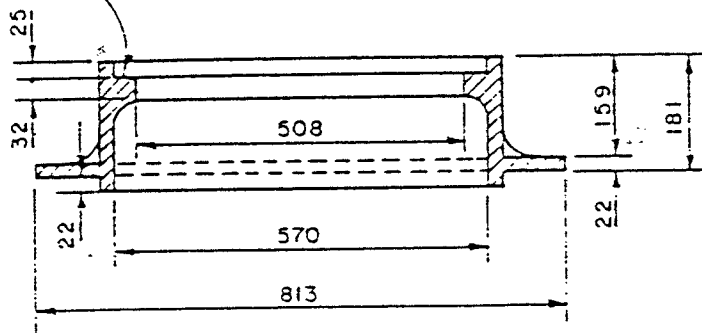


COVER

MACHINE SURFACE FOR  
 NON ROCKING FIT IN ALL  
 POSITIONS. ALLOW 2mm  
 RAISED FACE IN CASTING  
 FOR MACHINING



CARRIAGE BOLT DETAIL



FRAME

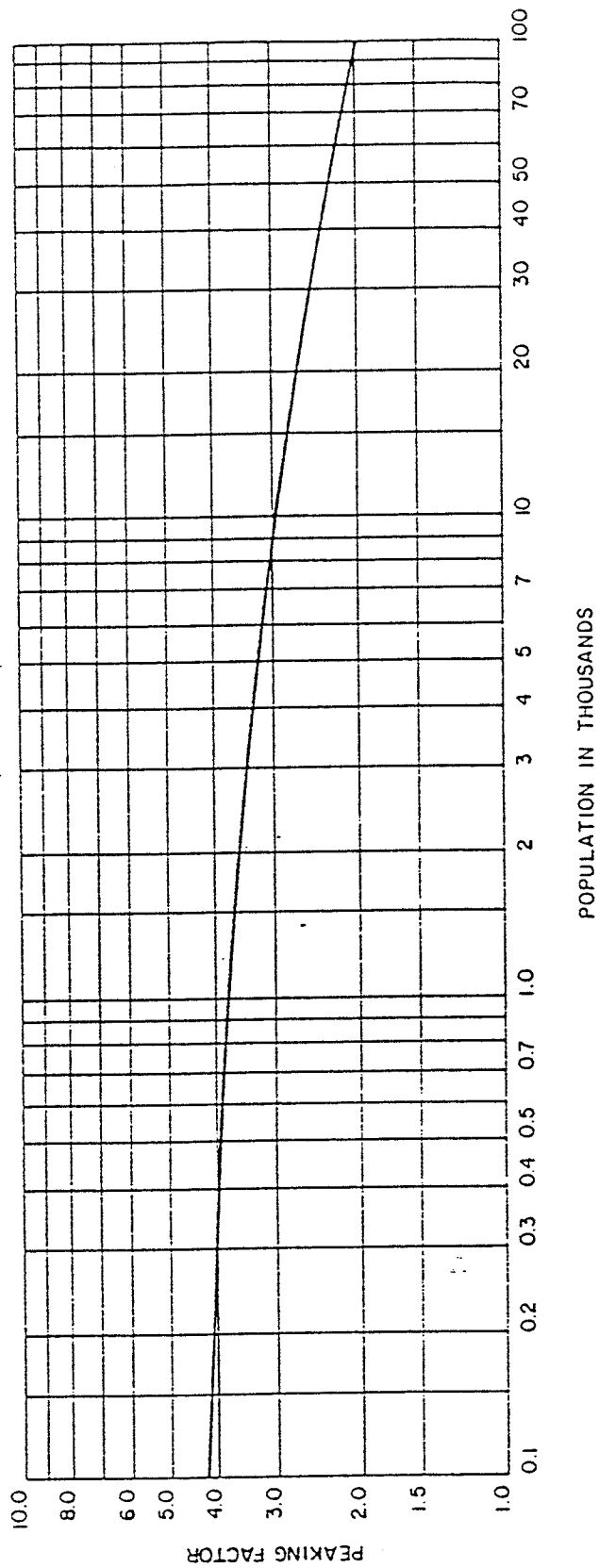
APPROXIMATE WEIGHTS

COVER - 60-66 kg  
 FRAME - 102-108 kg

NOTE:  
 ALL DIMENSIONS ARE GIVEN  
 IN millimetres UNLESS  
 OTHERWISE INDICATED

DISTRICT OF MACKENZIE

SUBDIVISION STANDARDS	ISSUED	SEPT, 1980	SCALE	N.T.S.
	REVISION		STD. DWG. No.	
	REVISION		E-109	
MANHOLE COVER & FRAME				



HARMAN FORMULA:

$$H = \frac{18 + \sqrt{P}}{4 + \sqrt{P}}$$

H = PEAKING FACTOR

P = POPULATION IN THOUSANDS

DISTRICT OF MACKENZIE

SUBDIVISION STANDARDS

ISSUED SEPT., 1980

SCALE N.T.S.

HARMAN PEAKING FACTOR CURVE

REVISION

STD. DWG. No.

REVISION

E-110

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STORM DRAINAGE  
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SCHEDULE F  
STORM DRAINAGE

GENERAL

This Schedule refers to clearing and grubbing, trench excavation and backfill, storm sewer mains, manholes, service connections, catch basins and testing.

**I. SPECIFICATIONS OR STANDARDS**

When references to the following abbreviations are made, they refer to Specifications, Standards or Methods of the respective Association. Abbreviations listed herein but not mentioned in the specifications shall be disregarded.

The numbers and letters following the abbreviations denote the Association's serial designation for the Specification or Standard to which reference is made. All references to these Specifications, Standards or Methods shall, in each instance, be understood to refer to the latest adopted revision, including all amendments.

ANSI American National Standards Institute  
ASTM American Society for Testing and Materials  
CAN3 National Standards of Canada  
CSA Canadian Standards Association

DESIGN CRITERIA

**I. GENERAL**

Drainage works shall be provided for the entire area to be subdivided with capacity allowances for the upstream tributary drainage area. In general, drainage works shall consist of storm sewers. Under certain circumstances ditches and culverts may be permitted by the Approving Officer.

Natural drainage courses may be used, providing easements are registered for access and for maintenance purposes. In the design of drainage system all necessary steps to preserve natural water courses shall be undertaken. Drainage works on streams supporting fish life shall be approved by the Federal Department of Fisheries and Oceans and/or the Fish and Wildlife Branch of the Provincial Ministry of the Environment before the District will approve them.

**2. RUNOFF CALCULATIONS**

The drainage system shall be designed on the basis of the Rational Formula:

$Q = A \times I \times R \times K$  where:



- Q = amount of runoff in litres per second
- A = drainage area in hectares
- I = intensity of rainfall expressed in millimetres per hour
- R = runoff coefficient
- K = 2.75 (metric conversion factor)

Times of concentration of local rainfall intensity factors shall be based on 10-year rainfall curves as shown on the drawings. In special cases a return period of 25 years may be required. In certain cases, pipe sizes may already be established as part of an overall drainage system. Such sizes shall be obtained from the District.

The corresponding runoff coefficient shall be used for the appropriate zones.

Description of Area	Runoff Coefficient
Commercial	0.70 to 0.90
Industrial	0.50 to 0.90
Residential	
R1	0.30 to 0.50
R2	0.40 to 0.60
R3	0.60 to 0.75
Parks - Cemeteries	0.10 to 0.25
Agricultural	0.10 to 0.25

For flat slopes or permeable soil the lower value may be used. For steep slopes or impermeable soil the higher values shall be used.

### 3. STORM SEWERS

#### a) Hydraulics

Manning Formula with a roughness coefficient of 0.013 shall be used for storm sewer design. Minimum diameter shall be 250 mm for mains and 200 mm for catch basin leads.

Minimum velocity shall 0.9 metres per second.

Where velocities exceed 4.5 metres per second special provisions shall be made for scouring.

Anchoring shall be provided where grades exceed 15 percent.

Inlet and outlet pipes in manholes shall be installed with crowns at equal elevations except where outlet diameter is reduced then inverts shall be equal.

Hydraulic losses are to be calculated through manholes with significant change in grade or alignment.

Pipe on curved alignment shall be laid to a radius of not less than the minimum radius recommended by the manufacturer.

Lateral sewers of a diameter greater than 375 mm shall be connected to the trunk sewer by a wye fitting located immediately upstream from a manhole.

**b) Manholes**

Manholes shall be located at every change of grade alignment, size and at terminal points. Maximum distance between manholes shall be 120 metres.

Drop manholes should be used only when it is not economically feasible to steepen the incoming sewer.

**c) Service Connections**

Service connections shall be provided for all lots or parcels and ends shall be capped. Minimum grades for service connections shall be 2 percent.

**d) Minimum Cover**

The minimum cover over the pipes shall be 2.7 metres unless otherwise approved by the District.

**e) Culverts**

Culverts shall be designed so that the depth of headwater at the inlet does not exceed the diameter of the culvert pipe.

**f) Outlets**

Where the velocity at outlets of storm sewers or culverts exceeds 2 metres per second, provision shall be made of dissipation of energy.

**MATERIALS**

**I. PIPE AND FITTINGS**

Sewer pipe and fittings employed on mains shall be PVC or concrete pipe as described below.

PVC pipe shall be in accordance with ASTM D3034, SDR 35 for 200 mm diameter or greater.

Non-reinforced concrete pipe shall be in accordance with ASTM C14, Class 3 and reinforced concrete pipe shall conform to ASTM C76, Class 3.

Pipe shall, in addition to the above, be specified to meet the actual installed loading conditions. Concrete pipe larger than 450 mm diameter shall be reinforced.

100 mm and 150 mm diameter service connection pipe shall be PVC, SDR 28 to CSA B182.1. Storm sewer service connection pipe shall be white in color.

## 2. BEDDING GRAVEL

The bedding material shall be clean well graded or crushed gravel, evenly graded from coarse to fine, with a maximum size of 25 mm and 90 percent retained on a 0.075 mm screen. If the trench conditions are dry and otherwise suitable, sand bedding may be used subject to prior written approval of the District.

## 3. MANHOLES

Manholes shall conform to the typical details shown on the drawings. Manholes shall, unless otherwise specified, be of preformed 1050 mm inside diameter reinforced concrete, conforming to ASTM C478, complete with 19 mm galvanized steps at 300 mm centres. Concrete lids shall be designed to withstand H-20 highway loading conditions. Precast concrete eccentric cones may be used as top manhole sections.

Base shall be 25 MPa concrete with minimum thickness of 150 mm. Brickwork shall be one to three courses of bricks used to support the cast iron frame and cover. Manhole frames and covers shall be of cast iron, conforming to ASTM 448, as manufactured by Mainland Foundry to Pattern 3R-13 and 12A. Bearing surfaces between the frame and cover shall be machined. The clear opening in frames shall be not less than 500 mm. Covers shall have embossed, in letter 50 mm high by 6 mm deep, the words "STORM SEWER". The surface of the lettering shall be flush with the remainder of the pattern embossed on the lids. Two lifting holes 22 mm in diameter shall be cored in each cover.

## 4. CATCH BASINS

Catch basins shall be of precast concrete, 600 mm diameter. The minimum wall thickness shall be 75 mm and the precast lid shall be suitable for an H-20 highway loading with an opening to suit the frame and cover.

Precast spaces for use between the precast package basins and the bottom of extruded curb and cast iron frame shall be precast, 50 mm thick.

Catch basin frames and covers shall be cast iron as manufactured by Dobney Foundry, Type D. Covers shall be No. B-23 and frames shall be No. B-24.

## 5. CONCRETE

Concrete work shall conform to CAN3-A23.1, except as modified herein.

Concrete shall develop a minimum compressive strength of 25 MPa at 28 days. Slump shall not exceed 75 mm.

## WORKMANSHIP

### I. CLEARING AND GRUBBING

All sewer and/or water piping alignments shall be cleared and grubbed to a sufficient width to allow for proper installation of the system components. Where alignments traverse virgin areas, care shall be taken to ensure that the cleared strip is only wide enough to permit proper excavation and temporary storage of excavated material. All necessary precautions shall be taken to preserve the indigenous aesthetic values of the location. Waste material shall be disposed of in a manner approved by the District.

All trees and brush, except those selected for preservation, shall be cut, and along with all stumps, logs, roots, rotten wood, and other organic materials shall be disposed of by burning or other approved means.

Topsoil shall be stockpiled as directed by the District.

The above material shall be removed from the ground surface and to a minimum depth of 300 mm below ground surface.

All other rubbish and debris existing on the site shall be removed and disposed of by burning or other approved means.

Trees shall be felled within the designated clearing area and those falling outside this area shall be cut up and returned to the clearing area for disposal.

On instruction from the District, individual leaning or dangerous trees or snags adjacent to but outside the designated clearing area shall be cut and disposed of.

Excavations resulting from removal of tree trunks, roots, or other material shall be filled by the Developer as a part of the clearing and grubbing operation.

### 2. BURNING

Burning shall be carried out at points located centrally in the area being cleared. The fire or fires burning at any one time shall be limited by the ability of the Developer's equipment and organization to provide adequate protection against spreading of fires to adjacent timber or property.

Burning shall be carried out subject to the provisions of the Provincial Acts and regulations thereto. In the event of Forestry regulations prohibiting burning, materials to be burned may either be piled until such time as the regulations are rescinded, or removed from the site.

Restrictions of federal, provincial, municipal, or other recognized authorities established to control burning in the area shall be complied with. If burning cannot be done on the clearing site, the material shall be hauled to an approved

location for burning or disposal. Burning sites, as required, shall be obtained by the Developer.

### 3. TRENCH EXCAVATION AND BACKFILL

#### a) Trenching and Backfilling Equipment

Mechanical trenching and backfilling equipment may be used except where by so doing damage to trees, buildings, sidewalks, curbs, piping, or other existing structures of manmade obstacles above or below ground cannot be avoided. Trenches shall be hand excavated and backfilled where such obstacles prevent the use of mechanical equipment.

#### b) Caution in Excavation

Trenches shall be excavated only as far in advance of the pipe laying operation as safety, traffic, and weather conditions permit. Caution shall be exercised with respect to structures, piping, or other manmade obstacles that may exist within the working area and due consideration given to the protection and support of such properties and structures.

#### c) Precutting Paved Surfaces

When trenching along or across a paved surface, pavement shall first be cut by hand or mechanical means in straight lines parallel to the trench centreline. The total cut width of pavement shall not be greater than that which is necessary of trench excavation under existing soil conditions and shall not, in any case, exceed the specified maximum trench width at the ground surface shown on the drawings. Where, in the opinion of the District, existing pavement is in such poor condition that precutting is not warranted, pavement may be cut by trenching equipment. Pavement that has been removed to permit trenching shall be disposed of as waste material and shall not be placed in the trench backfill.

#### d) Excavated Trench Material

Excavated trench material may be piled alongside the trench provided the working space is adequate for this purpose and provided that by so doing the backfill material does not spill onto private properties adjacent to line of trench there disturbing fences, buildings, shrubs, lawns or other items of value.

Piling of excavated material along the trench shall not unduly restrict cross traffic at road intersections. Material shall be cleared from road intersections and provision made for use of the cross road by traffic as soon as possible after excavation has taken place. Pedestrian traffic to individual properties shall be maintained at all times and timber bridges shall be provided where it is necessary to cross open trenches. Roadways, driveways, and drainage facilities shall not be blocked unnecessarily. The spoil pile shall be located such that hindrance to local traffic is minimal.

In order that excavated material may be piled along the trench, roads may be temporarily closed off to traffic provided that adequate detour traffic routes can be established to move traffic around the construction area, and provided also that street entrances to driveways are not blocked from vehicular traffic for periods in excess of one day.

Where excavated material cannot be piled along the trench in compliance with the above restrictions, it shall be trucked to locations where backfilling is taking place or trucked to stockpile for return to the trench at the time of backfilling. Alternatively, excavated material shall be wasted and replaced with approved material at time of backfilling.

**e) Trench Widths**

Trenches shall be excavated such that there is no less than 150 mm clearance between the outside of the pipe at its largest section and the trench sheeting or earth wall, and no more than 375 mm clearance between the pipe and the earth wall regardless of the existence of trench support works. The above conditions shall govern from the bottom of the trench to a distance 100 mm above the top of the pipe at its largest section. Trench widths above this level shall be maintained within the allowable limits shown on the approved drawings.

Ledge rock, boulders, and large stones shall be removed to provide a clearance of at least 150 mm below and on all sides of the pipe and fittings.

**f) Bracing and Sheeting**

Trenches shall be sheeted and braced in accordance with the requirements of the Workers' Compensation Board or as may be necessary to protect life, property, and structures adjacent to the work, the work itself, or to maintain trench widths within the specified limits. Trench sheeting and bracing shall be located no closer than 150 mm to the widest section of any installed pipe.

Whenever possible, vertical trench timber or sheeting shall be placed so that it does not extend below the springline of the pipe being installed. When it is necessary to place sheeting or timber below the pipe springline, as in the case of overexcavation for trench bottom stabilization, sheeting shall be raised in 600 mm lifts and all backfill placed below the level of the pipe springline shall be thoroughly compacted on each lift to fill the void left by the raising sheeting.

Trench sheeting and bracing shall be removed where its removal will not result in damage to adjacent structures, otherwise it shall be left in place. When sheeting and bracing is left in place, it shall be cut so that no sheeting remains closer than 900 mm to existing ground surface.

Where sheeting or timber is removed from a trench in which backfill is to be compacted, it shall be removed in a manner which permits compaction of the backfill in the manner specified.

g) Dewatering

Ground and surface water shall be controlled to the extent that excavation and pipe installation can proceed in the specified manner and such that trench bottom is not disturbed to the detriment of the pipe installation. Trench water shall not be permitted to enter the pipe being installed unless approval is received from the District.

The necessary pumps, well points, or other equipment shall be employed to keep excavations free of water. Caution shall be exercised to make sure that foundation problems with existing structures and works under construction do not result from the selected method of dewatering excavations. Discharge from pumps, well points, or other dewatering equipment shall be located and controlled such that loss, damage, nuisance, or injury to the public does not result.

h) Trench Bottom Conditions

Trench shall be maintained such that pipe can be installed without getting water, muck, silt, gravel, or other foreign material into the pipe. Material remaining in the trench bottom on completion of machine excavating which has been disturbed or softened by workmen or trench water shall be removed before bedding material is placed. The trench bottom shall be firm and capable of supporting the pipe to be installed, otherwise the bottom shall be stabilized by means of overexcavation or special foundation designed to support the pipe as hereinafter described.

When the material in the trench bottom is found to be unstable or otherwise unsuitable for pipe support or the support of appurtenant structures, the trench shall be overexcavated to the level at which stable material is encountered and the excavation backfilled to the level of normal bedding with base gravel material. This material shall be compacted with approved mechanical compactors in lifts having a maximum depth of 300 mm to provide a thoroughly consolidated pipe base. Bedding material, as specified for normal pipe bedding, may be employed for this purpose to a maximum depth of 300 mm below the normal depth of bedding.

i) Backfill Within Pipe Zone

The pipe zone is defined as that portion of the trench between the bottom level of the pipe bedding and a level 300 mm above the top of the installed pipe. Bedding of the pipe and backfill of the trench within the pipe zone shall be carried out as specified in MATERIALS, Section 2, "Bedding Gravel" and WORKMANSHIP, Section 4, "Storm Sewer Piping", Subsection a), "Bedding".

j) Concrete Fill

Concrete shall be used for pipe base, encasement, or backfill as directed by the District. Concrete shall have adequate time to set before backfill material is placed.

## **k) Placing Backfill**

In order that consolidation of backfill is not hampered, trench water, if present, shall be removed prior to commencement of backfilling. To prevent damage to the installed pipe, backfill shall be placed in the trench by rolling down a slope and not by pushing it over the edge of the trench and allowing it to drop vertically. Every effort shall be made to plan the backfilling operation such that exposure of backfill material to wet weather is kept to a minimum. The trench shall be backfilled as close to the pipe laying operation as conditions permit and trench excavations shall not be left open overnight without the written permission of the District.

## **l) Backfill Above Pipe Zone**

Materials and methods employed in backfilling trenches above the pipe zone shall depend on the location of the trench with respect to travelled and untravelled surfaces, and in particular on the type of material existing on the surface in which the trench is excavated.

Travelled surfaces are gravelled, or paved, roadways, lanes, driveways, parking areas, road shoulders, walkways, or other gravelled, or paved, surfaces which vehicular or pedestrian traffic normally travel.

Subject to provisions contained elsewhere herein, backfill above the pipe zone and surface restoration of trenches shall be carried out in accordance with the following paragraphs:

### **1. Untravelled Surfaces**

In untravelled surfaces, unless otherwise specified, trench backfill above the pipe zone shall be native backfill material. Backfill may initially be built up to a height above original ground level equal to 10 percent of the trench depth and allowed to settle. Prior to acceptance, however, the trench surface shall be restored to its original level and to a condition which at least is equivalent to that which existed prior to construction unless the approval of the District is given to leaving the trench surfaces in a bermed condition.

### **2. Gravel Travelled Surfaces**

In travelled surfaces which exist as gravel surfaces, trench backfill above the pipe zone to a level 850 mm below the original trench surface shall, unless otherwise specified, be native backfill material. The top 850 mm of backfill shall comprise a 750 mm layer of subbase material surfaced with a 100 mm layer of base course material.

### **3. Paved Travelled Surfaces**

When trenches have been excavated in existing paved surfaces which are to be repaved, trench backfill shall be mechanically compacted native backfill material to a level 915 mm below finished surface grade. The remainder of the trench shall be backfilled with 750 mm of compacted subbase material, 100 mm of base course material and finished with a minimum thickness of 65 mm of compacted hot asphalt mix.



If the edges of the cut pavement have become ragged as a result of the construction operation, pavement shall be recut to form a straight line and the base compacted prior to placing new pavement. The edges of the existing pavement shall be thoroughly cleaned and coated with an approved bituminous bonding agent prior to placing the hot asphalt mix. The asphalt shall be thoroughly compacted using an approved steel wheeled roller having a minimum weight of 7.3 tonnes or a vibratory compactor. The finished grade of the asphalt surface shall conform with that of the existing surface such that no rises, depressions, or ridges result from the repaving process.

**m) Imported Backfill Material**

Where excavated trench material is not suitable for backfill, it shall be hauled out and disposed of and imported backfill material shall be provided and placed.

**n) Compaction of Backfill**

Subject to the provision contained elsewhere herein, compaction of backfill above the pipe zone shall be obtained by using approved, mechanical, power-driven compactors. Compaction shall be carried out with the soil at optimum moisture content such that compaction to 90 percent of Standard Proctor Density (ASTM D698) is obtained. Backfill shall be compacted in lifts of not greater than 300 mm uncompacted depth.

**o) Road Shoulder Gravel**

Trenches in road shoulders adjacent to paved surfaces shall be resurfaced with shoulder gravel placed to a minimum depth, equivalent to the thickness of the adjacent pavement.

**p) Disposal of Waste Excavated Material**

Surplus excavated material shall be removed from the trench area at the time of backfilling and shall not be left along the trench following completion of the backfilling operation.

Waste material which is not required for the works, shall be disposed of at sites obtained by the Developer. Waste material shall not be dumped on private property without the written permission of the owner of the property.

**q) Restoration**

Surfaces adjacent to the trench or otherwise which have been disturbed by the trenching or backfilling operation shall be restored to a condition which is at least the equivalent of that which existed prior to construction and shall be maintained in this condition until the project has been accepted by the District of Mackenzie. All surplus material, equipment, tools, coverings, lumber, and all other rubbish resulting from the construction shall be removed from the site immediately after completion.

Working areas are those areas which are affected by the construction operation but which lie outside the specified limits of trench excavation. Working areas shall be restored in the following manner:

1. Travelled Surfaces

Working areas in untravelled surfaces shall be restored to their original condition.

2. Gravelled Surfaces

Working areas in gravelled surfaces shall be restored by scarifying and regarding the surface or, if necessary, by regravelling the surface with material which is equivalent to that which existed prior to commencement of construction.

**r) Trench Settlement During Guarantee Period**

The Developer shall replace materials and rectify all failures that occur as a result of settlement of trench backfill or collapse of trench walls during the guarantee period.

Trenches in which backfill settles shall be refilled with the specified backfill material, and paved surfaces that are adjacent to trenches or on trench backfill, which fail during this period, shall be replaced or repaired in an approved manner.

**4. STORM SEWER PIPING**

**a) Bedding**

Prior to installing pipe, a cushion of bedding material shall be placed in the trench bottom and compacted to grade by approved hand tampers or mechanical means to form a firm pipe base. This cushion shall cover the full width of the trench bottom and have a minimum depth of 100 mm on completion of compaction. In rock excavation, the minimum depth of bedding below the pipe shall be 150 mm. Bell or coupling holes shall be dug such that the full barrel of the pipe is supported throughout its length by the bedding material. After the pipe is in position, bedding material shall be placed around the pipe to the limits shown on the drawings. This material shall be compacted in lifts, each having a maximum compacted depth of 150 mm.

**b) Pipe Alignment and Grade**

The pipe shall be laid on line and grade. Batter boards or sight rails shall be erected across the trench at intervals not exceeding 15 metres. The centreline of the pipe shall be marked on these boards and a string line stretched between them. Alignment of the pipe shall be maintained by plumbing down from this line. The pipe shall be kept on grade by sighting across the batter boards to a boning rod resting on the invert of the pipe. Each pipe shall be plumbed and sighted for line and grade as it is installed.

Construction tolerances for sewer pipes shall be  $\pm 6$  mm in elevation and 1/10 of pipe diameter but not exceeding 50 mm in alignment.

c) **Pipe Installation**

Pipe shall be checked before being lowered into the trench to ensure that no foreign material, manufacturer's defects, or cracks exist that might prevent the proper jointing of the pipe or its operation as a sewer. Pipe and fittings shall be carefully lowered into the trench by means of derricks, ropes, or other approved tools or equipment in a manner that will prevent damage to the pipe and injury of workmen.

Pipe shall be jointed in strict accordance with the manufacturer's recommended practice. Sufficient pressure shall be applied in making the joint to assure that the distance between the end of the pipe installed and the pipe in place is within the tolerance recommended by the pipe manufacturer. Once the joint is home, restraint shall be applied to the pipe by tamping of backfill or placement of temporary blocking to assure that the pipe does not creep and dislodge the joint. At the end of the days work, or if the work is shut down for an extended period throughout the day, the last pipe shall be blocked to prevent entry of foreign material.

d) **Service Connection Junctions**

Fitting shall be provided with approved caps or plugs.

e) **Connections to Existing Sewers**

Caution shall be exercised in uncovering existing pipe to ensure that no damage occurs. Connections to the existing system shall not be made until all sewers have been tested and flushed to the satisfaction of the District. If requested by the District, plugs shall be installed until road construction is completed to prevent the eroding of material into the downstream system.

f) **Cleaning and Flushing**

On completion, sewer pipe shall be cleaned by flushing or the use of mechanical equipment as necessary to remove foreign material from the pipe.

5. **SEWER SERVICE CONNECTIONS**

a) **Grade**

Service connections shall be installed at a grade of not less than 20 mm per metre. Service pipe shall be installed at a uniform grade between the terminus at the property line and the junction fitting (or upper end of a service drop) at the sewer.

**b) Pipe Installation**

Pipe shall be checked before being lowered into the trench to ensure that no foreign material, manufacturer's defects, or cracks exist that might prevent the proper jointing of the pipe or its operation. Pipe and fittings shall be carefully lowered into the trench in a manner that will prevent damage to the pipe and injury of workmen.

Pipe shall be jointed in strict accordance with the manufacturer's recommended practice. Sufficient pressure shall be applied in making the joint to assure that the distance between the end of the pipe installed and the pipe in place is within the tolerances recommended by the pipe manufacturer.

**c) Capping Services**

Caps shall be installed on storm sewer services at the terminus of each service or as approved by the District.

**d) Marking Service Terminus**

A 38 mm x 89 mm marker stake shall be placed at the service terminus as shown on the standard drawing to facilitate future location of the service pipe. This stake shall extend from a point approximately 150 mm above ground to the invert of the service pipe except in locations where the extension of the stake above ground surface would prove hazardous, in which case the stake shall be cut off flush with ground surface. The stake shall be marked in an approved manner to show the depth of the service pipe invert below the top of the stake and shall be painted green.

**6. SEWER MANHOLES**

**a) Concrete Bases**

All water shall be removed from the excavations prior to placing base concrete. The base shall be constructed such that the first section of a precast section can be set plumb with uniform bearing throughout its full circumference.

If material in the bottom of the trench is unsuitable for support, the bottom shall be overexcavated for firm base and backfilled to the required grade with thoroughly compacted base gravel.

**b) Precast Sections**

Precast sections shall be placed plumb with joints mortared to exclude any entrance of ground water.

**c) Frames and Covers**

Frames shall be set on a concrete brick base as shown on the drawings. Brick shall be mortared in an approved manner and the inside and outside face of the brick shall be "battered" with mortar such that a neat, even finish results.

Frames shall be firmly embedded in mortar and shall be set to provide a cover surface which is even with and true to the contour of the road.

**d) Manhole Steps**

Manhole steps shall be placed as shown on the approved drawings.

**e) Manhole Channelling**

Manhole channelling shall be constructed as shown on the drawings. Wherever possible, channelling shall be formed using half sections of pipe or fittings. When pipe is set in the manhole base, the base shall be placed immediately following installation of the main sewer pipe to prevent settlement of the pipe. Particular care shall be taken when constructing manhole bases to ensure that the invert levels of pipe entering and leaving the manhole are set at the proper elevations. Invert levels of pipe at the manhole shall be checked by the Developer prior to and following placement of base concrete around the pipe. This shall be done by means of batter board, sight rail, or level instrument. Variation in manhole inverts from established grade or elevation shall be corrected. Construction tolerances shall be no more than 50 mm horizontal alignments.

**f) Drop Structures**

Manhole drop structures shall be constructed as shown on the approved drawings, where vertical drop in to the manhole exceeds 450 mm.

**g) Stubs**

Blind stub sections for connection of future sewers and service connections to the manholes shall be installed where shown on the drawings. The stub shall consist of one short length of the specified size of pipe installed in the manhole and plugged with a removable, watertight plug as shown on the drawings. Where stubs are installed, the bottom of the manhole shall be channelled to the stub entrance.

**h) Ground Water Infiltration**

Manholes shall not be required to be watertight.

**7. CATCH BASINS**

**a) Excavation**

The excavation for catch basins shall be made sufficiently large to permit the placing of the precast basin sections. The bottom of the excavation shall be cleared of all loose and soft material before placing the precast sections.

**b) Connections**

Catchbasin leads shall be connected directly to manholes. Connection of leads to storm sewers is not permitted. Catchbasin leads shall conform to the specifications for storm sewers.

c) Frames and Grates

Frames and grates shall be located as approved by the District.

8. CONCRETE

a) Concrete Installation

Mixing, placing and compacting shall be carried out in such a manner as to produce a good quality, homogeneous concrete conforming to the dimension shown on the drawings. Continuous moist curing shall be utilized for 7 days after placing.

b) Reinforcement

Reinforcement shall be free of any bond reducing coating. It shall be securely tied and placed with a minimum cover of 35 mm, except that, when concrete is placed against the ground, the cover shall be 75 mm.

c) Joints

The surface of the joint shall be thoroughly cleaned, with all laitance removed, and the surface thoroughly saturated with water before placement of new concrete.

d) Finish

Surfaces shall be screeded and shall be given a wood float finish unless otherwise noted on the approved drawings.

9. TESTING

a) Lamping and Inspection

The Developer shall provide all materials, equipment, labour, and supervision necessary, and shall carry out test on the sewers in accordance with the specifications in the presence of the District.

Gravity sewers, other than service connections, shall be lamped from manhole-to-manhole to check alignment and grade of the main sewer pipe. Lamping shall be carried out by employing lights or mirrors, or if necessary, pulling an approved light through the sewer pipe from manhole-to-manhole. Variation in line or grade of pipe and any jointing, pipe cleaning, or other deficiencies discovered during the inspection shall be rectified. During this test, manhole construction and invert elevations shall be checked, and any variations shall be rectified.

b) Leakage Testing

No leakage testing shall be required for storm sewers.

10. CLEAN-UP

The working area shall be maintained in an orderly manner and shall not be encumbered with equipment, materials or debris.

Clean-up shall be a continuing process from the start of the work to final acceptance of the project. The Developer shall at all times, and without further order, keep property on which work is in progress free from accumulations of waste materials or rubbish caused by employees or by the work. Accumulations of waste materials which might constitute a fire hazard will not be permitted. Spillage from the Developer's hauling vehicles on travelled public or private roads shall be promptly cleaned up. On completion of construction the Developer shall remove all temporary structures, rubbish and waste materials resulting from his operations.

11. STANDARD DRAWINGS

The following standard drawings form part of Schedule "F":

- F-100 Service Connection Record Card
- F-101 Typical Section Urban Local Undivided Street
- F-102 Typical Section Urban Collector Undivided Street
- F-103 Location of Service Connections
- F-104 Typical Trench Section for Underground Utility Installation
- F-105 Typical Residential Sewer Connection
- F-106 Service Connection Location Details
- F-107 Typical Manhole Detail for Sewers 375 mm or Less
- F-108 Manhole Details, Standard Precast Type for Sewers Greater than 375 mm
- F-109 Drop Manhole Type I and Type II
- F-110 Manhole Cover and Frame
- F-111 Catch Basin
- F-112 Sandbag Bulkhead for Culvert Inlets and Outlets
- F-113 Typical Culvert Installations
- F-114 Rainfall Intensity Duration Curve

ADDRESS OF PROPERTY

THE DISTRICT OF MACKENZIE

ROLL NUMBER		LEGAL DESCRIPTION					
I.O.T.	BLK.	D.L.	1/4	SEC.	T.P.	PLAN	

Municipal Services Record

MASTER LEGAL MAP

NOTE: THIS IS A REDUCTION OF A RECORD CARD FOR AS BUILT RECORD PURPOSES FULL SIZED CARDS CAN BE OBTAINED FROM THE APPROVING OFFICER.

	WATER	SANITARY SEWER	STORM SEWER
DATE OF APPLICATION			
PERMIT NUMBER			
INSTALLATION DATE			
SIZE OF SERVICE			
LOCATION AT P.L.			
INVERT AT P.L.			
LENGTH OF CONNECTION			
METER SIZE & TYPE			
DEPTH OF MAIN			
DIST. FROM WYE TO M.H.			
MEASURED FROM M.H. No.			
RISER			
TYPE OF PIPE			

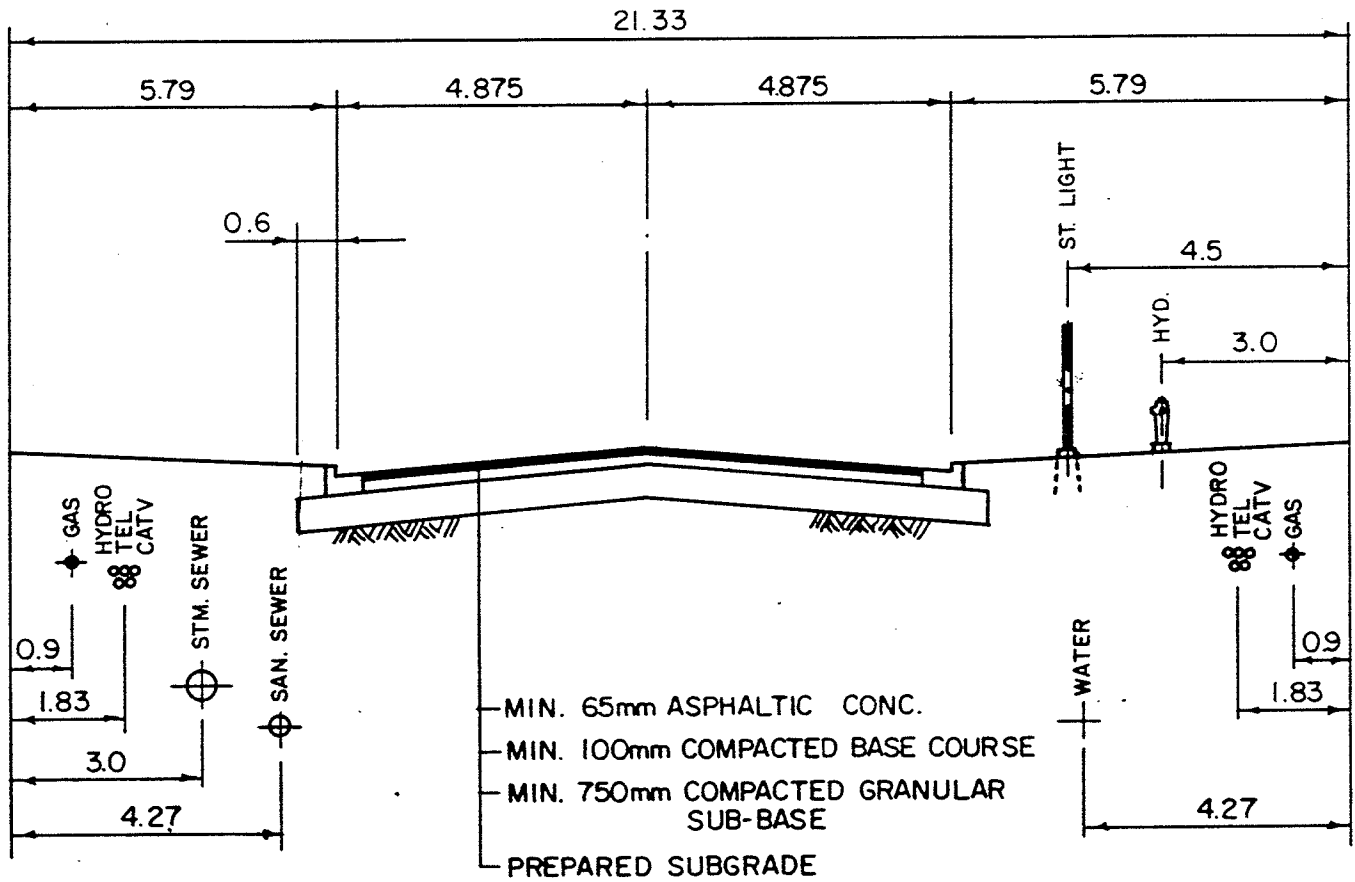
CONNECTION LOCATIONS SKETCH  
 WATER \_\_\_\_ SANITARY \_\_\_\_ STORM .....



CULVERT INSTALLATIONS			
DATE	PERMIT No.	SIZE/TYPE	FOOTAGE

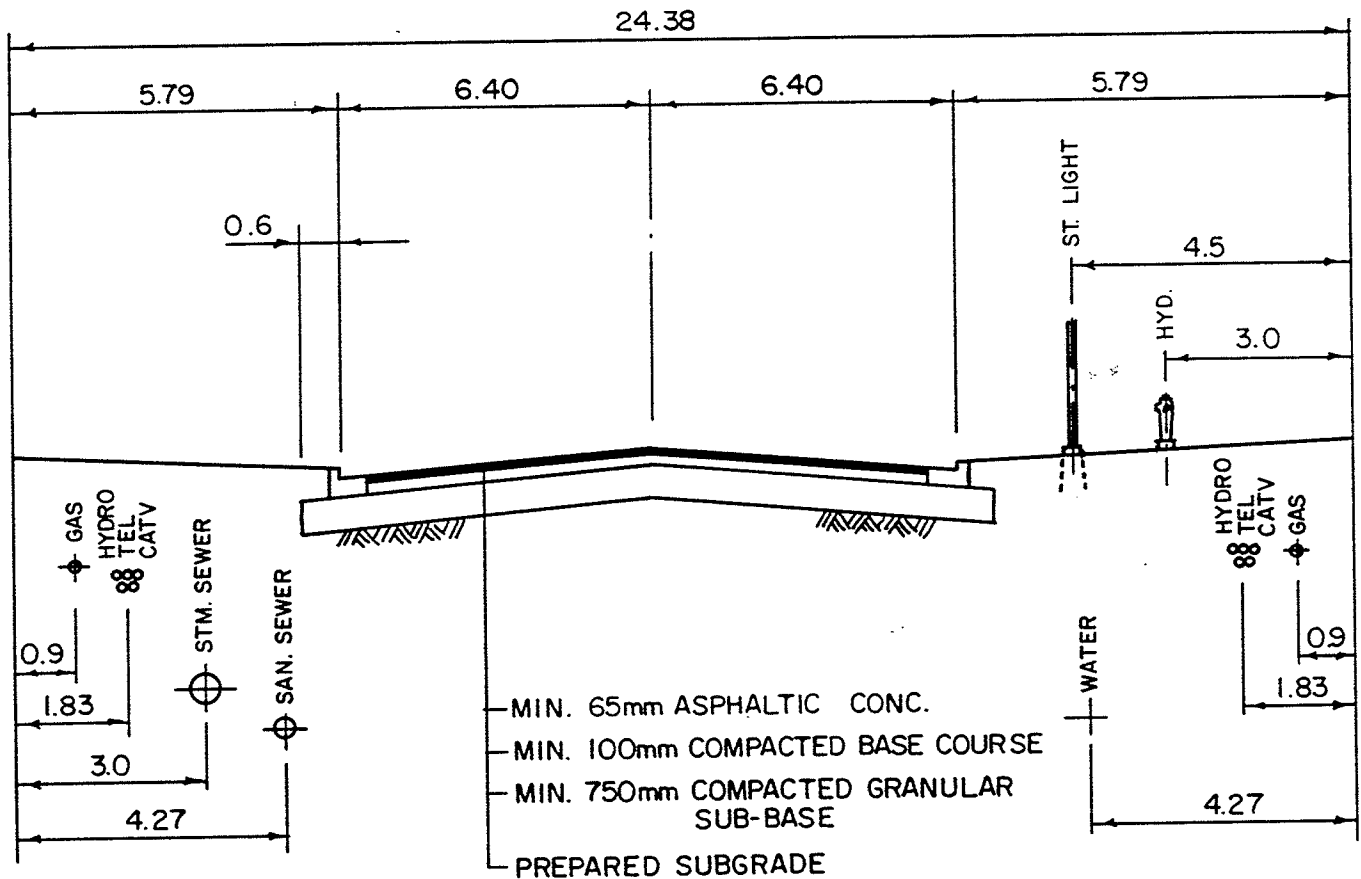
DISTRICT OF MACKENZIE  
 SUBDIVISION STANDARDS  
 ISSUED SEPT., 1980  
 SCALE N.T.S.  
 SERVICE CONNECTION RECORD CARD  
 REVISION  
 STD. DWG. No.  
 F - 100





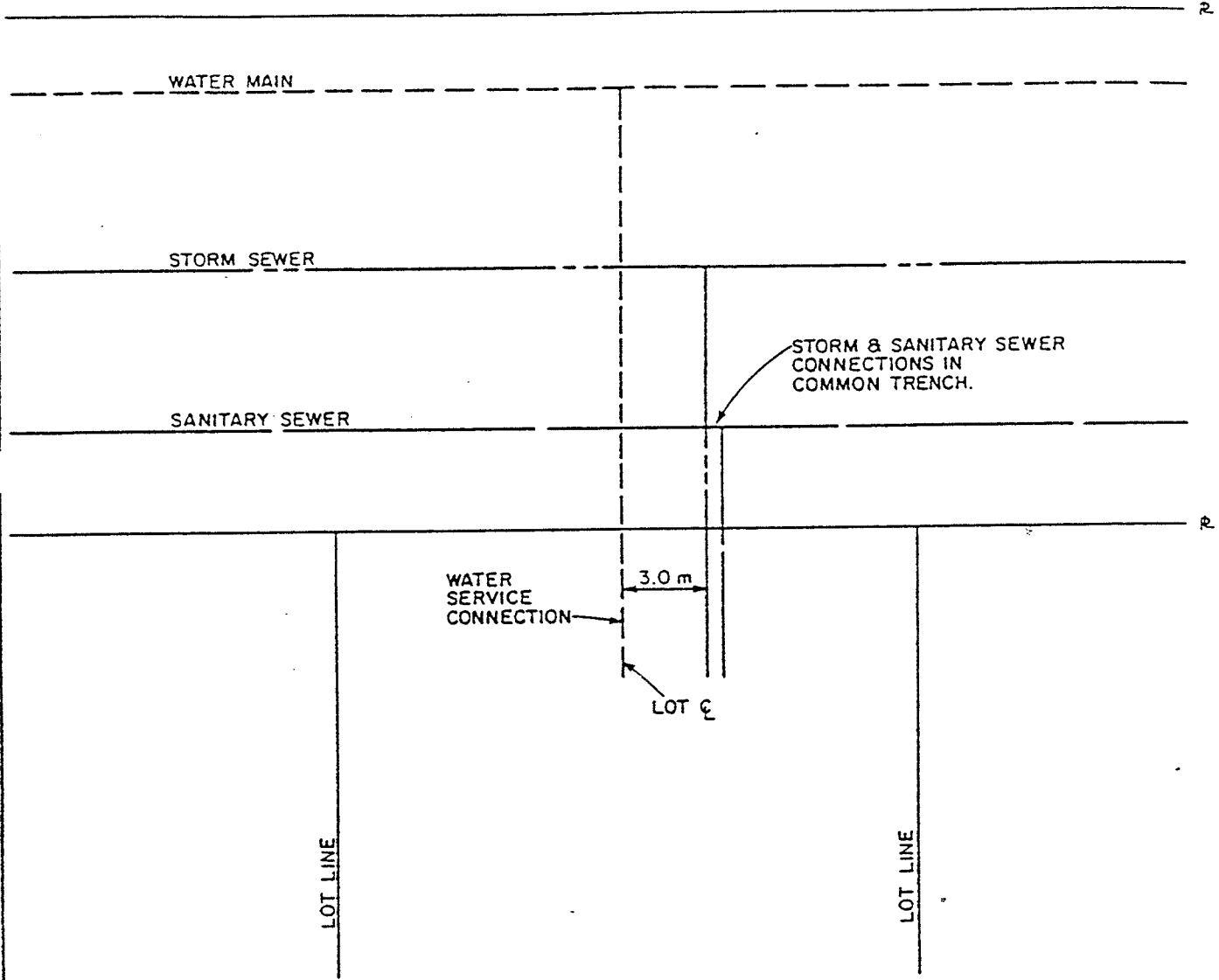
DISTRICT OF MACKENZIE

SUBDIVISION STANDARDS  TYPICAL SECTION URBAN LOCAL UNDIVIDED ROAD	ISSUED	JULY '89	SCALE	N.T.S.
	REVISION		STD. DWG. No.	
	REVISION		F-101	



DISTRICT OF MACKENZIE

SUBDIVISION STANDARDS	ISSUED	JULY '89	SCALE	N.T.S.
	REVISION		STD. DWG. No.	
	REVISION		F - 102	
TYPICAL SECTION				
URBAN COLLECTOR UNDIVIDED ROAD				

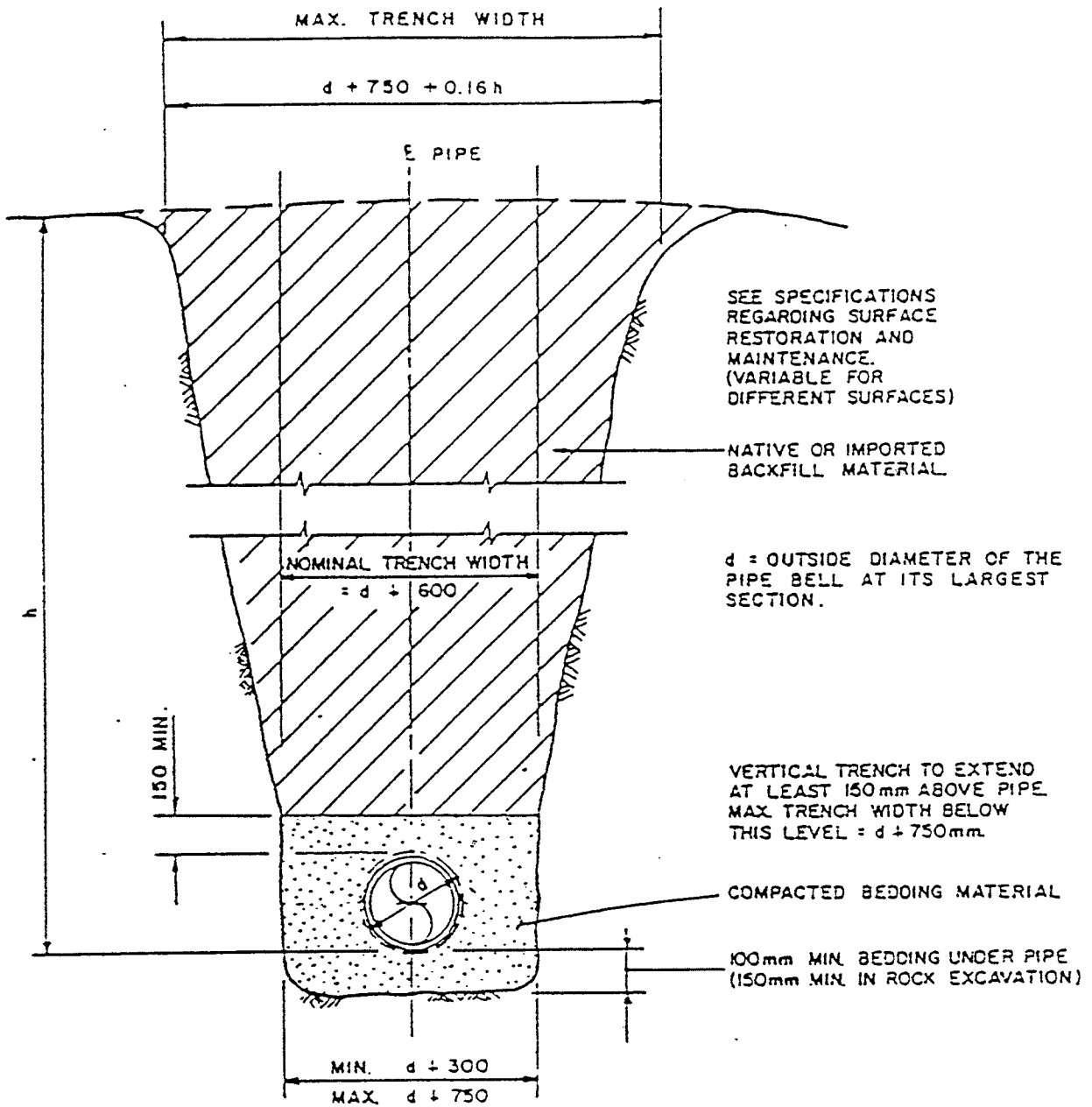


E:

SERVICE CONNECTIONS FOR DRAINAGE AND SEWER SHALL BE MEASURED FROM THE CENTRE OF THE LOT. FOR SLOPED LOTS THE SEWER CONNECTIONS SHALL BE LOCATED ON THE LOWEST SIDE OF CENTRE.

DISTRICT OF MACKENZIE

SUBDIVISION STANDARDS	ISSUED SEPT., 1980	SCALE N.T.S.
LOCATION OF SERVICE CONNECTIONS	REVISION	STD. DWG. No
	REVISION	F-103



DISTRICT OF MACKENZIE

SUBDIVISION STANDARDS

TYPICAL TRENCH SECTION FOR UNDERGROUND UTILITY INSTALLATION

ISSUED SEPT, 1980

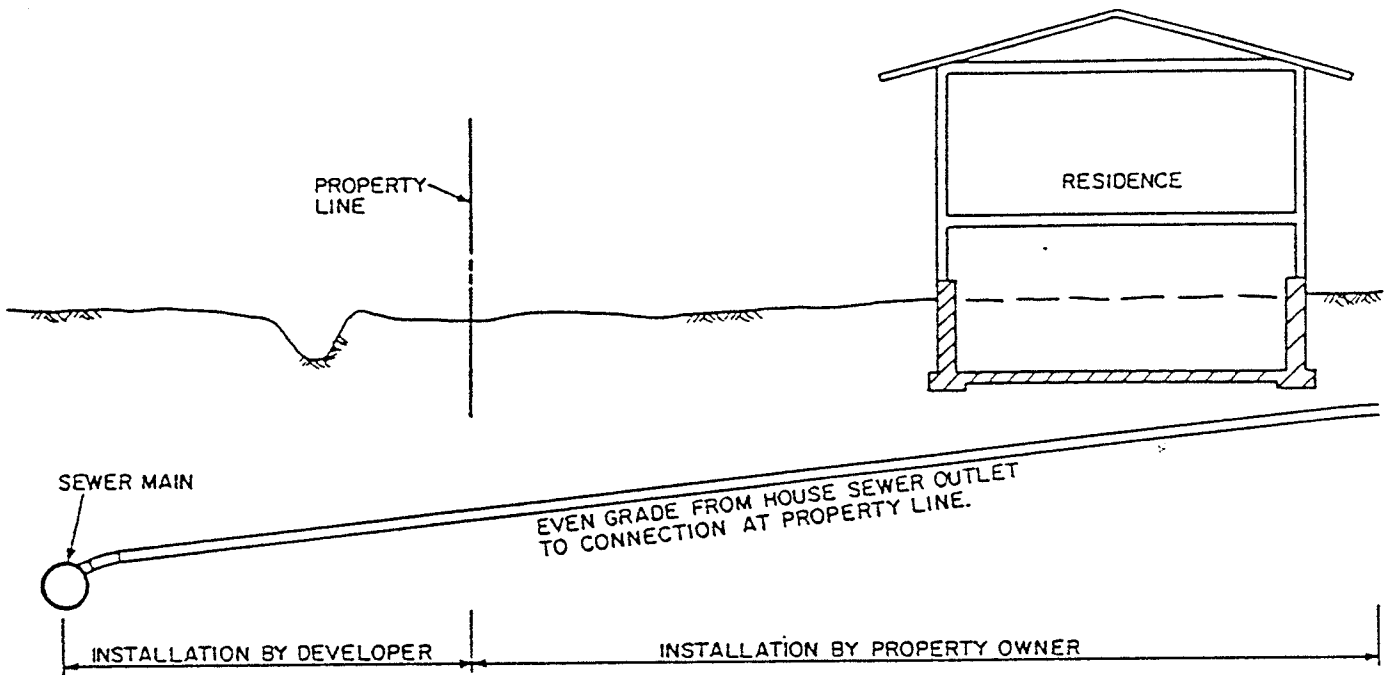
REVISION

REVISION

SCALE N.T.S.

STD. DWG. No.

F-104



NOTES:

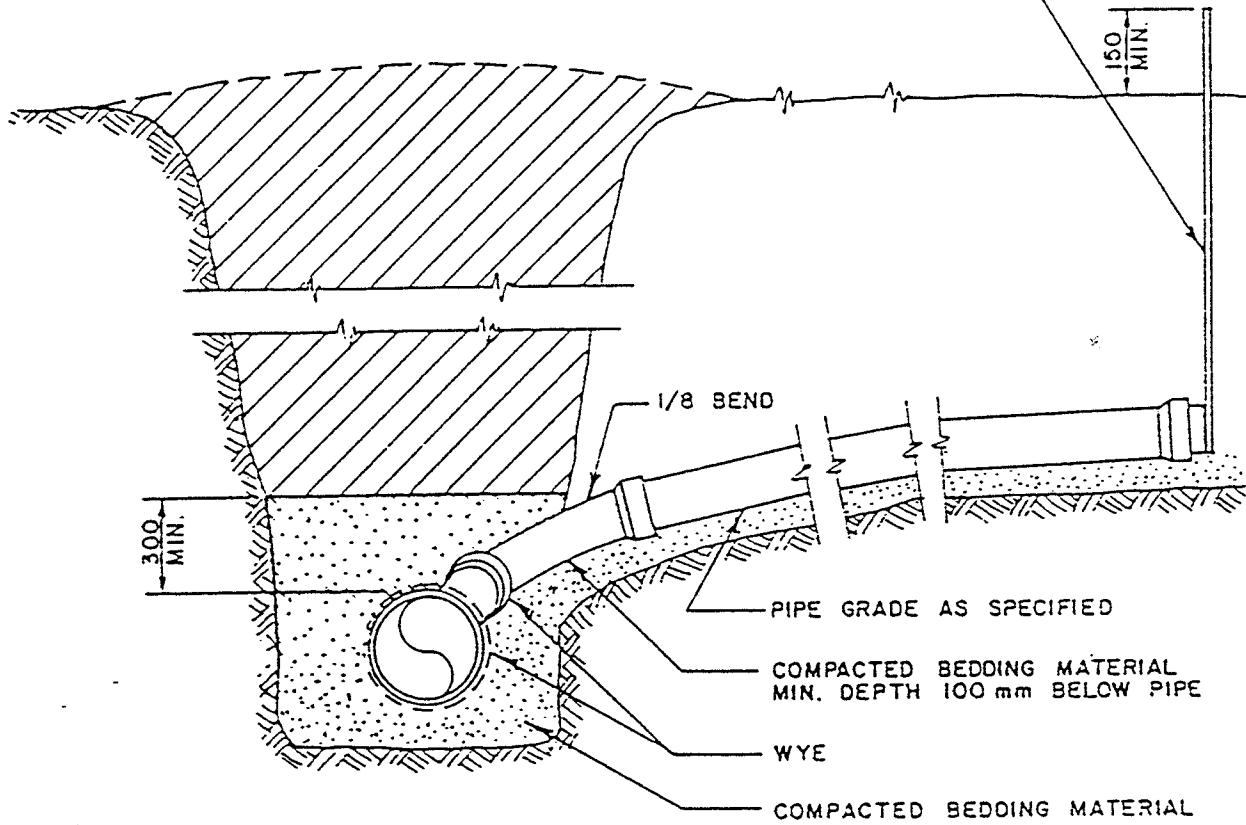
1. THE SECTION FROM THE HOUSE SEWER OUTLET TO THE PROPERTY LINE INCLUDING THE CONNECTION TO THE EXIST. SERVICE LINE IS THE PROPERTY OWNER'S RESPONSIBILITY.
2. MIN. PIPE DIA. IS 100 mm.
3. MIN. PIPE COVER AT PROPERTY LINE IS 2.5 m.
4. SAND BEDDING REQUIRED FOR ALL TYPES OF PIPE FROM 100 mm BELOW THE PIPE TO THE SPRINGLINE.
5. RAINWATER AND FOUNDATION DRAINS ARE NOT TO BE CONNECTED TO THE SANITARY SEWER.
6. MIN. GRADE FOR 100 mm DIA. PIPE IS 1.25% OR 12.5 mm/m.
7. ANY CHANGE IN DIRECTION TO BE MADE WITH WYES OR 1/8 BENDS.

DISTRICT OF MACKENZIE

SUBDIVISION STANDARDS	ISSUED SEPT., 1980	SCALE N.T.S.
TYPICAL RESIDENTIAL SEWER CONNECTION	REVISION	STD. DWG. No.
	REVISION	F - 105

IF THE SERVICE IS IN A LOCATION WHERE THE STAKE MAY BE A HAZARD TO PEDESTRIAN OR VEHICULAR TRAFFIC, IT SHALL BE BROUGHT TO GROUND SURFACE.

38 x 89 mm STAKE PAINTED GREEN, WITH DEPTH FROM TOP OF STAKE TO INVERT OF SERVICE, PAINTED ON TO THE NEAREST 10mm STAKE TO BE LOCATED ON PROPERTY LINE OR EASEMENT LINE.



NOTE:

1. ALL DIMENSIONS ARE GIVEN IN millimetres UNLESS OTHERWISE INDICATED.
2. MINIMUM SERVICE CONNECTION DIAMETER TO BE 100 mm.

DISTRICT OF MACKENZIE

SUBDIVISION STANDARDS

ISSUED SEPT., 1980

SCALE N.T.S.

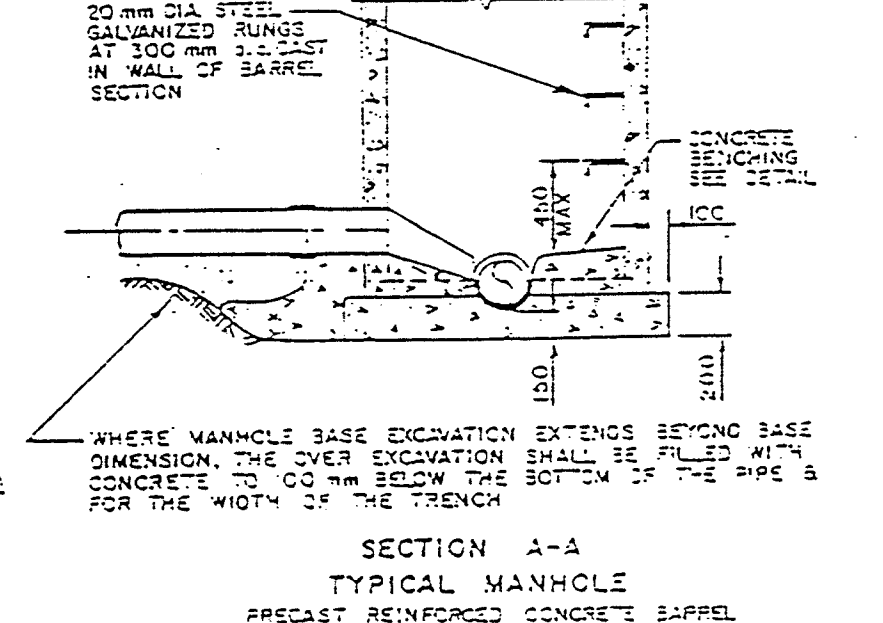
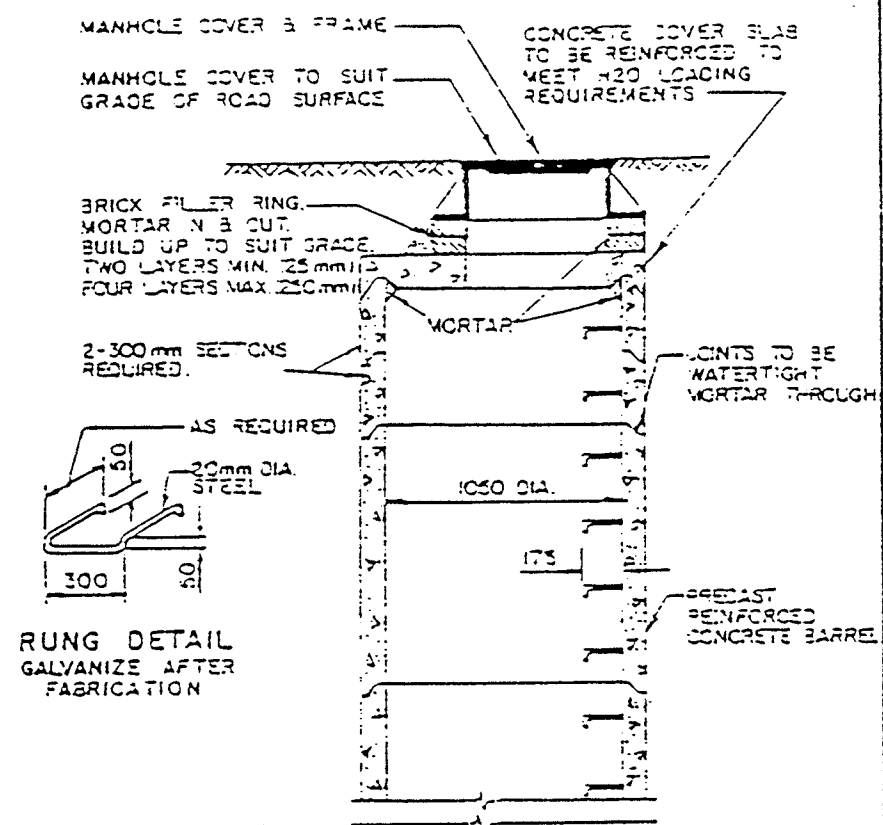
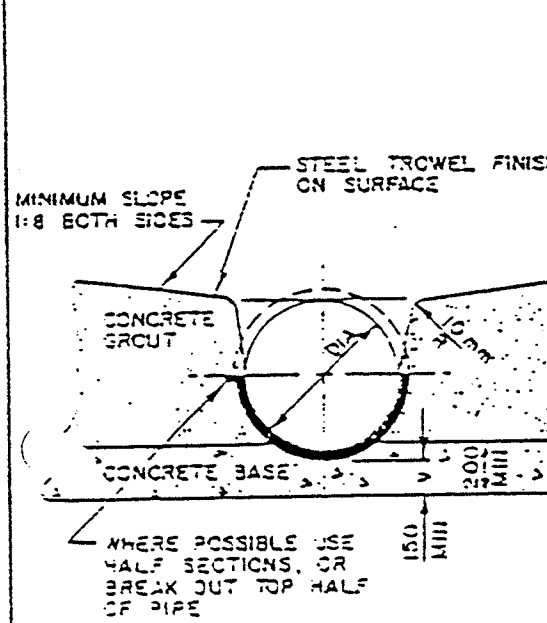
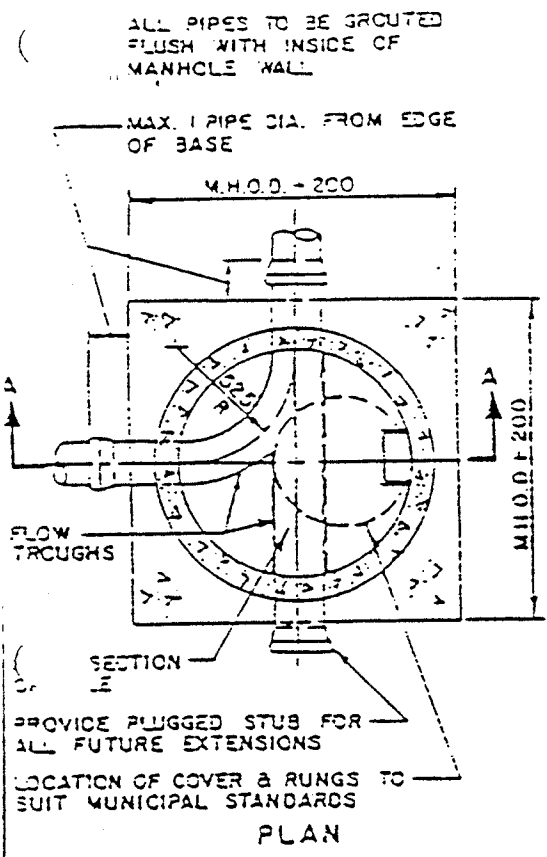
SERVICE CONNECTION  
LOCATION DETAILS

REVISION

STD. DWG. No.

REVISION

F-106



SECTION A-A  
TYPICAL MANHOLE  
PRECAST REINFORCED CONCRETE BARREL

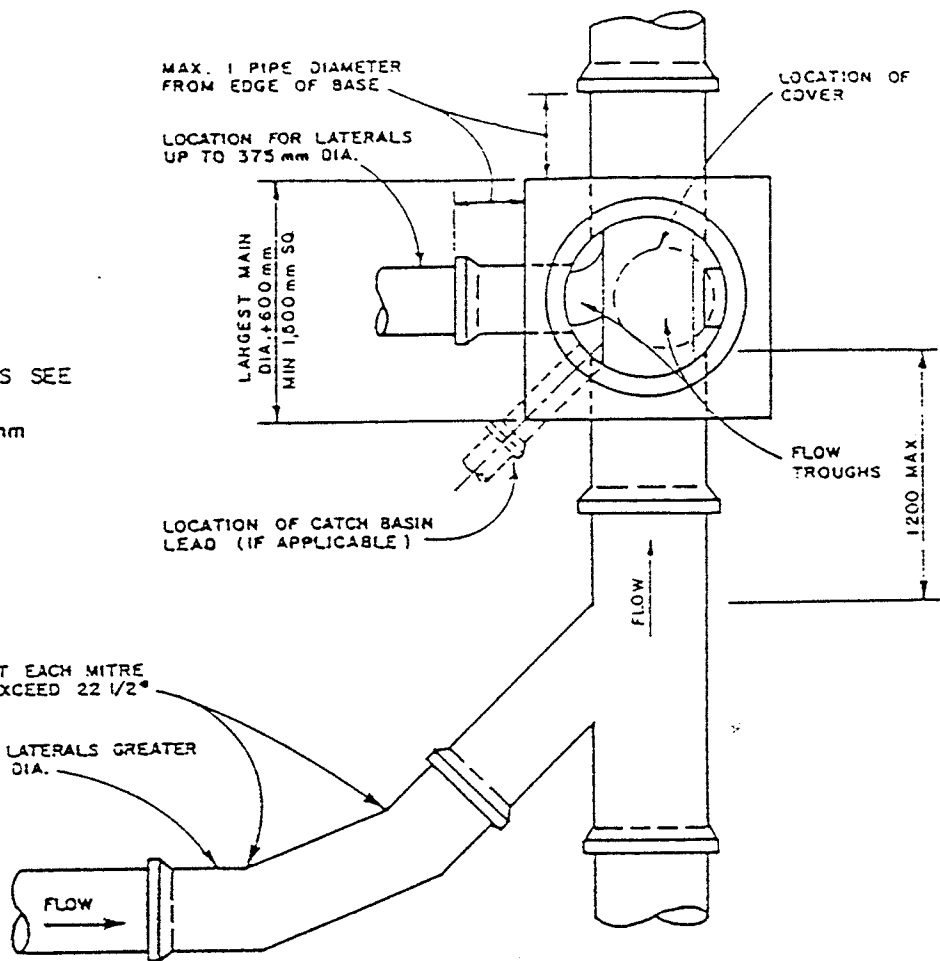
**INVERT CHANNELLING IN MANHOLE**

1. FOR MANHOLE BASE DETAILS ON SEWERS GREATER THAN 375 mm SEE DWG. F-108
2. FOR DETAILS ON DROP TYPE MANHOLES SEE DWG. F-109
3. ALL DIMENSIONS ARE GIVEN IN millimetres UNLESS OTHERWISE INDICATED.

<b>DISTRICT OF MACKENZIE</b>		
SUBDIVISION STANDARDS	ISSUED SEPT., 1980	SCALE N.T.S.
TYPICAL MANHOLE DETAIL FOR SEWERS 375 mm OR LESS	REVISION	STD DWG No.
	REVISION	F-107

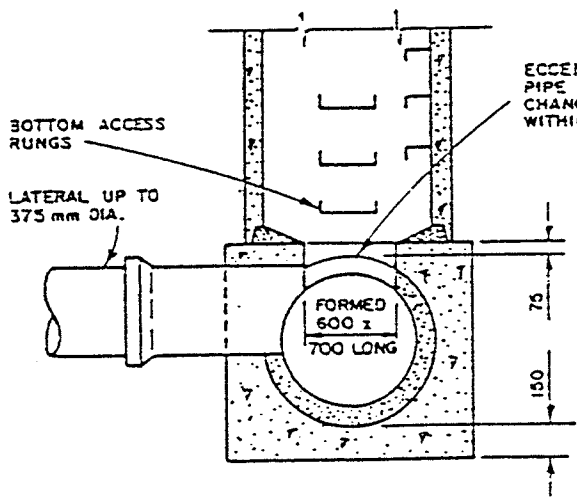
**NOTE**

1. FOR GENERAL MANHOLE DETAILS SEE DWG. F-107.
2. ALL DIMENSIONS ARE GIVEN IN mm UNLESS OTHERWISE INDICATED.

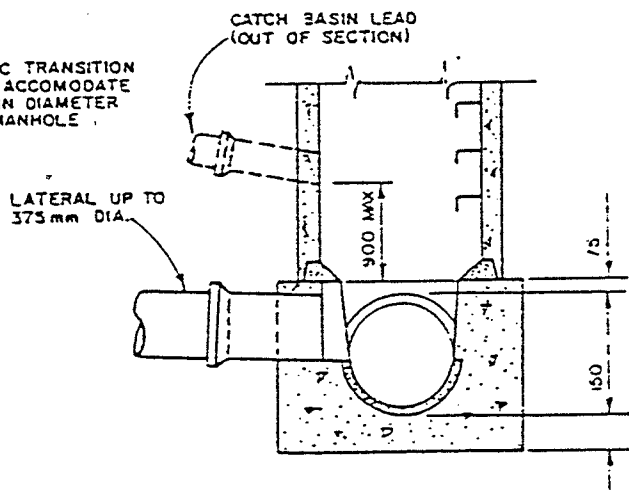


DEFLECTION AT EACH MITRE SHALL NOT EXCEED 22 1/2°

LOCATION FOR LATERALS GREATER THAN 375 mm DIA.



BASE SECTION THRU MANHOLES FOR PIPE GREATER THAN 600 mm DIA.

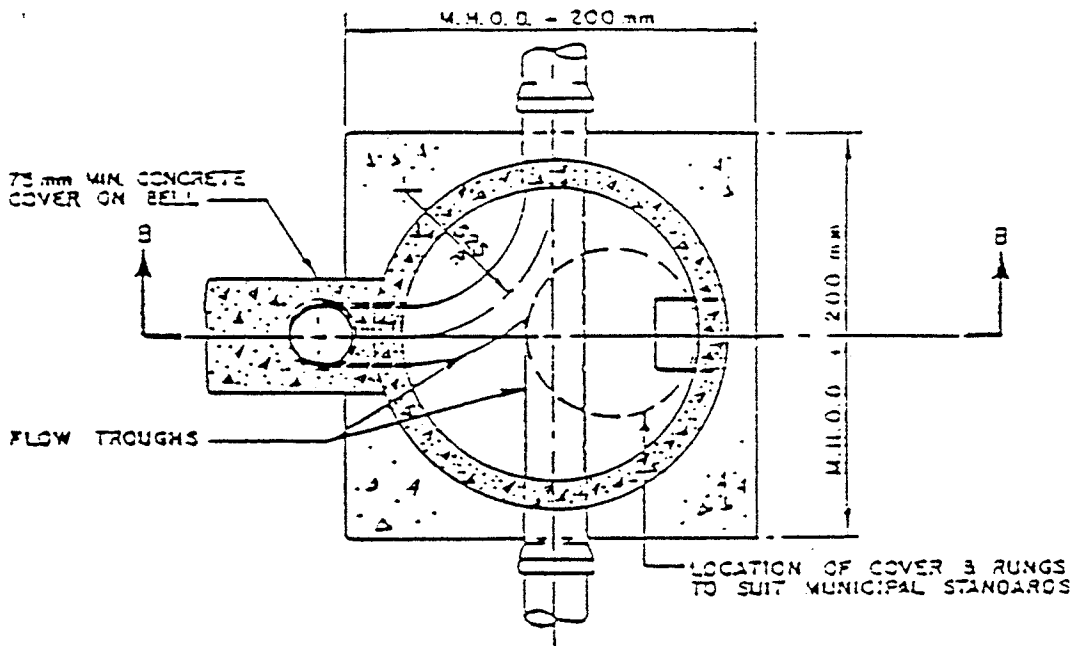


BASE SECTION THRU MANHOLES FOR PIPE UP TO 600mm DIA. INCLUSIVE

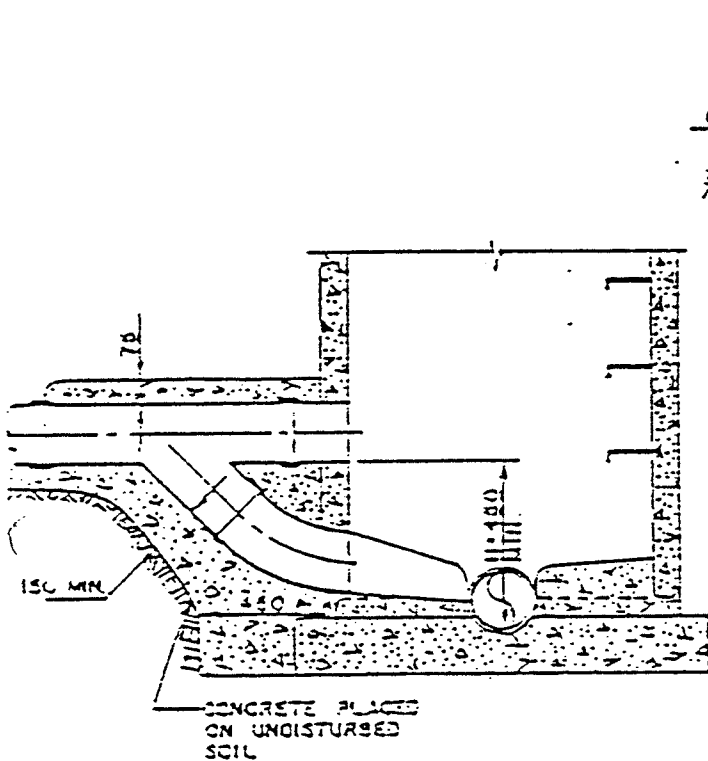
DISTRICT OF MACKENZIE

SUBDIVISION STANDARDS	ISSUED SEPT., 1980	SCALE N.T.S.
	REVISION	STD. DWG. No.
MANHOLE DETAILS STANDARD PRECAST TYPE FOR SEWERS GREATER THAN 375 mm	REVISION	F-108

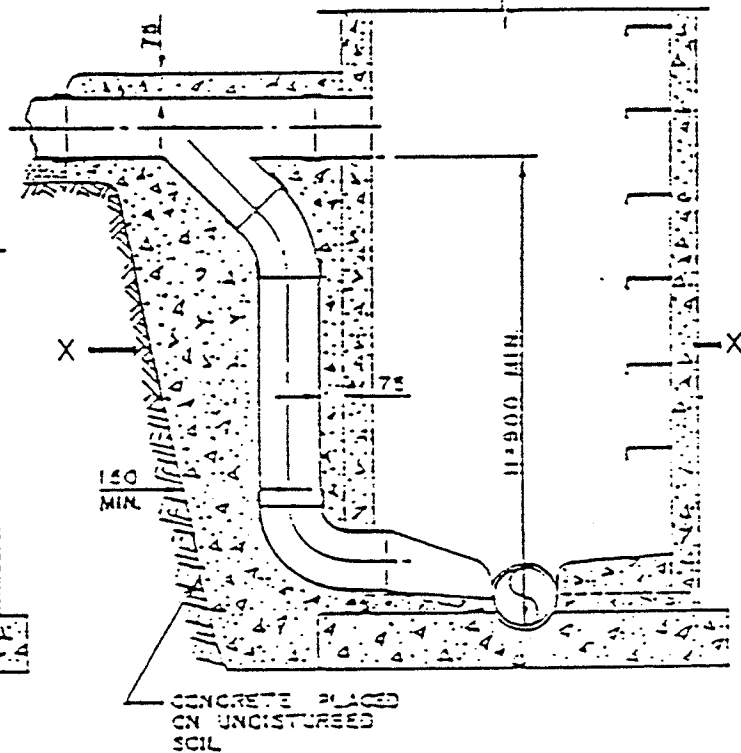




PLAN AT "X-X" SHOWING DROP



SECTION B-B  
DROP MANHOLE TYPE II



SECTION B-B  
DROP MANHOLE TYPE I

1. SEE DWG. F-107 FOR DETAILS ON INVERT CHANNELLING IN MANHOLE.
2. ALL DIMENSIONS ARE GIVEN IN millimetres UNLESS OTHERWISE INDICATED.

DISTRICT OF MACKENZIE

SUBDIVISION STANDARDS

ISSUED SEPT, 1980

SCALE N.T.S.

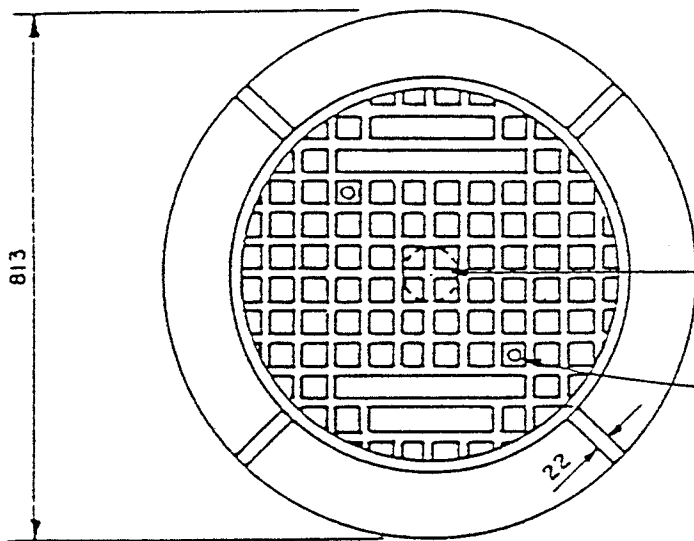
DROP MANHOLE  
TYPE I AND TYPE II

REVISION

STD. DWG. No.

REVISION

F-109



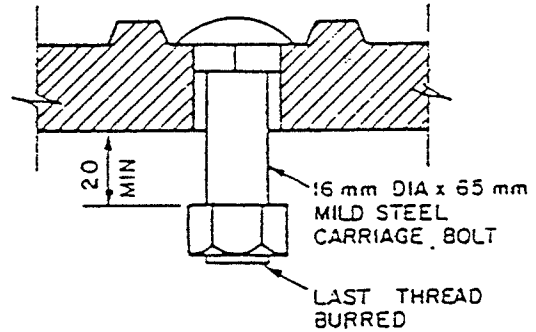
NOTE:

LETTERING SHALL BE 25 mm FLATTENED FACE GOTHIC LETTERING WITH FACE OF LETTERS RAISED TO THE SAME LEVEL AS THE TOP OF THE RIBS

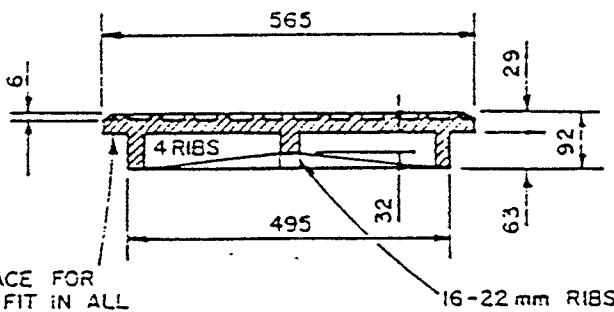
MANUFACTURERS SYMBOL 90 mm MAX. DIMENSION, CIRCLE OR SQUARE

22 mm DIA. HOLE FOR CARRIAGE BOLT TWO REQ'D AS SHOWN

PLAN

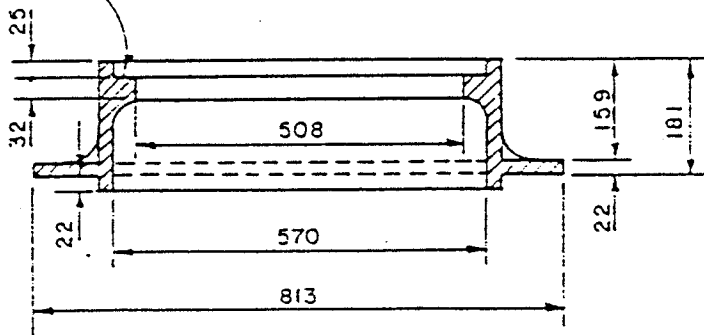


CARRIAGE BOLT DETAIL



COVER

MACHINE SURFACE FOR NON ROCKING FIT IN ALL POSITIONS. ALLOW 2 mm RAISED FACE IN CASTING FOR MACHINING



FRAME

APPROXIMATE WEIGHTS

COVER - 60-66 kg  
FRAME - 102-108 kg

NOTE:

ALL DIMENSIONS ARE GIVEN IN millimetres UNLESS OTHERWISE INDICATED

DISTRICT OF MACKENZIE

SUBDIVISION STANDARDS

ISSUED SEPT., 1980

SCALE N.T.S.

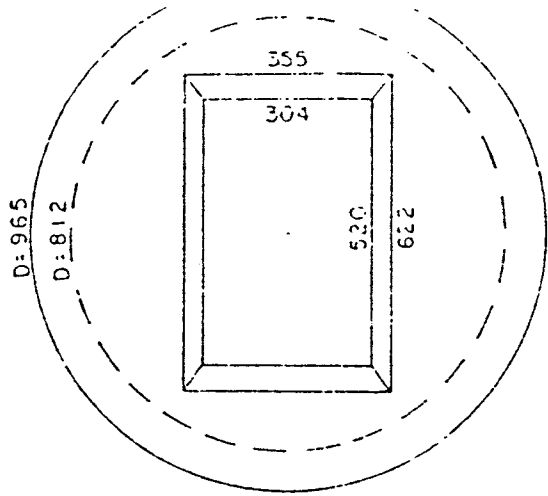
MANHOLE COVER & FRAME

REVISION

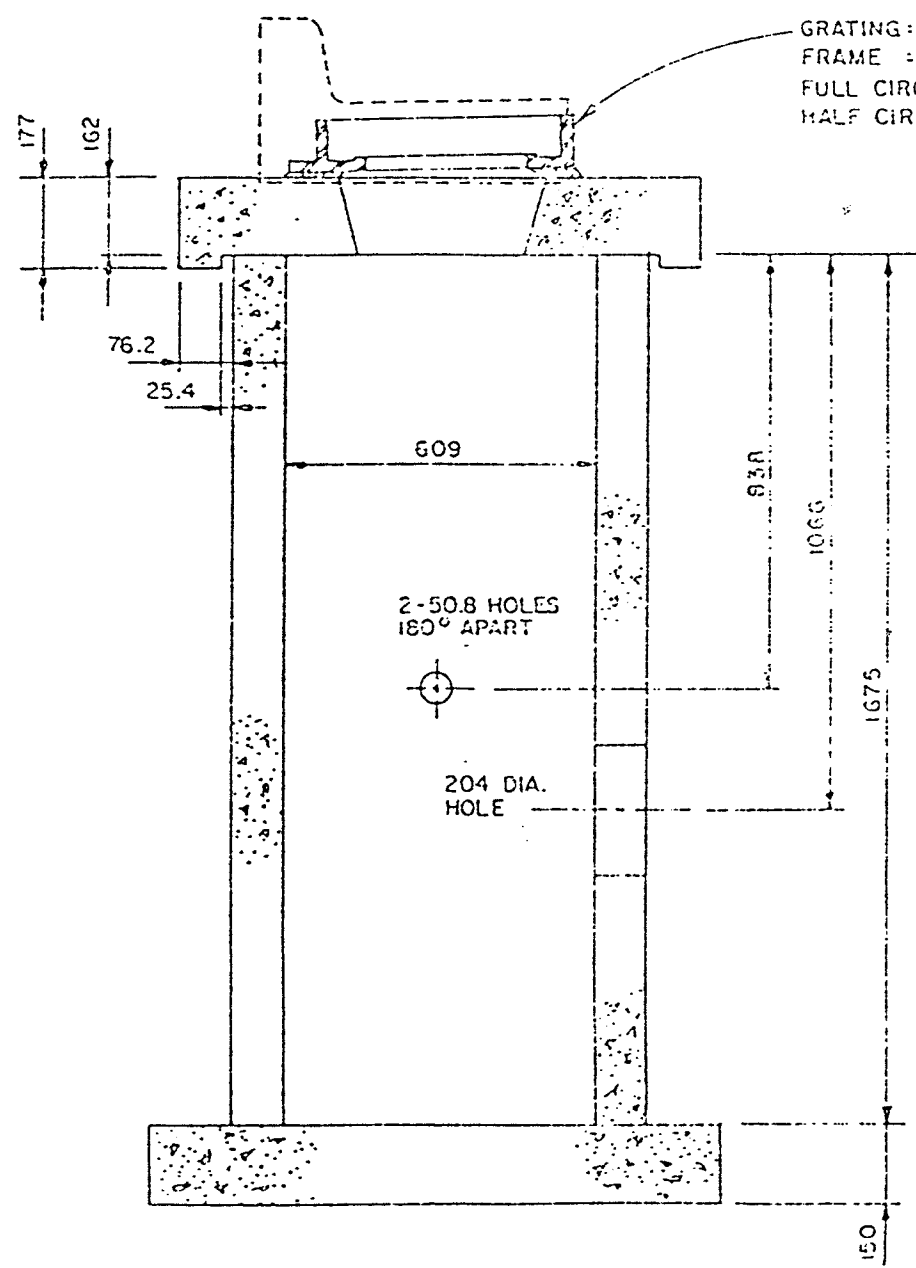
STD. DWG. No.

REVISION

F-110



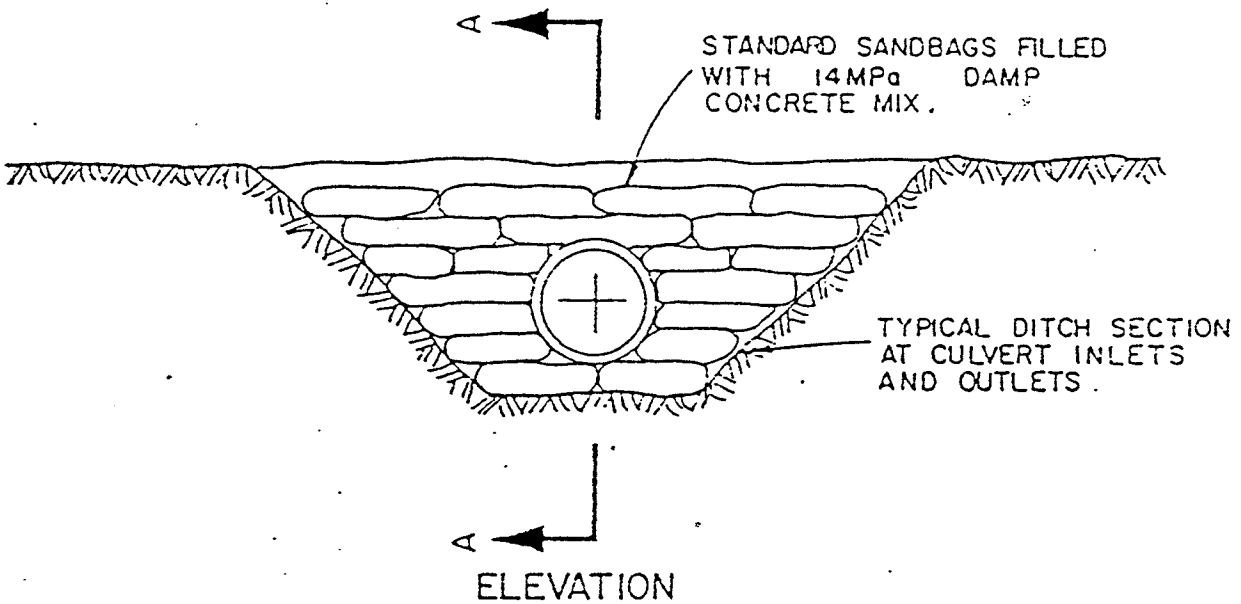
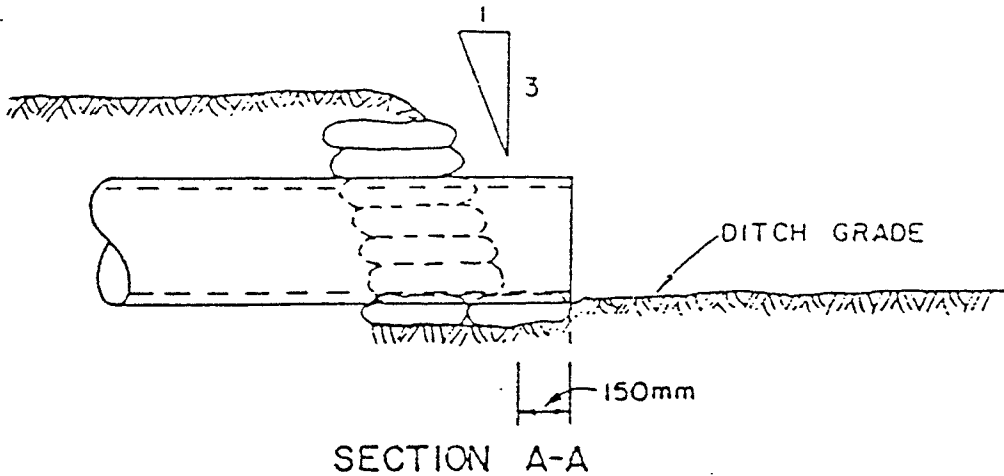
NOTE:  
 - LID TO BE REINFORCED TO WITHSTAND H2O LOADING.  
 - BARREL TO BE CL. III OR EQUAL.  
 - BASE REINFORCING TO BE 150 x 15 x 10 ga. STEEL WIRE MESH, 127mm FROM EDGES & CENTRED IN SLAB.



GRATING: DOBNEY TYPE 'D' B-23  
 FRAME: DOBNEY TYPE 'D' B-24  
 FULL CIRCLE WITHOUT CURB  
 HALF CIRCLE WITH CURB

NOTE:  
 ALL DIM'S. ARE IN MILLIMETERS

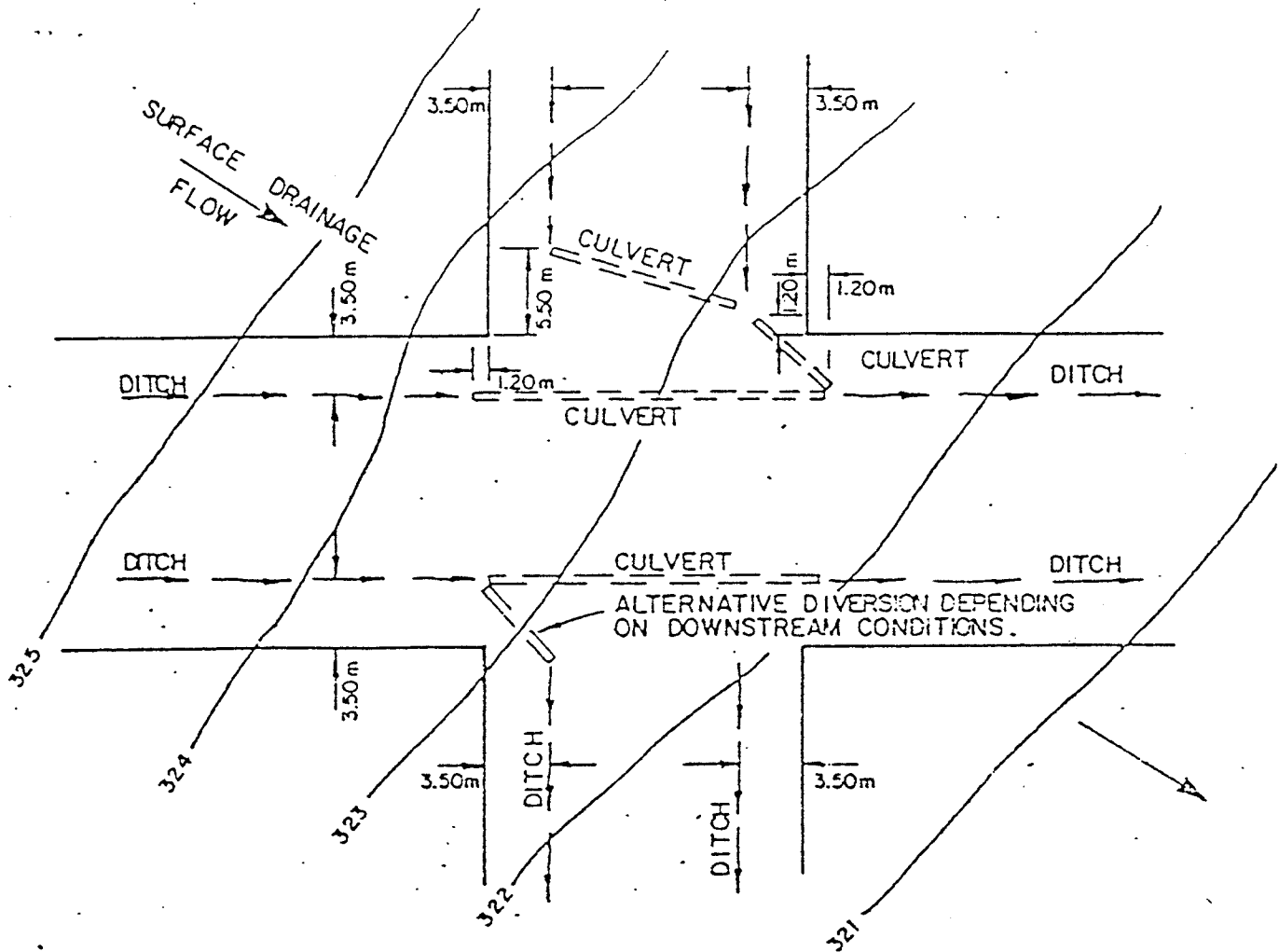
DISTRICT OF MACKENZIE		
SUBDIVISION STANDARDS	ISSUED	SCALE 1:10
CATCH BASIN TYPE	REVISION	STD DWG NO
		F-111



NOTES :

1. IF THE HORIZONTAL DIRECTION OF FLOW AT CULVERT INLETS AND OUTLETS EXCEEDS 30°, THE SANDBAG BULKHEADS REQUIRE CURVED WING WALLS TO FUNNEL THE FLOW.

DISTRICT OF MACKENZIE		
SUBDIVISION STANDARDS	ISSUED SEPT., 1980	SCALE N.T.S.
SANDBAG BULKHEAD FOR CULVERT INLETS AND OUTLETS	REVISION	STD. DWG. No
	REVISION	F - 112

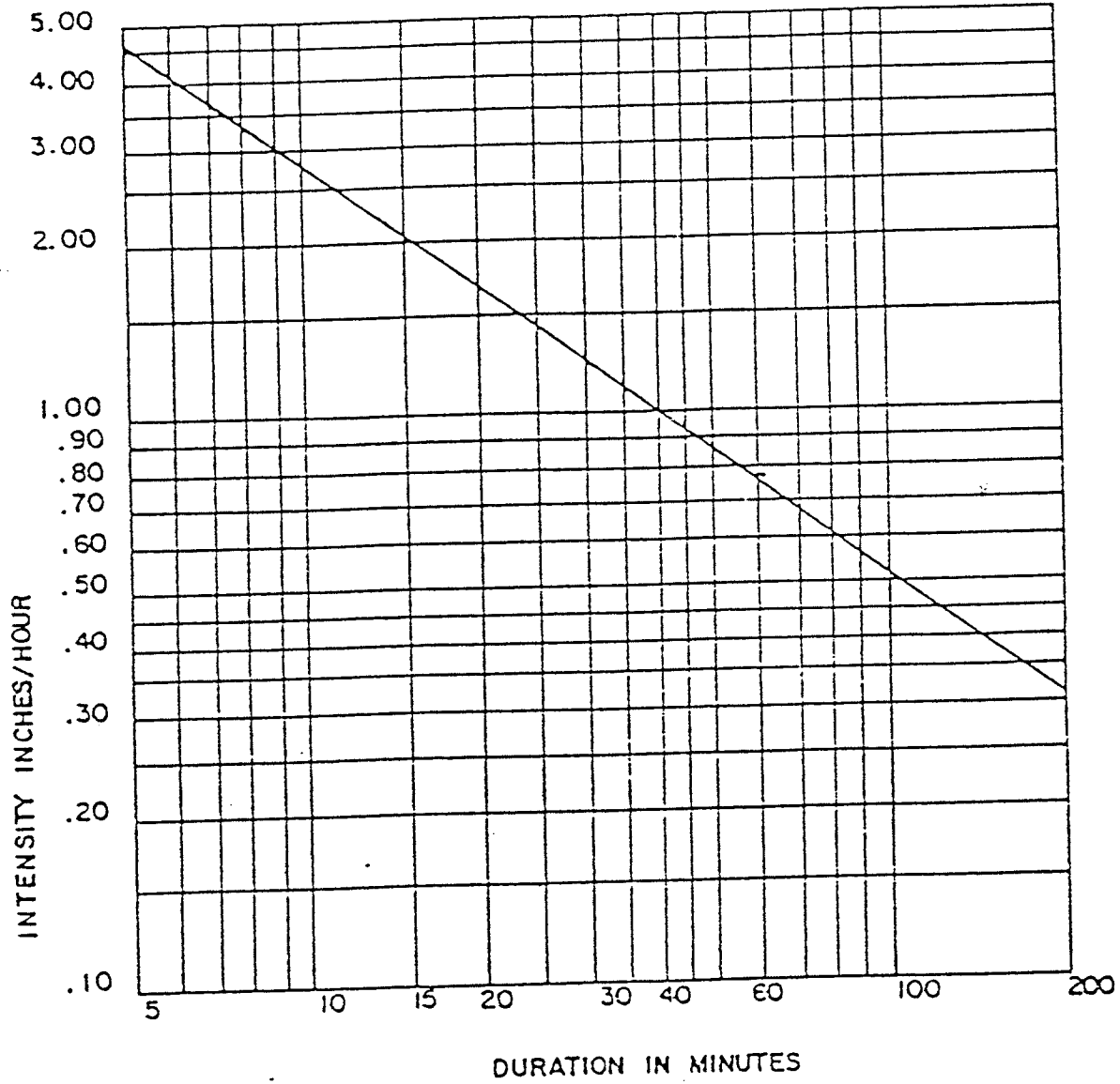


**NOTES:**

1. MINIMUM DIAMETER FOR ALL CULVERT PIPE TO BE 300 mm
2. APPROVED PIPE: (i) GALVANIZED CORRUGATED STEEL WITH RIVETED OR LOCK SEAMS, GALGES AS SPECIFIED UNDER MATERIALS  
(ii) CONCRETE WITH GASKETS AS SPECIFIED UNDER MATERIALS.
3. SAND OR GRAVEL (25mm MINUS) BEDDING REQUIRED FOR ALL CULVERT INSTALLATIONS
4. IF THE HORIZONTAL DIRECTION OF FLOW AT CULVERT INLETS AND OUTLETS EXCEEDS 30°, THE SANDBAG BULKHEADS REQUIRE CURVED WING WALLS TO FUNNEL THE FLOW.

DISTRICT OF MACKENZIE

SUBDIVISION STANDARDS	ISSUED SEPT., 1980	SCALE N.T.S.
	REVISION	STD. DWG. No.
TYPICAL CULVERT INSTALLATIONS	REVISION	F-113



DISTRICT OF MACKENZIE

SUBDIVISION STANDARDS	ISSUED SEPT., 1980	SCALE N.T.S.
RAIN FALL INTENSITY DURATION CURVE	REVISION	STD. DWG. No.
	REVISION	F-114

**DISTRICT OF MACKENZIE**

**BYLAW NO. 1370**

A Bylaw to amend Subdivision Bylaw No.780, 1993

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**WHEREAS** the Council of the District of Mackenzie deems it desirable to amend its Subdivision Bylaw;

**NOW THEREFORE** the Council of the District of Mackenzie, in open meeting assembled, hereby enacts as follows:

1. That Bylaw No. 780 cited as "Subdivision Bylaw No. 780, 1993" be amended as follows:

1.1 by adding the following to "Section 1. Interpretation":

"Driveway" means a short private road consisting of crushed granular, cement, or asphalt that leads to a house or garage which is maintained by an individual or group.

1.2 by replacing Section 3 (b) with the following:

"An applicant for subdivision approval shall submit with his/her application for approval a fee, payable to the District in the amount as prescribed in the District's General Fees Bylaw, as amended from time to time."

1.3 by adding the following to Schedule C "General Provisions Index":

C-5 4. STANDARD WIDTHS

"i) Driveways"

Minimum width in residential zones	4.0m
Maximum width in residential zones	6.5m
Minimum width in commercial/industrial zones	6.0m
Maximum width in commercial/industrial zones	11.0m

Property Owners may apply to the District of Mackenzie for driveway width extensions. Driveway width extension applications are approved by the Director of Operations.

and renumbering the subsequent numbers accordingly.

2. This Bylaw may be cited as "Subdivision Amendment Bylaw No. 1370, 2017".

READ a first time this 24th day of July, 2017.

READ a second time this 24th day of July, 2017.

READ a third time this 24th day of July, 2017.

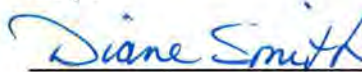
ADOPTED this 14th day of August, 2017.

I hereby certify the foregoing  
to be a true and correct copy  
of the District of Mackenzie  
Bylaw No.1370 cited as  
"Subdivision Amendment  
Bylaw No. 1370, 2017".

\_\_\_\_\_  
Corporate Officer



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Mayor



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Corporate Officer